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Foreword

This European Telecommunication Standard (ETS) has been produced by the Transmission and Multiplexing (TM) Technical Committee of the European Telecommunications Standards Institute (ETSI) in order to meet the requirements of network operators and equipment manufacturers for the deployment and design of synchronous cross connect equipment to be used in synchronous digital leased line networks.

This is Part one of a two-part standard (ETS 300 010) comprising:

ETS 300 010: Synchronous cross connect equipment - 64 and n x 64 kbit/s cross connection rate - 2 048 kbit/s access ports.

ETS 300 010 Part 1: Core functions and characteristics.

ETS 300 010 Part 2: Management.

NOTE: Part 2 of this ETS is under development within ETSI TC-TM.

The corresponding ETS for equipment for cross connection of sub-rate signals is under development.

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1 Scope

Part 1 of this ETS describes requirements of cross connect equipment for use in synchronous digital leased line networks. It covers equipment having 2 048 kbit/s access ports and is limited to the basic functions, external characteristics and performance of the equipment. Requirements for the management of the equipment are to be covered in Part 2 of this ETS (ETS 300 010-2) which should be used in conjunction with this Part of the ETS.

NOTE: Part 2 of this ETS is under development within ETSI TC-TM.

Some network operators may have additional requirements and these are provided in normative Annexes A to C.

2 Normative references

This ETS incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this ETS only when incorporated in it by amendment or revision. For undated references, the latest edition of the publication referred to applies.

[1] CCITT Recommendation G.703 (1991): "Physical/electrical characteristics of hierarchical digital interfaces".

[2] CCITT Recommendation G.704 (1988): "Synchronous frame structures used at primary and secondary hierarchical levels".

[3] CCITT Recommendation G.706 (1991): "Frame alignment and cyclic redundancy check (CRC) procedures relating to basic frame structures defined in CCITT Recommendation G.704".

[4] CCITT Recommendation G.732 (1991): "Characteristics of primary PCM multiplex equipment operating at 2 048 kbit/s".

[5] CCITT Recommendation G.735 (1988): "Characteristics of primary PCM multiplex equipment operating at 2 048 kbit/s and offering synchronous digital access at 384 and/or 64 kbit/s".

[6] CCITT Recommendation G.736 (1988): "Characteristics of a synchronous digital multiplex equipment operating at 2 048 kbit/s".

[7] CCITT Recommendation G.773 (1988): "Protocol suites for Q interface for management of transmission systems".

[8] CCITT Recommendation G.811 (1988): "Timing requirements at the outputs of primary reference clocks suitable for plesiochronous operation of international digital links".

[9] CCITT Recommendation G.812 (1988): "Timing requirements at the outputs of slave clocks suitable for plesiochronous operation of international digital links".

[10] CCITT Recommendation G.822 (1988): "Controlled slip rate objectives on an international digital connection".

[11] CCITT Recommendation G.823 (1988): "The control of jitter and wander within digital networks which are based on the 2 048 kbit/s hierarchy".

[12] CCITT Recommendation M.20 (1988): "Maintenance philosophy for telecommunication networks".

[13] CCITT Recommendation M.3010 (1988): "Principles for a telecommunication management network".

[14] CCITT Recommendation M.550 (1988): "Performance limits for bringing into service and maintenance of digital paths, sections and line sections".

[15] CCITT Recommendation O.162: "Specifications for an instrument to monitor the frame alignment signal of frame structures (frame alignment signal monitor)".

[16] CEPT Recommendation T/TR 02-02, edition 3 (1987): "Rack/telecommunication centre power supply interfaces".

NOTE: This CEPT Recommendation is to be replaced by prETS 300 132 once available ("Equipment Engineering (EE); Power supply interface at the input to the telecommunications equipments (DE/EE-2001)").

[17] prETS 300 166: "Transmission and Multiplexing; Physical/electrical characteristics of hierarchical digital interfaces for equipment using the 2 048 kbit/s-based plesiochronous or synchronous digital hierarchies (DE/TM-3002)".

[18] prETS 300 167: "Transmission and Multiplexing; Functional characteristics of 2 Mbit/s interfaces (DE/TM-3006)".

3 Definitions

For the purpose of this ETS the following definitions apply.

Synchronous cross connect equipment: a device which accepts a number of signals comprising synchronously multiplexed lower bit rate signals and cross connects the constituent lower bit rate signals.

Blocking factor: the existence of cross connections in a cross connect equipment can block the establishing of any new cross connection. The blocking factor is the probability that a new cross connection cannot be made, expressed as a decimal fraction of 1.

Synchronisation signal: a clock control signal obtained from a synchronisation network.

Access port: access ports of a cross connect equipment are input and output ports used to terminate 2 048 kbit/s signals transporting synchronous 64 and n x 64 kbit/s signals to be cross connected.

4 Symbols and abbreviations

For the purpose of this ETS the following symbols and abbreviations apply.

AIS	Alarm Indication Signal
CRC	Cyclic Redundancy Check
CRC4	Cyclic Redundancy Check procedure relating to the 2 048 kbit/s basic frame structure according to CCITT Recommendation G.704 [2]
EFS	Error Free Signal
FAS	Frame Alignment Signal
fr0	Frame 0
ppm	part per million
SES	Severely Errored Second

TMN	Telecommunication Management Network
TS	Time Slot
TS16	Time Slot 16
TS0 NFAS	Time Slot 0 without Frame Alignment Signal
UI	Unit Interval

5 Network reference configuration

Figure 1 gives typical representation of the cross connect equipment in its network environment.

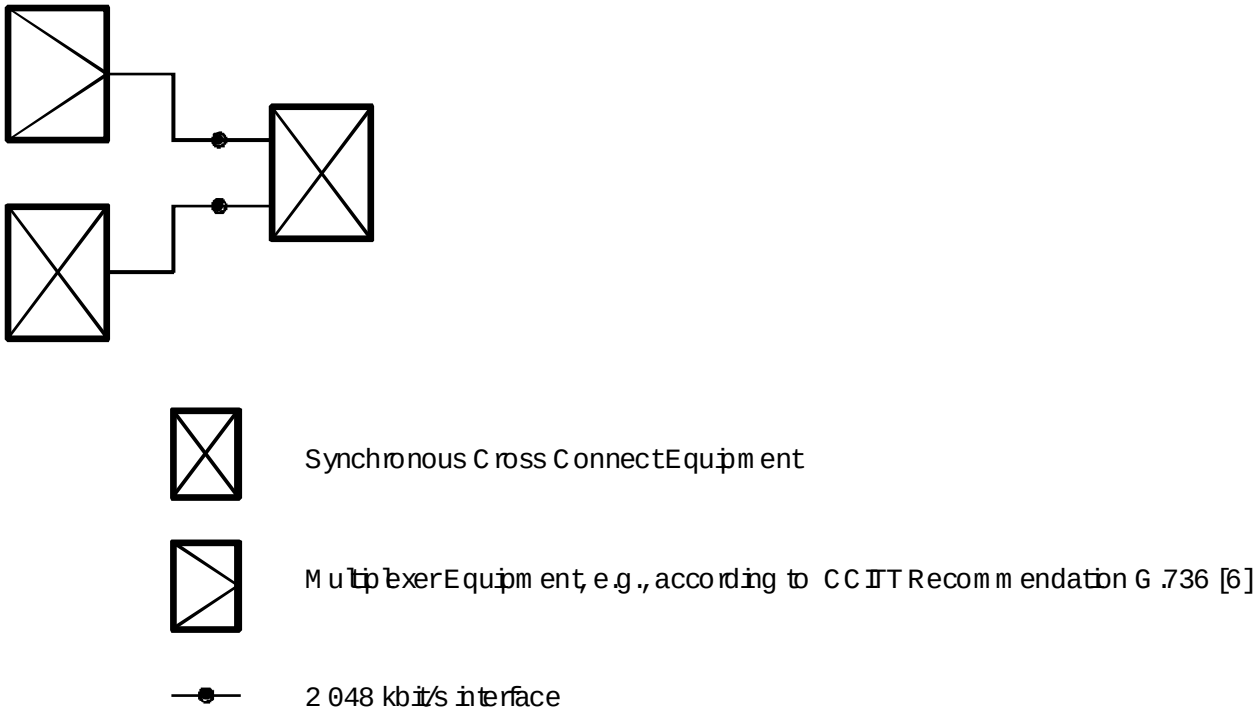
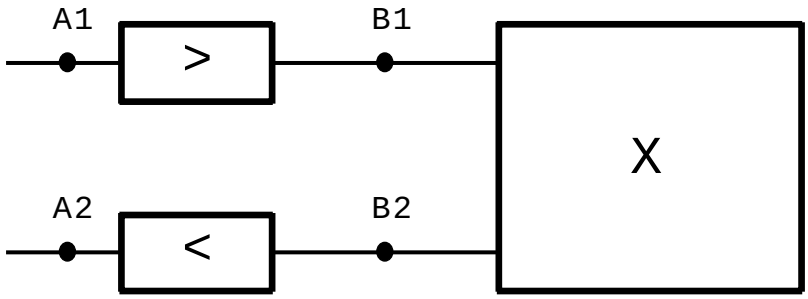


Figure 1: Network reference configuration

6 Reference model

Figure 2 below provides a reference model for the equipment, including the location and definition of reference points.



A1 reference point = ETS 300 167 [18] frame logical signal at receive part of 2 048 kbit/s access port;

A2 reference point = ETS 300 167 [18] frame logical signal at transmit part of 2 048 kbit/s access port;

B1 reference point = 64 kbit/s data channels derived from signals at the A1 reference point before cross connection;

B2 reference point = 64 kbit/s data channels derived from signals at the B1 reference point after cross connection;

> = receive part of a 2 048 kbit/s access port excluding the adaptation of CCITT Recommendation G.703 [1] signal to ETS 300 167 [18] frame logical signal;

< = transmit part of a 2 048 kbit/s access port excluding the adaptation of CCITT Recommendation G.704 [2] frame logical signal to ETS 300 166 [17] signal;

X = cross connection function.

NOTE: A1 and A2 (B1 and B2 respectively) relate to the same 2 048 kbit/s access port.

Figure 2: Equipment reference model

7 General characteristics

7.1 Size

This parameter depends mainly on network growth and can therefore change with time. It shall be possible to increase the size of an equipment without disturbing the existing traffic.

7.2 Timing signal

7.2.1 Control of timing signal

It should be possible to configure the equipment to derive the internal timing signal from:

a) one of a number of external source(s) at 2 048 kHz according to subclause 9.2;

b) one of a number of 2 048 kbit/s signal(s) according to subclause 9.1;

c) an internal oscillator.

On fault condition on the active synchronisation signal it shall be possible to program a fall-back strategy up to three steps; see subclause 11.2.1.2.

Complementary information corresponding to management aspects of the equipment will be provided in ETS 300 010-2 (currently under development).

The frequency accuracy of signals in a) and b) should normally be $\pm 1{:}10^{-11}$. To take into account possible frequency deviations on these signals occurring due to failure in the synchronous network, the design of timing derivation circuits should assume a frequency accuracy of ± 1 ppm.

The requirements for the 2 048 kbit/s physical interface according to subclause 9.1.1 are not affected.

7.2.2 Timing performance

The timing performance of the internal clock shall comply with CCITT Recommendation G.812 [9]. In the holdover mode, the local clock requirements of § 2.2.2 of CCITT Recommendation G.812 [9] shall be met.

NOTE: For other timing performance options, refer to Annex C.

8 Functions

The cross connect equipment shall perform the functions given in subclauses 8.1 and 8.2 of this ETS.

8.1 Cross connection

Cross connection of 64 and n x 64 kbit/s signals, bidirectional.

The n x 64 kbit/s signals shall be according to § 5.2 of CCITT Recommendation G.704 [2]. 6 x 64 kbit/s (384 kbit/s) signals according to § 2.2.3 of CCITT Recommendation G.735 [5] should be taken into account in the design of the equipment. The equipment shall maintain octet sequence integrity of the signals being cross connected.

NOTE 1: For some n x 64 kbit/s applications it may be necessary to maintain octet sequence integrity within each frame.

NOTE 2: Refer to Annex B for other n x 64 kbit/s Time Slot (TS) allocations.

8.2 Management

This includes control functions and provision of maintenance information and will be detailed in Part 2 of this ETS.

9 Interfaces

9.1 2 048 kbit/s interface

9.1.1 Physical interface

The 2 048 kbit/s physical interface shall be according to section 6 of CCITT Recommendation G.703 [1].

9.1.2 Frame structure

The details of frame structure carrying channels at various bit rates in 2 048 kbit/s shall be according to § 2.3 and § 5 of CCITT Recommendation G.704 [2]. Bit 1 of the frame shall be used in accordance with § 2.3.3 of CCITT Recommendation G.704 [2], i.e. for a Cyclic Redundancy Check (CRC) check bit procedure. However, § 2.2.3 of CCITT Recommendation G.735 [5] for TS allocation of 384 kbit/s sound programme signals contained in a 2 048 kbit/s frame should be taken into account.

NOTE: Refer to Annex B for other n x 64 kbit/s TS allocation.

9.2 Synchronisation interface at 2 048 kHz

The physical and electrical characteristics of the synchronisation interface shall be according to section 10 of CCITT Recommendation G.703 [1].

9.3 Interface with Telecommunication Management Network (TMN)

The interface with the TMN shall be the Q interface according to CCITT Recommendation G.773 [7].

9.4 User interface

The user interface shall be the F interface according to CCITT Recommendation M.3010 [13].

9.5 Power supply interface

The power supply interface shall be the A interface according to CEPT Recommendation T/TR 02-02 [16] (See NOTE to clause 2).

10 Frame alignment and CRC procedure

An illustration of the procedure is given in figure 2 of CCITT Recommendation G.706 [3].

10.1 Loss of frame alignment

The strategy for loss of frame alignment shall be according to § 4.1.1 of CCITT Recommendation G.706 [3].

10.2 Recovery of frame alignment

The strategy for recovery of frame alignment shall be according to § 4.1.2 of CCITT Recommendation G.706 [3].

10.3 CRC multiframe alignment in TS 0

CRC multiframe alignment in TS 0 shall comply with § 4.2 of CCITT Recommendation G.706 [3].

10.4 CRC bit monitoring

The CRC bit monitoring shall be performed according to § 4.3 of CCITT Recommendation G.706 [3].

11 Defect or failure conditions and performance monitoring

11.1 Defect or failure conditions at the A1 reference point and consequent actions at the B1 and A2 reference points

11.1.1 Defect or failure condition

The equipment shall detect the conditions given in the 11.1.1.1 to 11.1.1.6 subclauses.

11.1.1.1 Failure of power supply

11.1.1.2 Loss of incoming signal at 2 048 kbit/s

The detection of this defect is required only when it does not result in an indication of loss of frame alignment.

11.1.1.3 Loss of frame alignment

See subclause 10.1.

11.1.1.4 Error ratio 1:10-3

The detection of this defect shall comply with § 4.1.5 of CCITT Recommendation G.736 [6].

The detection of this defect is optional. When required, it can be determined by counting either the number of errored frame alignment signals or the number of errored bits in frame alignment signals or by using the CRC4 procedure. Part 2 of this ETS will cover the details of this.

11.1.1.5 Reception of Alarm Indication System (AIS)

The detection of AIS shall comply with § 4.2.4 of CCITT Recommendation G.736 [6], and § 3.3.2 of CCITT Recommendation O.162 [15].

11.1.1.6 Defect indication from a remote equipment

11.1.2 Consequent actions

Further to the detection of a defect or a failure condition, appropriate consequent actions shall be taken as specified in table 1. The consequent actions should be taken as soon as possible:

- AIS at B1 reference point should be applied within 3 ms of the detection of the relevant defect or failure condition;

- the maximum period between the detection of a defect or a failure condition and the transmission of defect indication at the A2 reference point shall be of the order of 100 ms;

- the maximum period between the detection of a defect or a failure condition and the generation of any failure information is dependent on the maintenance strategy for the equipment. This will be covered in Part 2 of this ETS which will specify the management aspects of cross connect equipment.

However, in case of the fault condition error ratio $1:10^{-3}$ provision shall be made for some form of persistence check (e.g. 2 or 3 x the integration time) with appropriate confidence that a fault condition does exist (cf §§ 4.1.5.1 and 4.1.5.2 of CCITT Recommendation G.736 [6]).

Table 1: Defect or failure conditions and consequent actions for a 2 048 kbit/s access port

Defect or failure condition at the A1 reference point	Consequent actions		
	Failure information generated (NOTE 1)	Defect indication to remote end at A2 reference point	AIS applied to data TS at B1 reference point
Failure of power supply		Yes if practicable	
Loss of incoming signal		Yes, bit 3 TS0 NFAS	Yes
Loss of frame alignment		Yes, bit 3 TS0 NFAS	Yes
Error ratio $1:10^{-3}$ (NOTE 4)		Yes, bit 3 TS0 NFAS	Yes (NOTE 2)
Defect indication received from remote end, bit 3 TS0 NFAS		No	No
AIS received		Yes (NOTE 3) (NOTE 5)	Yes

NOTE 1: Consequent actions related to the generation of failure information will be specified in ETS 300 010-2 (currently under development). These actions could be taken at the level of the equipment (e.g. bell, lamp,...) or at the level of the management of the equipment.

NOTE 2: Provision shall be made for disabling this action.

NOTE 3: In order to enable appropriate actions at the remote end, the indication of reception of AIS may be transmitted in addition to any other defect information to the remote end. The use of the 4 kbit/s data link on Sa4 in TS0 NFAS or the use of a free Sa bit of TS0 NFAS is suggested for this application.

NOTE 4: The detection of this defect condition is optional.

NOTE 5: This consequent action is optional.

11.2 Defect or failure conditions and consequent actions for the core of the equipment

11.2.1 Defect or failure conditions

The equipment shall detect the conditions given in subclauses 11.2.1.1 and 11.2.1.2.

11.2.1.1 Failure of a connection

A connection inside the equipment shall be deemed to have failed when the 64 or n x 64 kbit/s path between the A1 and A2 reference points of the relevant ports is not available for a period of more than 1 second.

11.2.1.2 Loss of synchronisation signal(s)

The equipment is timed by its own internal oscillator in the case where this is not the normal mode of operation. In the case of loss of active synchronisation reference, the equipment shall switch over to another reference according to the programmed fall-back strategy. In the case of selecting the internal oscillator (case c) of subclause 7.2.1) the equipment shall enter into the holdover mode.

11.2.2 Consequent actions

Further to the detection of a defect or a failure condition, appropriate consequent actions shall be taken as specified in table 2. The consequent actions shall be taken as soon as possible:

- the application of AIS at relevant B2 reference points (or B1 or A2) should be taken within 3 ms of the detection of the failure condition;

- the maximum period between the detection of a defect or failure condition and the transmission of a defect indication at the A2 reference point should be of the order of 100 ms;

- the maximum period between the detection of a defect or failure condition and the generation of any failure information is dependent on the maintenance strategy for the equipment. ETS 300 010-2 (currently under development) will specify the management aspects of cross connect equipment.

Table 2: Defect or failure conditions and consequent actions for the core of the equipment

Defect or failure condition	Consequent actions		
	Failure information generated (NOTE 1)	Defect indication to remote end at A2 reference point	AIS applied to data TS at B2 reference point (or B1 or A2)
Failure of a connection		No	Yes (if practicable)
Loss of synchronisation signal(s)		Yes (NOTE 2)	No
NOTE 1: As for table 1. NOTE 2: This action should be taken at the level of all A2 reference points. In order to enable appropriate actions at the remote ends the indication of loss of synchronisation signal(s) may be transmitted. The use of the 4 kbit/s data link on Sa4 in TSO NFAS or the use of a free Sa bit of TSO NFAS is suggested for this application.			

11.3 Performance monitoring

The following performance indications can be derived from error events or other defects:

- unavailable time;
- degraded performance;
- unacceptable performance.

The strategy to determine these quality performance parameters is described in CCITT Recommendation M.20 [12] and CCITT Recommendation M.550 [14]. More details will be given in ETS 300 010-2 which will specify management aspects of cross connect equipment.

12 Performance

12.1 Blocking factor

The blocking factor shall be zero for cross connect equipment of size up to at least 256 x 2 048 kbit/s access ports.

12.2 Jitter

12.2.1 Jitter at 2 048 kbit/s output

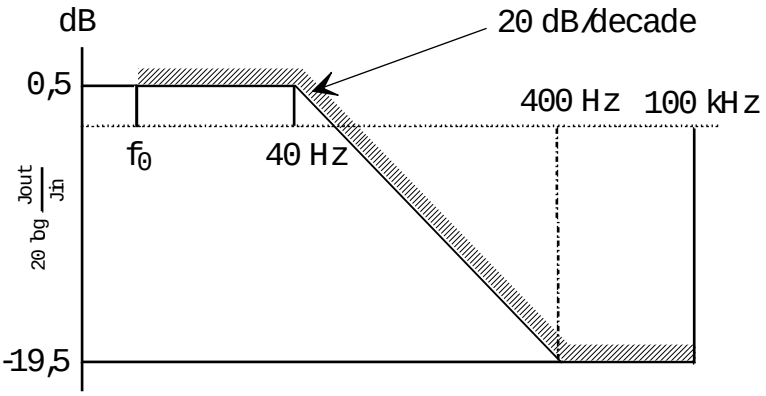
When the timing source is jitter free, the peak-to-peak jitter at any 2 048 kbit/s output shall not exceed 0,05 UI when it is measured in the range from f1 = 20 Hz to f4 = 100 kHz (refer to figure 2 of CCITT Recommendation G.823 [11]).

12.2.2 Jitter tolerance at 2 048 kbit/s input

The tolerance to jitter of any 2 048 kbit/s input port shall be according to § 3 of CCITT Recommendation G.823 [11].

12.2.3 Jitter transfer function

The jitter transfer function between the input used for synchronisation purposes and any 2 048 kbit/s output shall not exceed the gain/frequency limits given in figure 3. The input signal shall be modulated with sinusoidal jitter.



NOTE 1: The frequency f_0 should be less than 20 Hz and as low as possible (e.g. 10 Hz), taking into account the limitation of measuring equipment.

NOTE 2: To achieve accurate measurements, the use of a selective method is recommended with a bandwidth sufficiently small referred to the relevant measurement frequency, but not wider than 40 Hz.

Figure 3: Limits for jitter transfer function

12.3 Transfer delay

The transfer delay of 64 and n x 64 kbit/s signals through a cross connect equipment should be as small as possible taking account of buffer sizes. The delay shall not exceed 650 µs between the connectors of the corresponding access ports. For a temporary period this limit may be exceeded for existing equipment.

12.4 Slips

Three situations should be considered:

a) in normal operation the timing signal and the relevant input signal are timed from the same CCITT Recommendation G.811 [8] $1:10^{-11}$ clock. No slip should occur, assuming adequate wander buffers are provided;

b) the timing signal and the relevant input signal are timed from separate CCITT Recommendation G.811 [8] clocks. In this plesiochronous mode of operation, the rate of controlled slips should be in accordance with § 2.3 of CCITT Recommendation G.822 [10];

c) the timing signal and the relevant input signal are independently timed as the result of loss of all synchronisation signals. The rate of controlled slips shall be limited to that caused by internal clock frequency changes in the holdover mode. Refer to subclause 7.2.2.

NOTE: For other slip rate options in the holdover mode refer to Annex C.

12.5 Error characteristics of the equipment

The design objective long term error performance for a single pass through the equipment of a 64 kbit/s connection from/to reference points A1 and A2 shall be:

- no Severely Errored Second (SES);
- better than 99,995 % Error Free Second (EFS).

Annex A (normative): Additional requirements for cross connection of channel associated signalling bits in TS 16

This annex describes the additional requirements for cross connect equipment when some 2 048 kbit/s access frames contain channel associated signalling according to CCITT Recommendation G.704 [2].

References are made to the relevant Clauses of this ETS but are prefixed by the letter A.

A.5 Network reference configuration

Figure A.1 gives typical representation of the cross connect equipment in its network environment.

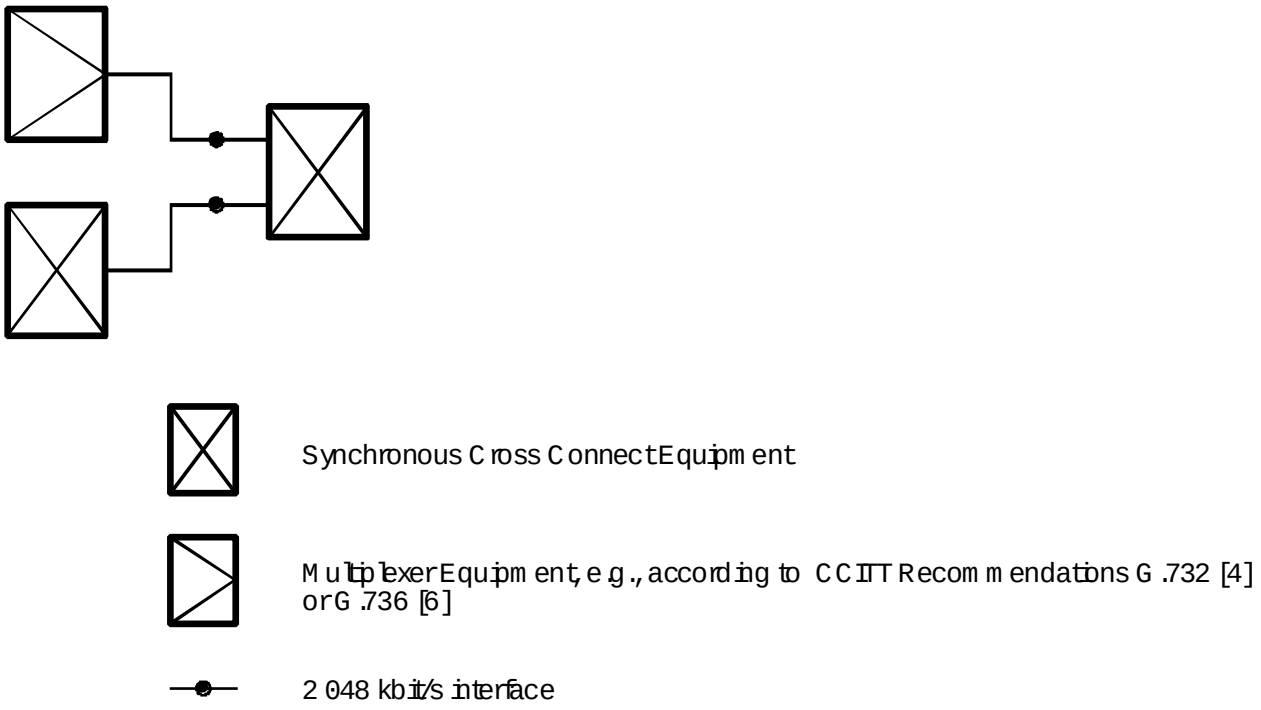
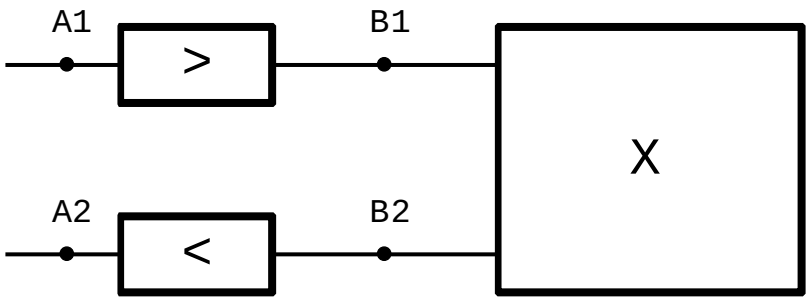


Figure A.1: Network reference configuration

A.6 Reference model

The figure A.2 gives a reference model for the equipment including the location and definition of reference points.



A1 reference point = G.704 [2] frame logical signal at receive part of 2 048 kbit/s access port;

A2 reference point = G.704 [2] frame logical signal at transmit part of 2 048 kbit/s access port;

B1 reference point = 64 kbit/s data channels and related signalling derived from signals at A1 reference point before cross connection;

B2 reference point = 64 kbit/s data channels and related signalling derived from signals at B1 reference point after cross connection;

> = receive part of a 2 048 kbit/s access port excluding the adaptation of CCITT Recommendation G.703 [1] signal to CCITT Recommendation G.704 [2] frame logical signal;

< = transmit part of a 2 048 kbit/s access port excluding the adaptation of CCITT Recommendation G.704 [2] frame logical signal to G.703 [1] signal;

X = cross connection function.

NOTE: A1 and A2 (respectively B1 and B2) relate to the same 2 048 kbit/s access port.

Figure A.2: Equipment reference model

A.8 Functions

A.8.1 Cross connection

Cross connection of 64 and n x 64 kbit/s signals, bidirectional. The n x 64 kbit/s signals shall be according to § 5.2 of CCITT Recommendation G.704 [2]. 6 x 64 kbit/s (384 kbit/s) signals according to § 2.2.3 of CCITT Recommendation G.735 [5] should be taken into account in the design of the equipment. The equipment shall maintain octet sequence integrity of the signals being cross connected.

For access ports carrying 2 048 kbit/s frames which contain channel associated signalling, the equipment shall cross connect signalling bits a, b, c, d in TS 16 corresponding to 64 kbit/s TS cross connection. The equipment shall maintain a, b, c, d bit sequence integrity.

NOTE 1: For some n x 64 kbit/s applications it may be necessary to maintain octet sequence integrity within each frame.

NOTE 2: Refer to Annex B for other n x 64 kbit/s TS allocation.

A.9 Interfaces

A.9.1.2 Frame structure

The details of frame structure carrying channels at various bit rates in 2 048 kbit/s shall be according to §§ 2.3 and 5 of CCITT Recommendation G.704 [2]. Bit 1 of the frame shall be used in accordance with § 2.3.3 of CCITT Recommendation G.704 [2], i.e. for a CRC check bit procedure. However, § 2.2.3 of CCITT Recommendation G.735 [5] for TS allocation of 384 kbit/s sound programme signals contained in a 2 048 kbit/s frame should be taken into account. Some 2 048 kbit/s access frames contain channel associated signalling.

NOTE: Refer to Annex B for other n x 64 kbit/s TS allocation.

A.11 Defect or failure conditions and performance monitoring

A.11.1.1 Defect or failure conditions

The equipment shall detect the additional conditions given in the following subclauses.

A.11.1.1.7 Loss of multiframe alignment

The detection of this defect shall comply with § 5.2 of CCITT Recommendation G.732 [4].

A.11.1.1.8 Reception of AIS in TS 16

The equivalent binary content of the AIS is a continuous stream of binary 1's. The strategy for detecting the presence of the AIS should be such that the AIS is detectable, even in the presence of an error ratio of $1:10^{-3}$. However, a signal with all bits except the multiframe alignment in the 1 state, should not be mistaken as an AIS.

A.11.1.1.9 Defect indication in TS 16 from a remote equipment

The defect indication in TS16 from a remote equipment corresponds to the loss of multiframe alignment in this remote equipment and is transmitted on bit 6 of TS16 of frame 0 according to § 5.3.2.3 of CCITT Recommendation G.732 [4].

A.11.1.2 Consequent actions

Table 1 is replaced by table A.1.

Table A.1: Defect or failure conditions and consequent actions for 2 048 kbit/s access port

Defect or failure Condition at the A1 reference point	Consequent actions			
	Failure information generated (NOTE 1)	Defect indication to remote end at A2 reference point	AIS applied at B1 reference point	
			Data TS	TS16 bits
Failure of power supply		Yes if practicable		
Loss of incoming signal		Yes, bit 3 TS0 NFAS	Yes	Yes
Loss of frame alignment		Yes, bit 3 TS0 NFAS	Yes	Yes
Error ratio $1:10^{-3}$		Yes, bit 3 TS0 NFAS	Yes (NOTE 2)	Yes (NOTE 2)
Defect indication received from remote end, bit 3 TS0 NFAS		No	No	No
AIS received		Yes (NOTE 3)	Yes	Yes
Loss of multiframe alignment		Yes bit 6 TS16 fr0	No	Yes
Defect indication received from remote end, bit 6 TS16 fr0		No	No	No
AIS received in TS16		Yes bit 6 TS16 fr0	No	Yes

NOTE 1: Consequent actions related to the generation of failure information will be specified in ETS 300 010-2 (currently under development). These actions could be taken at the level of the equipment (e.g. bell, lamp,...) or at the level of the management of the equipment.

NOTE 2: Provision shall be made for disabling this action.

NOTE 3: In order to enable appropriate actions at the remote end, the indication of reception of AIS may be transmitted in addition to any other defect information to the remote end. The use of the 4 kbit/s data link on Sa4 in TSO NFAS or the use of a free Sa bit of TSO NFAS is suggested for this application.

NOTE 4: The detection of this defect condition is optional.

NOTE 5: This consequent action is optional.

A.11.2 Defect or failure conditions and consequent actions for the core of the equipment

A.11.2.1.1 Failure of a connection

A connection inside the equipment shall be deemed to have failed when either the 64 or n x 64 kbit/s path or associated signalling a, b, c, d path or both paths between the A1 and A2 reference points of the relevant ports is (are) not available for a period of more than 1 second.

A.11.2.2 Consequent actions

Table 2 is replaced by table A.2.

Table A.2: Defect or failure conditions and consequent actions for the core of the equipment

Defect or failure condition	Consequent actions			
	Failure information generated (NOTE 1)	Defect indication to remote end at A2 reference point	AIS applied at B2 reference point (or B1 or A2)	
			Data TS	TS16 bits
Failure of a connection		No	Yes (if practicable) (NOTE 3)	
Loss of synchronisation signal(s)		Yes (NOTE 2)	No	No

NOTE 1: As for table 1.

NOTE 2: This action should be taken at the level of all A2 reference points. In order to enable appropriate actions at the remote ends, the indication of loss of synchronisation signal(s) may be transmitted. The use of the 4 kbit/s data link on Sa4 in TSO NFAS or the use of a free Sa bit of TSO NFAS is suggested for this application

NOTE 3: Application of AIS to Data TS corresponds only to the failure of 64 or n x 64 kbit/s path. Application of 1111 to TS 16 bits corresponds only to the failure of associated signalling path.

A.12 Performance

A.12.3 Transfer delay

A.12.3.1 64 and n x 64 kbit/s signals

The transfer delay of 64 and n x 64 kbit/s signals through a cross connect equipment should be as small as possible taking account of buffer sizes. The delay shall not exceed 650 µs between the connectors of the corresponding access ports. For a temporary period this limit may be exceeded for existing equipment.

A.12.3.2 Channel associated signalling in TS 16

The transfer delay of channel associated signalling data in TS 16 shall not exceed 7 ms between the connectors of the corresponding access ports.

Annex B (normative): Additional TS allocation

Network operators may require additional TS allocation for n x 64 kbit/s signals. This is described in this annex. References are made to the relevant Clauses of this ETS concerned but prefixed by the letter B.

B.8.1 Cross connection

Cross connection of 64 and n x 64 kbit/s signals, bidirectional. The n x 64 kbit/s signals shall be:

either

- according to § 5.2 of CCITT Recommendation G.704 [2]. 6 x 64 kbit/s (384 kbit/s) signals according to § 2.2.3 of CCITT Recommendation G.735 [5] should be taken into account in the design of the equipment. The equipment shall maintain octet sequence integrity of the signals being cross connected;

or

- not according to the TS order given in § 5.2 of CCITT Recommendation G.704 [2] or § 2.2.3 of CCITT Recommendation G.735 [5] or where the formats differ between input and output ports. The equipment shall maintain octet sequence integrity of signals being cross connected.

NOTE: For some n x 64 kbit/s applications it may be necessary to maintain octet sequence integrity within each frame.

B.9.1.2 Frame structure

The details of frame structure carrying channels at various bit rates in 2 048 kbit/s shall be according to §§ 2.3 and 5 of CCITT Recommendation G.704 [2]. Bit 1 of the frame shall be used in accordance with § 2.3.3 of CCITT Recommendation G.704 [2], i.e. for a CRC check bit procedure. However, § 2.2.3 of CCITT Recommendation G.735 [5] for TS allocation of 384 kbit/s sound programme signals contained in a 2 048 kbit/s frame should be taken into account. Some 2 048 kbit/s signals contain n x 64 kbit/s signals which are not according to the TS order given in § 5.2 of CCITT Recommendation G.704 [2] or § 2.2.3 of CCITT Recommendation G.735 [5].

Annex C (normative): Other timing and slip performance requirements

When the application of the cross connect equipment requires less stringent or more stringent performance requirements for timing and slips, one of the following options can be selected. References are made to the relevant Clauses of this ETS but are prefixed by the letter C.

C.1 More stringent performance

Subclause 7.2.2 of this ETS is referenced.

C.7.2.2 Timing performance

The text shall be replaced by the following:

The timing performance of the internal clock shall comply with CCITT Recommendation G.812 [9]. In the holdover mode, the transit clock requirements of § 2.2.3 of CCITT Recommendation G.812 [9] shall be met.

C.2 Less stringent performance

Subclause 7.2.2 of this ETS is referenced.

C.7.2.2 Timing performance

Performance requirements shall be consistent with § C.12.4 below.

C.12.4 Slips

Subclause 12.4 of this ETS is referenced.

Three situations should be considered:

a) in normal operation the timing signal and the relevant input signal are timed from the same CCITT Recommendation G.811 [8] $1:10^{-11}$ clock. No slip should occur, assuming adequate wander buffers are provided;

b) the timing signal and the relevant input signal are timed from separate CCITT Recommendation G.811 [8] clocks. In this plesiochronous mode of operation, the rate of controlled slips should be in accordance with § 2.3 of CCITT Recommendation G.822 [10];

c) the timing signal and the relevant input signal are independently timed as the result of loss of all synchronisation signals. Depending on the way the cross connect equipment is synchronised one of the two following options can be chosen:

   - for the first 24 hours, no more than 10 controlled slips per hour (cross connect equipment with only one synchronisation signal);

   - for the first 24 hours, no more than 300 controlled slips per hour (cross connect equipment with several independent sychronisation signals).

History

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