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TITLE: 6,312 kbps UNI SPECIFICATION (Final version)

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2.8 Physical Layer for 6,312 kbps Interface

This section specifies the physical layer for the 6,312 kbps interface for the public UNI, which is described as the Physical Media Dependent (PMD) sublayer and the Transmission Convergence (TC) sublayer. The PMD sublayer specification is based on ITU-T Recommendation G.703. The TC sublayer specification is based on ITU-T Recommendations I.432, G.704 and G.804.

This specification is not based on North American DS-2 interface.

2.8.1 Physical Media Dependent (PMD) Specification

The PMD sublayer specifies both electrical and physical conditions.

2.8.1.1 Physical requirements

(R) The Terminal Equipment (TE) and the Network Termination 1 (NT1) shall be interconnected via BNC coaxial connectors, conforming to JIS C5412-1976 high frequency coaxial CO2-type connectors [1], which is equivalent to MIL C 3608 BNC connectors, and coaxial cables.

Figure 2-1 describes the physical connection conditions.

User-Network Interface bit rate	6,312 kbps
Connector	Pair of BNC connectors (Terminals for coaxial cables / JIS C5412-1976 CO2-type connectors)
Wiring between TE and NT1	Point to point wiring

Figure 2-1 Physical connection conditions

2.8.1.2 Electrical requirements

(R) The electrical requirements shall be based on ITU-T Recommendation G.703 Section 3 as shown in Figure 2-2.

User-Network Interface bit rate	6,312 kbps
Transmission line code	50 % pulse width B8ZS code
Load impedance	75 ohms
Balanced/Unbalanced circuit	Unbalanced circuit

Figure 2-2 Electrical requirements

2.8.2 Transmission Convergence (TC) Specification

The TC sublayer specifies the transmission frame structure, the mapping of ATM cells into the frame.

2.8.2.1 Transmission Frame structure

(R) The frame structure of the 6,312 kbps UNI shall be based on ITU-T Recommendation G.704 Section 2.2.
The structure is shown in Figure 2-3. A frame consists of 789 bits (125 µsec). It contains 98 continuous time slots (TS), numbered from 1 to 98, and F bits consisting of the last five bits of a frame. Excluding F bits plus time slots 97 and 98, 6,144 kbps can be used for cell transmission. Each time slot consists of 8 bits continuously numbered from 1 to 8. F bits are structured by 4 multiframe and are used for frame synchronization and OAM. Allocation of the F-bits is given in Table 3/G.704 of ITU-T Recommendation G.704.

(R) The 6,312 kbps UNI shall meet the synchronization characteristics as described in ITU-T Recommendation G.704 Section 2.2.3.1. The synchronization pattern (110010100) consists of F bits of the first and second multiframe except for the bit '789' in the first frame.

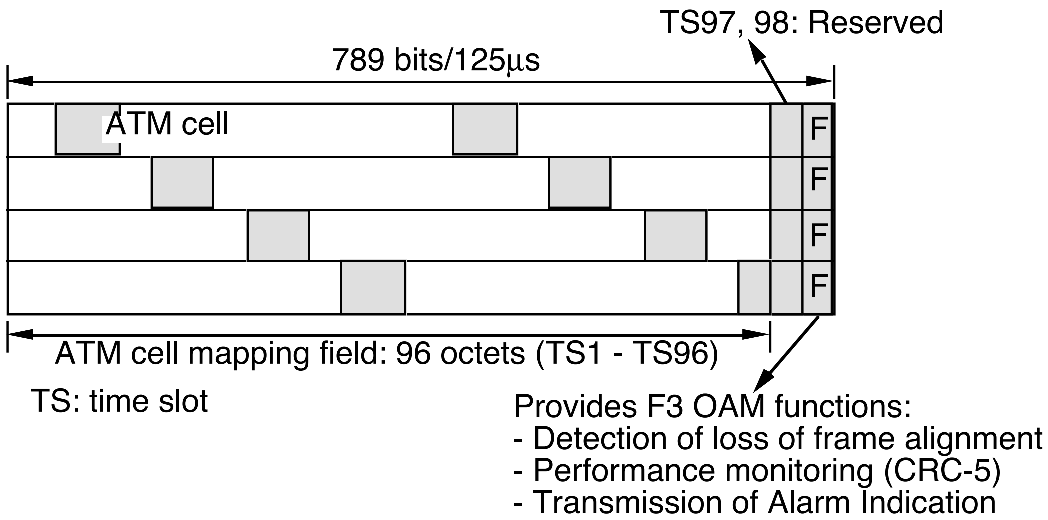

Figure 2-3 Frame structure for 6,312 kbps used to transport ATM cells

2.8.2.2 Mapping of ATM cells into the transmission frame

(R) ATM cells shall be directly mapped into TS1 through TS96 in the transmission frame with octet alignment as defined in ITU-T Recommendation G.804 Section 4.1 (see Figure 2-3).

2.8.2.3 HEC Generation/Verification

The Header Error Control (HEC) covers the entire cell header.

(R) Equipment supporting the UNI shall implement error detection as defined in ITU-T Recommendation I.432 Section 4.3.

(O) Equipment supporting the UNI may also implement single bit error correction in addition to error detection. In this case, the two modes of operation shall interact in accordance to the procedure defined in ITU-T Recommendation I.432 Section 4.3.

(R) Equipment supporting the UNI shall generate the HEC byte as described in ITU-T Recommendation I.432 Section 4.3.

(R) The generator polynomial, coset used and the HEC sequence generation procedure shall be in accordance with ITU-T Recommendation I.432 Section 4.3.

2.8.2.4 Idle Cells

(R) Idle cells shall be inserted and discarded for cell rate adaption function based on ITU-T Recommendation I.432 Section 4.4. They shall cause no action at a receiving node except for cell delineation including HEC verification.

The definition and use of idle cells are described in ITU-T Recommendation I.432 Section 4.4.

2.8.2.5 Cell Scrambling and Descrambling

Cell scrambling/descrambling permits the randomization of the cell payload to avoid continuous non-variable bit patterns and improve the efficiency of the cell delineation algorithm.

(R) Equipment supporting the UNI shall implement the self synchronizing scrambler polynomial and procedure as defined in ITU-T Recommendation I.432 Section 4.5.

2.8.2.6 Cell Delineation

The cell delineation function permits the identification of cell boundaries in the payload. It uses the HEC field in the cell header.

(R) Equipment supporting the UNI shall perform cell delineation using the HEC based algorithm described in ITU-T Recommendation I.432 Section 4.5.

(O) Equipment supporting the UNI may implement the cell delineation state-machine in conformance with the following state transition timing requirements:

- The process enters the SYNC state after the HEC coding law has been confirmed six cell times consecutively under the Pre-SYNC state.

- In the SYNC state the cell delineation will be assumed to be lost and the process enters to the Hunt state if the HEC coding law is recognized incorrectly seven cell times consecutively.

2.8.3 Physical Layer OAM (M-plane) Specification

This section identifies the physical layer OAM functions and procedures involved over the UNI. The physical layer contains two kinds of maintenance functions for Fault Management. The flows of maintenance signals are shown in Figure 2-4.

2.8.3.1 Physical layer failure detection functions

(R) The following physical layer failures shall be detected at the UNI.

- Loss of signal (LOS)

  This failure is described in section 6.1 of ITU-T Recommendation I.432. The LOS will be detected at the user and network sides.

  The LOS detection and removal shall be implemented according to ITU-T Draft Recommendation G.775.

- Loss of frame (LOF)

  This failure is described in Section 6.1 of ITU-T Recommendation I.432. The LOF will be detected at the user and network sides.

  The LOF is detected when 7 or more consecutive errored framing patterns (4 multiframe) are received. The LOF is cleared when 3 or more consecutive correct framing patterns are received.

- Loss of cell delineation (LOC)

  This failure is described in Section 6.1 of ITU-T Recommendation I.432. The LOC will be detected at the user side.

The LOC detection and removal shall be implemented according to ITU-T Recommendation I.432 Section 6.1.

- Physical layer Alarm Indication Signal (AIS)

  The Physical layer AIS shall be sent from the NT1 to the user to indicate a loss of the 6,312 kbps frame capability on the network side. The Physical layer AIS is defined as a bit array of 6,312 kbps in which all binary bits are set to '1'. The Physical Layer AIS will be detected at the user side.

  The Physical layer AIS detection and removal shall be implemented according to ITU-T Draft Recommendation G.775.

- Payload Alarm Indication Signal (AIS).

  The Payload AIS shall be sent from the network to the user to indicate a loss of the transmission capability of the 6,312 kbps frame payload [TS1-TS96] in the network. The Payload AIS is defined as a bit array of the frame payload in which all binary bits are set to '1'. The Payload AIS will be detected at the user side.

  The Payload AIS is detected when the incoming signal of the 6,312 kbps frame payload [TS1-TS96] has 2 or less 0's in a sequence of 3072 bits (0.5 ms). The Payload AIS is cleared when the incoming signal of the 6,312 kbps frame payload [TS1-TS96] has 3 or more 0's in a sequence of 3072 bits (0.5 ms).

The VP-RDI signal at the ATM layer, described in section 3.5.3.1, will be used to indicate these physical failure indication to the upstream equipment, as described in Figure 2-4.

2.8.3.2 Physical layer failure indication functions

(R) The Remote Alarm Indication (RAI) signal indicates the loss of physical layer capability at the UNI. If the loss of physical layer capability, which is a loss of frame alignment (LOF or LOS) and/or Physical layer AIS condition, is detected at the user side, the RAI signal shall be generated and transmitted to the network side. If the capability is lost at the network side, the RAI signal shall be transmitted to the user side.

The RAI signal is defined on m-bits as a repetition of the 16-bit sequence consisting of eight binary '1s' and eight binary '0s' in m-bits (1111111100000000). When the RAI signal is not sent (in normal operation), the HDLC flag pattern (01111110) in the m-bit is sent.

The RAI is detected when 16 or more consecutive RAI-patterns (1111111100000000) are received. The RAI is cleared when 4 or more consecutive incorrect-RAI-patterns (other than 1111111100000000) are received.

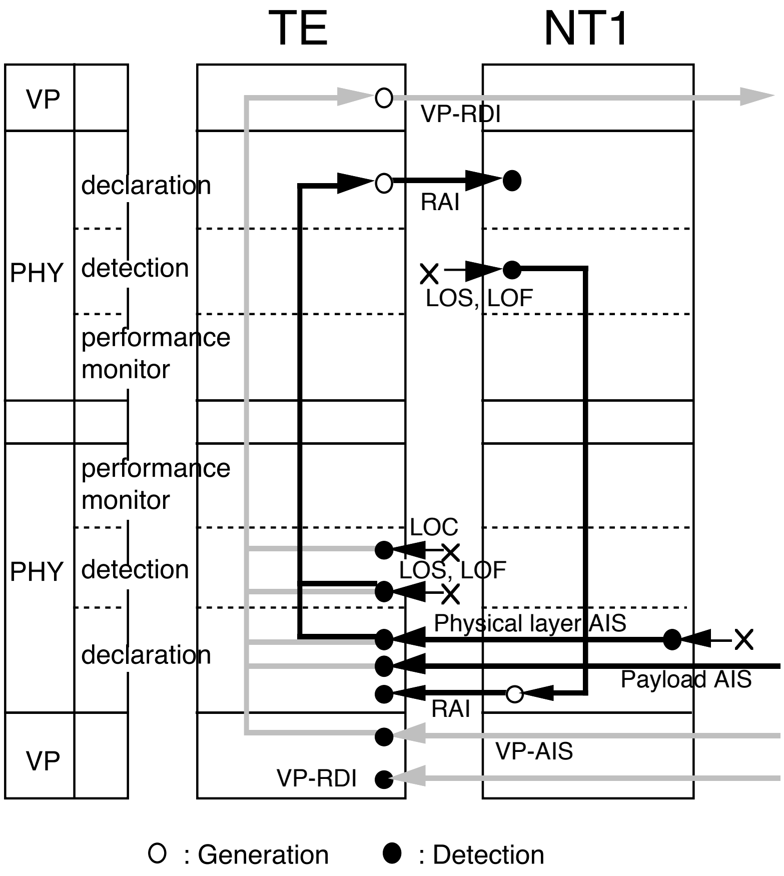

Figure 2-4 Maintenance signal flow

< References >

[1] JAPANESE INDUSTRIAL STANDARD, "C02 Type Connectors for Radio Frequency Coaxial Cables (JIS C5412)", revised 1976-10-01, investigated by Japanese Industrial Committee.
