TTC STANDARDS

JJ-20.81

Usage of Physical Layer for Interconnecting ATM Equipment through Leased Line and ISDN

Version 1

April 28 1998

THE TELECOMMUNICATION TECHNOLOGY COMMITTEE

Introduction

This document provides the TTC original Standards formulated and put into effect by the Technical Assembly. It contains unabbreviated version of 'JJ-' Standards, which have not been defined as international standards.

In case of dispute, the original to be referred is the Japanese version of the text.

We trust that greater understanding of TTC Standards by a wider range of users will further contribute to the development of telecommunications.

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＜Remarks＞

1. Relations with international standards

There is no international standard relating to this standard.

2. Application of this standard

This standard defines

This standard defines specifications necessary for the usage of Physical Layer to transfer ATM cells on existing STM network service layer 1.

In case of using the User-Network Interface of ATM network, TTC standard JT-I432 is applied for layer specification.

3. History of revisions

Version	Date of issue	Contents
1	April 28, 1998	Initial issue

4. Others

(1) Referred recommendations and/or standards

TTC standards: JT-I361, JT-I430, JT-I430-a, JT-I431-a, JT-I432, JT-I432.2, JT-I610, JT-G703-a, JT-G931, JS-13871

ITU-T Recommendation: G.804

1. Scope

1.1 Specification Scope

This standard defines specifications necessary for the usage of physical layer to transfer ATM cells between ATM equipment through leased line service or circuit switched mode ISDN service.

User-network interface defined in this standard refers to leased line secondary rate user-network interface, leased line primary rate user-network interface, leased line basic user-network interface, ISDN primary rate user-network interface and ISDN basic rate user-network interface.

1.2 Application Scope

This standard is applied in case of ATM equipment being connected with the existing STM network that is not equipped with ATM associated functions in transmission convergence sub-layer, such as cell delineation, HEC generation/verification and cell scrambling/descrambling .

Reference model of the interface is shown in Fig.1-1/JJ-20.81.

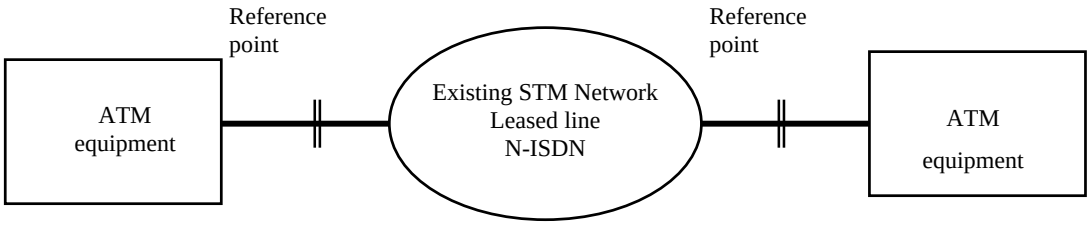

Fig.1-1/JJ-20.81 Interface reference model

1.3 Terminology

Following terminology is used to describe this standard.

1.3.1 Bearer Channel

Octet aligned basic channel with bit rate of 64kbit/s that leased line or ISDN described in this standard provides is called “Bearer Channel”. Namely, a bearer channel is a logical transmission path provided as a B-channel through a basic interface and a timeslot through primary rate or secondary rate interface.

1.3.2 Digital Section

Digital Section is the whole of bearer channels available for transferring user information through a physical interface. The number of bearer channels depends on User-Network Interface; 96 for secondary rate, 24 for primary rate and 2 for basic rate.

1.3.3 Transmission Path

A transmission path is composed of n (n≧1） bearer channels, and has an octet aligned logical path with BSI (Bit Sequence Independence). It is used for transferring ATM cells.

This standard contains in case of several transmission paths being set up through a physical interface and being to linked to different destinations, and in case of a transmission path being set

up thorough plural physical interfaces.
Plural bearer channels of which the Time Slot Sequence Integrity (TSSI) is ensured between time slots of each bearer channel, this status is called “time slot aligned”. Put another way, the status of no difference in the transmission delay between bearer channels is called “time slot aligned”.

2. Functional Structure of Physical Layer

2.1 Classification of Physical Layer Functions

This standard describes functions of Physical Layer classified into the following sub-layer functions.
(see Table 2-1/JJ-20.81) .

・PMD：Physical Media Dependent Sublayer
・TC：Transmission Convergence Sublayer
- Transport-specific TC functions
- Channel handling functions
- ATM specific TC functions

Table 2-1/JJ-20.81 Functional Structure of Physical Layer

Sub Layer		Functions
Transmission Convergence （TC） Sublayer	ATM specific TC functions	Cell mapping, Cell delineation, Cell scrambling/descrambling、 HEC generation/verification
	Channel handling functions	Generate transmission path, Multiple access, Channel aggregation
	Transport-specific TC functions	Frame alignment, Frame scrambling, Octet timing, Transmission overhead
Physical Media Dependent （PMD） Sublayer		Bit timing, Line coding, Electrical characteristics, Physical medium

Primitive defined in this chapter refers to abstract expression which represents the logical exchange of information and controls between sub-layers. It does not specify nor restrict the implementation of entity or interface.

2.2 Physical Media Dependent sub-layer

Physical Media Dependent provides upper layer (Transmission Convergence) with bit stream as Service Data Unit (SDU). SDU is comprised of primitive related to data bit and bit timing. The sub-layer functions allow the followings:
- Bit timing
- Line coding
- Electrical characteristics
- Mechanical characteristics
- Physical medium
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2.3 Transmission Convergence Sublayer

2.3.1 Functional Model

Transmission Convergence Sublayer provides upper layer (ATM Layer) with valid ATM cell stream on end to end basis as a role of Service Data Unit (SDU). In ATM cell stream, the order of cell to be transmitted is ensured. Transmission convergence is defined by three separate functions illustrated in Fig. 2-1/JJ-20.81.

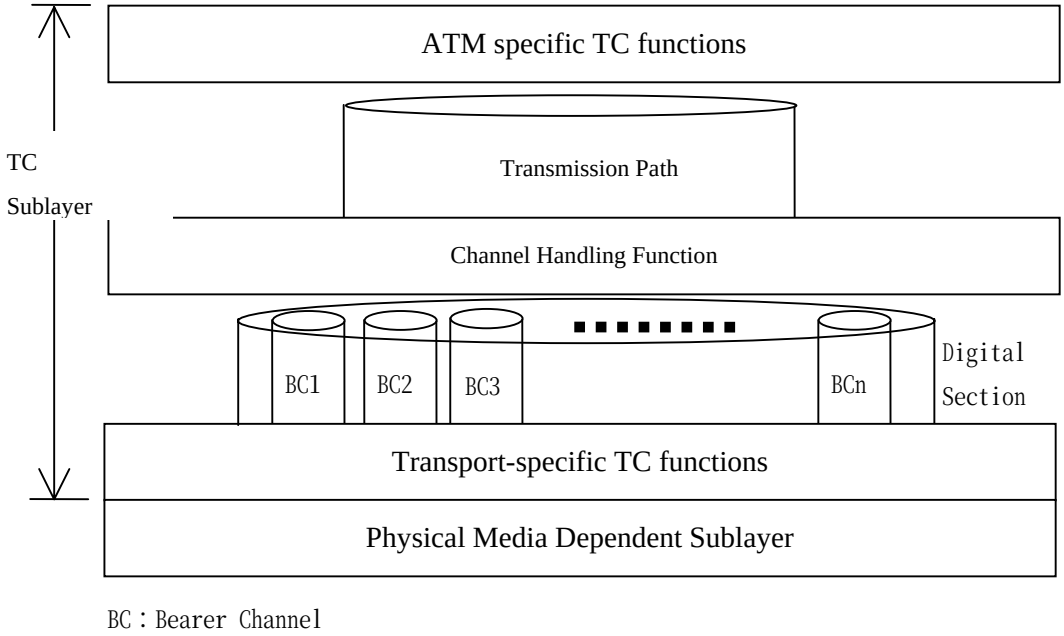

Fig.2-1/JJ-20.81 Functional Model of TC

2.3.2 Transport-specific TC function

It allows to exchange as a role of Service Data Unit (SDU) bit stream with lower layer and to provide upper layer with digital section. SDU is comprised of primitive related to data octet and octet timing. Transport-specific TC functions include the followings:

- Frame alignment/Multi frame alignment
- Frame scrambling
- Octet timing
- Alarm (Implemented in Overhead part)

2.3.3 Channel handling functions

It allows to exchange as Service Data Unit (SDU) with lower layer, digital section associated with more than one physical interfaces and to provide upper layer transmission path on end to end basis. SDU is comprised of primitive related to data octet and octet timing.

Channel handling functions provide the followings:

- Basic functions
- Sub-rate functions
- Channel Aggregation functions

2.4.4 ATM specific TC functions

It allows to exchange as Service Data Unit (SDU) with lower layer, an octet stream transmission path and to provide upper layer with a valid ATM cell stream on end to end basis. Each transmission path provided by lower layer has an entity of ATM specific TC functions. Put another way, an entity of ATM specific TC functions provides upper layer with a valid ATM cell stream from end to end through point-to-point transmission path.

ATM specific TC functions define the followings:

- Cell mapping
- Cell delineation
- Cell scrambling/descrambling
- Header Error Control (HEC) generation/verification

3. Physical Media Dependent/Transport-specific TC functions

3.1 Leased Line Secondary Rate Interface

Same provision as 6312kbit/s Leased Line Secondary Rate User-Network Interface defined in TTC standard JT-G703-a.

3.2 Leased Line Primary Rate Interface

Same provision as 1544kbit/s Leased Line Primary Rate User-Network Interface defined in TTC standard JT-I431-a.

3.3 Leased Line Basic Interface

Same provision as Leased Line Basic User-Network Interface defined in TTC standard JT-I430-a.

3.4 ISDN Primary Rate Interface

Same provision as 1544kbit/s ISDN Primary Rate User-Network Interface defined in TTC standard JT-I431.

3.5 ISDN Basic Interface

Same provision as ISDN Basic User-Network Interface defined in TTC standard JT-I430.

4. Channel Handling Functions

Channel handling functions define three functions; basic function, sub-rate function and channel aggregation function. The latter two functions are options.

4.1 Basic Functions

4.1.1 Basic Function Model

Basic functions provide a transmission path by making use of the whole digital section provided by physical interface as illustrated in Fig.4-1/JJ-20.81.

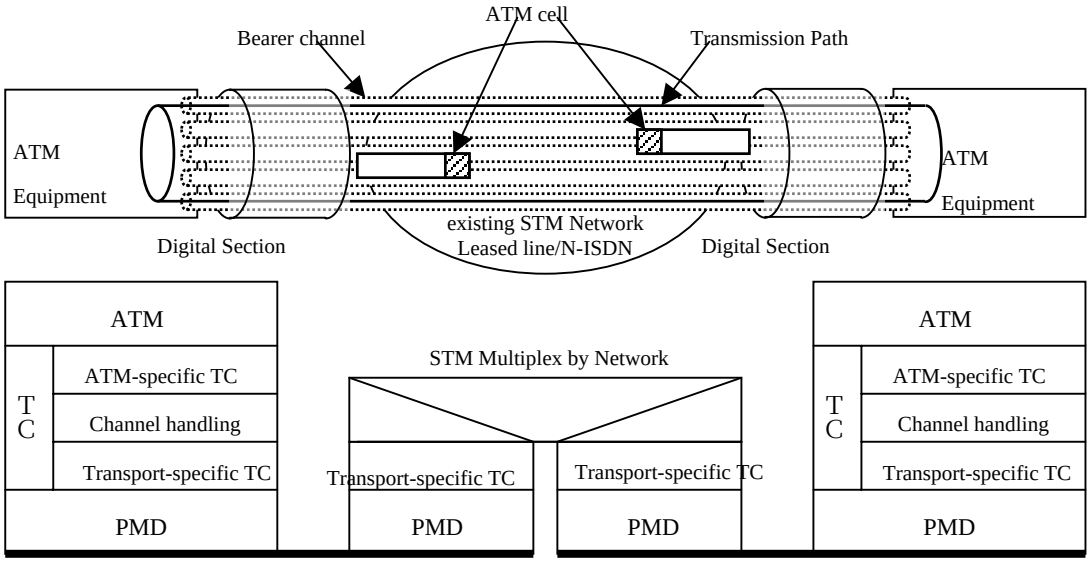

Fig.4-1/JJ-20.81 Basic Function Model

4.1.2 Number of Transmission Paths

The number of transmission paths is one for a physical interface.

4.1.3 Bit Rate of Transmission Path

Bit rate of transmission path is defined depending on transport-specific TC functions.

(1) Leased line secondary rate interface : 6144kbit/s

(2) Leased line primary rate interface : 1536kbit/s

(3) ISDN primary rate interface : 1536kbit/s (H1 channel)

(4) Leased line basic interface : 128kbit/s

(5) ISDN basic interface: basic function is not supported

4.2 Sub-rate Functions

4.2.1 Sub-rate Function Model

Sub-rate functions offer a transmission path by making use of a part of bearer channels in the digital section provided by a transport-specific TC associated with a physical interface as illustrated in Fig.4-2/JJ-20.81. A bearer channel or plural bearer channels with time slot alignment are utilized to link bearer channels at every octet and that make up a transmission path. By means of sub-rate functions, it is possible to set up plural transmission paths through a single physical interface (multiple access) as illustrated in Fig. 4-2/JJ-20.81. These plural transmission paths can be connected to different destinations.

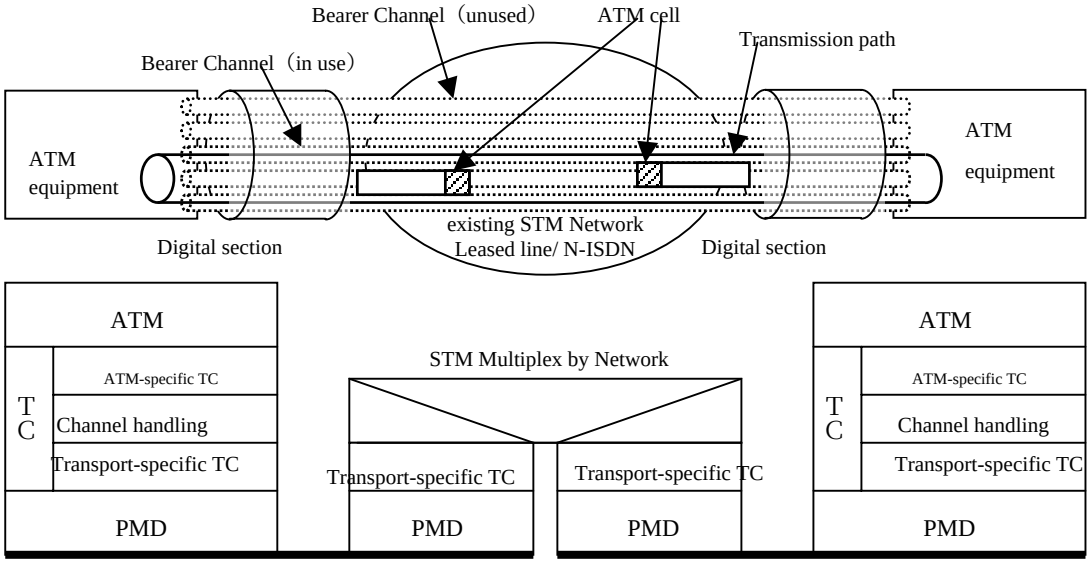

Fig. 4-2/JJ-20.81　Sub-rate functions Model

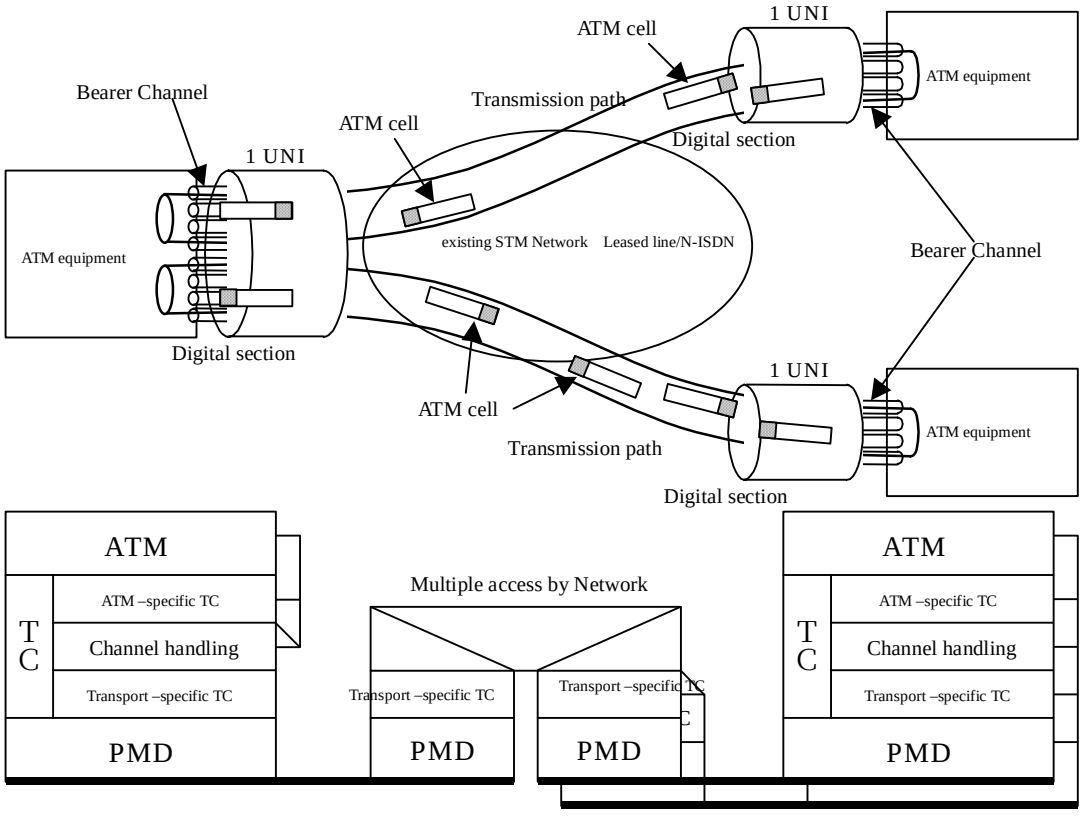

Fig. 4-3/JJ-20.81　Multiple access model with sub-rate functions

4.2.2 Bearer Channel combination

In case of implementing sub-rate functions, the essential function is to combine bearer channels

accordance with time slot order. However it is desirable to reserve an alternative way to construct digital paths with a combination of arbitrary bearer channels.

4.2.3 Maximum Number of Transmission Paths

The maximum number of transmission paths provided by a physical interface is depending on transport-specific TC functions.

(1) Leased line secondary rate interface : 96
(2) Leased line primary rate interface : 24
(3) ISDN primary rate interface : 24
(4) Leased line basic interface : 2
(5) ISDN basic interface: 2

4.2.4 Bit Rate of Transmission Path

The basic is N×64kbit/s and depending on transport-specific TC functions.

(1) Leased line secondary rate interface : N×64kbit/s（N=1,2,...,95）
(2) Leased line primary rate interface : N×64kbit/s（N=1,2,...,23）
(3) ISDN primary rate interface : 64kbit/s、384kbit/s
(4) Leased line basic interface : 64kbit/s
(5) ISDN basic interface: 64kbit/s

4.3 Channel Aggregation Functions

4.3.1 Channel Aggregation Function Model

Channel aggregation functions align by means of delay equalization, the time slot of plural bearer channels which are terminated the same destination but are lacking in time slot alignment and to construct a transmission path of a larger rate. It is shown in Fig.4-4/JJ-20.81

There are two types of bearer channels employed for channel aggregation functions ; one is included in a digital section and the other is laid over plural digital sections.

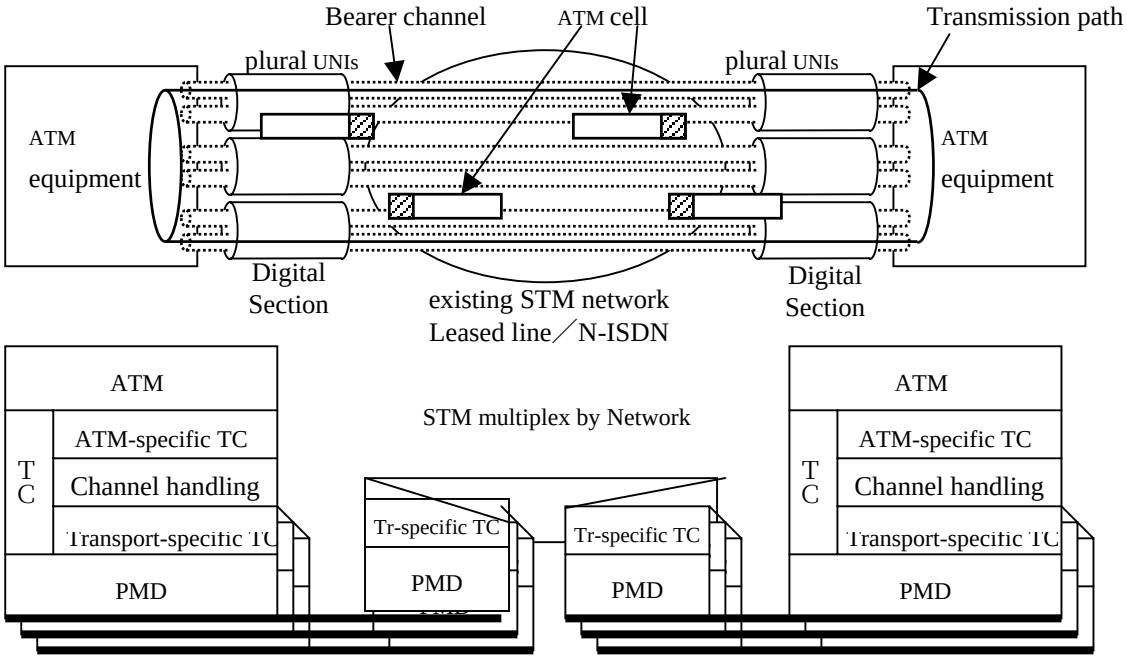

Fig.4-4/JJ-20.81 Channel Aggregation Model

4.3.2 Bearer Channels Multiplexing Method

Bearer channels multiplexing method fulfill the following requirements.

- Not making use of rate and information on other bearer channels except for the channel to be employed
- Providing octet stream transmission
- Monitoring capability to check delay divergence after the delay adjustment

These requirements are met by Mode 2 defined by TTC standard JS-13871 which enables the construction of transmission path of N×63kbit/s.

As bit rate of transmission path is determined by the standard of the aggregation functions to be used, it is not defined in this standard.

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5. ATM-Specific TC Functions

5.1 ATM cell format

The same as defined in TTC standard JT-I361.

5.2 Cell Mapping

ATM cells are mapped in transmission path in conformity with the way recommended by ITU-T recommendation G.804. ATM cells are laid side by side of octet boundary and cell boundary in the transmission path. The order of cell bits transfer is the same definition as defined in JT-I361.

5.3 Header Error Control

The same as “4.3.2 Header Error Control(HEC)” defined in TTC standard JT-I432.1.

5.4 Cell Delineation

The same as “4.3.3 Cell delineation ” defined in TTC standard JT-I432.1.

5.5 Cell Scrambling and Descrambling

The Information field bits are randomized by means of self-synchronizing scrambler (generate polynomial: $X^{43}+1$) in accordance with “ 4.3.4.1 ATM cell level scrambler for SDH -based systems “ defined in TTC standard JT-I432.1. The use of cell scrambling function is not mandatory, however in this case, considerations should be given to the fact that there may bring about a degradation of security and robustness in HEC delineation algorithm.

(note)Attention should be also paid for the fact that the usage/non usage of cell scramble function should be the same selection at both end of ATM equipment connected through the Network.

5.6 Idle Cells

The same as “4.3.5 Idle cells ” defined in TTC standard JT-I432.1.

6. OAM Functions

OAM flow (associated with transport-specific TC functions(corresponding to F2)) between ATM equipment and STM network terminal equipment is defined the same as the standard regarding PMD/Transport –specific TC functions that each interface is referring to.

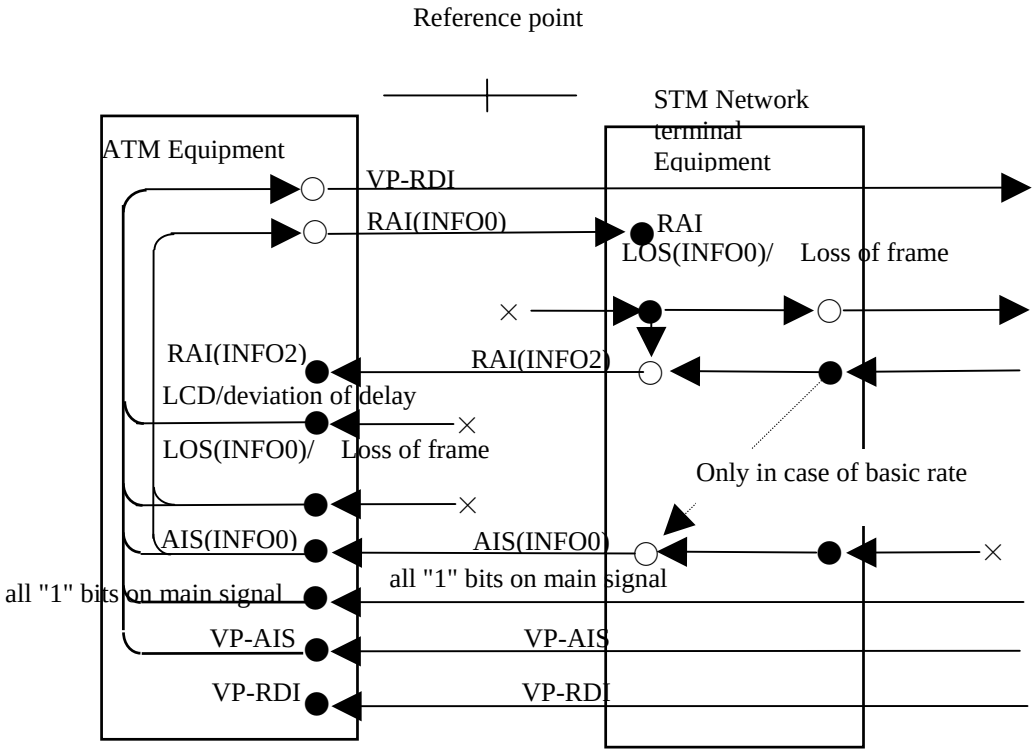
OAM flow (associated with ATM-specific TC functions(corresponding to F3)) between ATM equipment and ATM equipment is not defined except for LCD. LCD is the same as “5.1.3 Cell

delineation ” defined in TTC standard JT-I432.2.

OAM flow (associated with channel handling functions) between ATM equipment and ATM equipment is defined in the standard regarding the usage of channel aggregation etc.

Alarm transfer refers to Annex I.

Annex I : Alarm Transfer



Annex. Fig I-1/JJ-20.81 Alarm transfer

(Note 1) legend ×: Failuare, ●: Detection, ○: Transfer

(Note 2) Indication in parentheses is signalling name in case of basic rate.

(Note 3) All "1" bits on main signal may be provided by Network service.

(Note 4) ATM layer alarm (VP-AIS, VP-RDI) is illustrated in the Fig. above to show the relation with physical layer, however the definition is out of scope of this standard.

Annex II : Signaling

When ISDN primary rate interface and ISDN basic interface are applied, in order to ensure the interconnectivity between ATM terminals, it is recommended to set “transfer capability” for B channel information element in the signaling defined “ISDN User-Network Interface layer 3” of JT-Q931 as followed;

Information transfer capability (octet 3: bit 5-1) : unrestricted digital information
Transfer mode (octet 4: bit 7,6) : Circuit-switched mode
Information transfer rate (octet 4: bit 5-1) : associated rate
Rate multiplier (octet 4,1) : Added in case where Information transfer rate is Multi-rate
User Information layer 1 protocol (octet 5) : Not applied
User Information layer 2 protocol (octet 6) : Not applied
User Information layer 3 protocol (octet 7) : Not applied