



G.751

GENERAL ASPECTS OF DIGITAL TRANSMISSION SYSTEMS

TERMINAL EQUIPMENTS

DIGITAL MULTIPLEX EQUIPMENTS OPERATING AT THE THIRD ORDER BIT RATE OF 34 368 kbit/s AND THE FOURTH ORDER BIT RATE OF 139 264 kbit/s AND USING POSITIVE JUSTIFICATION

ITU-T Recommendation G.751

(Extract from the *Blue Book*)

NOTES

1 ITU-T Recommendation G.751 was published in Fascicle III.4 of the *Blue Book*. This file is an extract from the *Blue Book*. While the presentation and layout of the text might be slightly different from the *Blue Book* version, the contents of the file are identical to the *Blue Book* version and copyright conditions remain unchanged (see below).

2 In this Recommendation, the expression “Administration” is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

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Recommendation G.751

DIGITAL MULTIPLEX EQUIPMENTS OPERATING AT THE THIRD ORDER BIT RATE OF 34 368 kbit/s AND THE FOURTH ORDER BIT RATE OF 139 264 kbit/s AND USING POSITIVE JUSTIFICATION

(Geneva, 1976; further amended)

1 General characteristics

1.1 There should be a 4th-order bit rate of 139 264 kbit/s in the digital hierarchy which is based on the 2nd-order bit rate of 8448 kbit/s.

There should be two methods of achieving the 4th-order bit rate:

Method 1 - by using a 3rd-order bit rate of 34 368 kbit/s in the digital hierarchy.

Method 2 - by directly multiplexing sixteen digital signals at 8448 kbit/s.

The digital signals at the bit rate of 139 264 kbit/s obtained by these two methods should be identical.

1.2 The existence of the above two methods implies that the use of the bit rate of 34 368 kbit/s should not be imposed on an Administration that does not wish to realize the corresponding equipment.

1.3 In accordance with the above two methods, the following realizations of digital multiplex equipments using positive justification are recommended:

Method 1 - Realization by separate digital multiplex equipments: one type which operates at 34 368 kbit/s and multiplexes four digital signals at 8448 kbit/s; the other type which operates at 139 264 kbit/s and multiplexes four digital signals at 34 368 kbit/s.

The multiplexing for the 34 368 kbit/s digital multiplex equipment is recommended in § 1.4 below, while further specification of this equipment is given in § 2 below.

The multiplexing for the 139 264 kbit/s digital multiplex equipment is recommended in § 1.5 below, while further specification of this equipment is given in § 3 below.

Method 2 - Realization by a single digital multiplex equipment which operates at 139 264 kbit/s and multiplexes sixteen digital signals at 8448 kbit/s.

The digital multiplexing for the 139 264 kbit/s bit rate should be achieved by multiplexing, in accordance with § 1.5 below, four digital signals at 34 368 kbit/s, each of which is obtained by multiplexing, in accordance with § 1.4 below, four digital signals at 8448 kbit/s. Further specification of this equipment is given in § 4 below.

1.4 Multiplexing four digital signals at 8448 kbit/s

1.4.1 Bit rate

The nominal bit rate should be 34 368 kbit/s.

The tolerance on that rate should be ± 20 parts per million (ppm).

1.4.2 Frame structure

Table 1/G.751 gives:

- the tributary bit rate and the number of tributaries;

- the number of bits per frame;
- the bit numbering scheme;
- the bit assignment;
- the bunched frame alignment signal.

TABLE 1/G.751

34 368 kbit/s multiplexing frame structure

Tributary bit rate (kbit/s)	8448
Number of tributaries	4
Frame structure	Bit number
Frame alignment signal (1111010000)	<i>Set I</i>
Alarm indication to the remote digital multiplex equipment	1 to 10
Bit reserved for national use	11
Bits from tributaries	12
	13 to 384
Justification service bits C_{j1} (see Note)	<i>Set II</i>
Bits from tributaries	1 to 4
	5 to 384
Justification service bits C_{j2} (see Note)	<i>Set III</i>
Bits from tributaries	1 to 4
	5 to 384
Justification service bit C_{j3} (see Note)	<i>Set IV</i>
Bits from tributaire available for justification	1 to 4
Bits from tributaries	5 to 8
	9 to 384
Frame length	1536 bits
Bits per tributary	378 bits
Maximum justification rate per tributary	22 375 kbit/s
Nominal justification ratio	0.436

Note - C_{jn} indicates the n th justification service bit of the j th tributary.

1.4.3 Loss and recovery of frame alignment

Loss of frame alignment should be assumed to have taken place when four consecutive frame alignment signals have been incorrectly received in their predicted positions.

When frame alignment is assumed to be lost, the frame alignment device should decide that such alignment has effectively been recovered when it detects the presence of three consecutive frame alignment signals.

The frame alignment device having detected the appearance of a single correct frame alignment signal, should begin a new search for the frame alignment signal when it detects the absence of the frame alignment signal in one of the two following frames.

Note - As it is not strictly necessary to specify the detailed frame alignment strategy, any suitable frame alignment strategy may be used provided the performance achieved is at least as efficient in all respects as that obtained by the above frame alignment strategy.

1.4.4 *Multiplexing method*

Cyclic bit interleaving in the tributary numbering order and positive justification is recommended. The justification control signal should be distributed and use the C_{jn} -bits ($n = 1, 2, 3$, see Table 1/G.751). Positive justification should be indicated by the signal 111, no justification by the signal 000. Majority decision is recommended.

Table 1/G.751 gives the maximum justification rate per tributary and the nominal justification ratio.

1.4.5 *Service digits*

Two bits per frame are available for service functions. Bit 11 of Set I is used to transmit an alarm indication to the remote multiplex equipment when specific fault conditions are detected in the multiplex equipment (see §§ 2.5 and 4.5 below). Bit 12 of Set I is reserved for national use. On a digital path crossing the border, this bit is fixed at 1.

1.5 *Multiplexing four digital signals at 34 368 kbit/s*

1.5.1 *Bit rate*

The nominal bit rate should be 139 264 kbit/s. The tolerance on that rate should be ± 15 parts per million (ppm).

1.5.2 *Frame structure*

Table 2/G.751 gives:

- the tributary bit rate and the number of tributaries;
- the number of bits per frame;
- the bit numbering scheme;
- the bit assignment;
- the bunched frame alignment signal.

1.5.3 *Loss and recovery of frame alignment*

Loss of frame alignment should be assumed to have taken place when four consecutive frame alignment signals have been incorrectly received in their predicted positions.

When frame alignment is assumed to be lost, the frame alignment device should decide that such alignment has effectively been recovered when it detects the presence of three consecutive frame alignment signals.

The frame alignment device having detected the appearance of a single correct frame alignment signal, should begin a new search for the frame alignment signal when it detects the absence of the frame alignment signal in one of the two following frames.

Note - As it is not strictly necessary to specify the detailed frame alignment strategy, any suitable frame alignment strategy may be used provided the performance achieved is at least as efficient in all respects as that obtained by the above frame alignment strategy.

1.5.4 *Multiplexing method*

Cyclic bit interleaving in the tributary numbering order and positive justification is recommended. The justification control signal should be distributed and use the C_{jn} -bits ($n = 1, 2, 3, 4, 5$, see Table 2/G.751). Positive justification should be indicated by the signal 11111, no justification by the signal 00000. Majority decision is recommended.

Table 2/G.751 gives the minimum justification rate per tributary and the nominal justification ratio.