INTERNATIONAL TELECOMMUNICATION UNION

ITU-T G.751

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

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.

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

TABLE 2/G.751

139 264 kbit/s multiplexing frame structure

Tributary bit rate (kbit/s)	34 368
Number of tributaries	4
Frame structure	Bit number
	Set I
Frame alignment signal (111110100000)	1 to 12
Alarm indication to the remote digital multiplex equipment	13
Bits reserved for national use	14 to 16
Bits from tributaries	17 to 488
	Set II to V
Justification service bits C_{jn} (n = 1 to 4) (see Note)	1 to 4
Bits from tributaries	5 to 488
	Set VI
Justification service bit C_{j5} (see Note)	1 to 4
Bits from tributaire available for justification	5 to 8
Bits from tributaries	9 to 488
Frame length	2928 bits
Bits per tributary	723 bits
Maximum justification rate per tributary	47 563 bit/s approx.
Nominal justification ratio	0.419

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

1.5.5 *Service digits*

Four bits per frame are available for service functions. Bit 13 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 §§ 3.5 and 4.5 below). Bits 14 to 16 of Set I are reserved for national use. On a digital path crossing the border, these bits are fixed at 1.

2 Digital multiplex equipment operating at 34 368 kbit/s and multiplexing four tributaries at 8448 kbit/s

2.1 *Multiplexing*

The multiplexing for the 34 368 kbit/s bit rate should be in accordance with § 1.4.

2.2 *Digital interfaces*

The digital interfaces at 8448 kbit/s and 34 368 kbit/s should be in accordance with Recommendation G.703.

2.3 *Jitter*

2.3.1 *Jitter transfer characteristic*

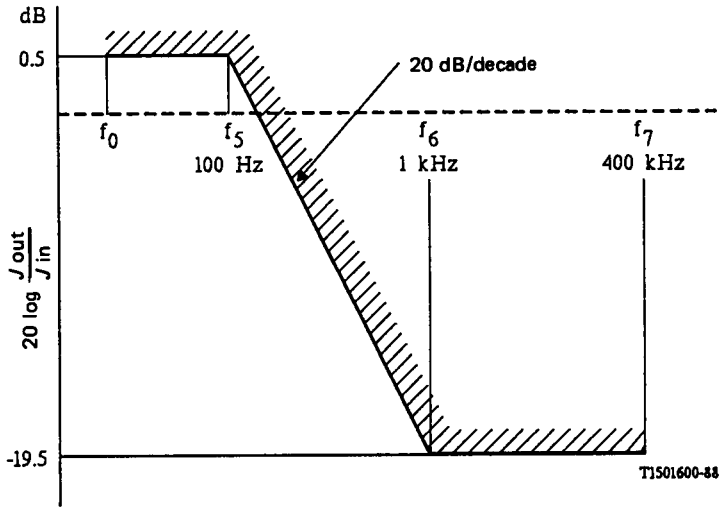
An 8448 kbit/s signal, modulated by sinusoidal jitter, should be subject to a muldex jitter transfer characteristic within the gain/frequency limits given in Figure 1/G.751. The equivalent binary content of the test signal should be 1000.

2.3.2 *Tributary output jitter*

The peak-to-peak jitter at a tributary output in the absence of input jitter should not exceed 0.25 UI when measured in the frequency range up to 400 kHz.

When measured with an instrument incorporating a bandpass filter having a lower cutoff frequency of 3 kHz, a rolloff of 20 dB/decade and an upper limit of 400 kHz, the peak-to-peak output jitter should not exceed 0.05 UI with a probability of 99.9% during a measurement period of 10 s.

Note - For interfaces meeting the national low Q option detailed in Recommendation G.703, the lower cutoff frequency for the above measurement should be 80 kHz.



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 limitations 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.

Note 3 - The need to tolerate spurious responses greater than -19.5 dB in the frequency range f_6 to f_7 is for further study.

FIGURE 1/G.751

2.3.3 *Multiplex signal output jitter*

In the case where the transmitting timing signal is derived from an internal oscillator, the peak-to-peak jitter at the 34 368 kbit/s output should not exceed 0.05 UI when it is measured within the frequency range from f_1 = 100 Hz to f_4 = 800 kHz.

2.4 *Timing signal*

If it is economically feasible, it may be desirable to be able to derive the multiplexer timing signal from an external source as well as from an internal source.

2.5 *Fault conditions, and consequent actions*

2.5.1 *Fault conditions*

The digital multiplex equipment should detect the following fault conditions:

2.5.1.1 Failure of power supply.

2.5.1.2 Loss of an incoming signal at 8448 kbit/s at the input of the multiplexer.

Note - Where separate circuits are used for the digital signal and the timing signal then loss of either or both should constitute loss of the incoming signal.

2.5.1.3 Loss of the incoming signal at 34 368 kbit/s at the input of the demultiplexer.

Note - The detection of this fault condition is required only when it does not result in an indication of loss of frame alignment.

2.5.1.4 Loss of frame alignment.

2.5.1.5 Alarm indication received from the remote multiplex equipment at the 34 368 kbit/s input of the demultiplexer (see § 2.5.2.2 below).

2.5.2 *Consequent actions*

Further to detection of a fault condition, actions should be taken as specified by Table 3/G.751. The consequent actions are as follows:

2.5.2.1 Prompt maintenance alarm indication generated to signify that performance is below acceptable standards and maintenance attention is required locally. When the Alarm Indication Signal (AIS) (see Note 2 under § 2.5.2.5) at 34 368 kbit/s is detected at the input of the demultiplexer, the prompt maintenance alarm indication associated with loss of frame alignment should be inhibited, while the rest of the consequent actions are in accordance with those associated in Table 3/G.751 with the fault condition.

Note - The location and provision of any visual and/or audible alarm activated by this maintenance alarm indication is left to the discretion of each Administration.

2.5.2.2 Alarm indication to the remote multiplex equipment generated by changing from the state 0 to the state 1 bit 11 of Set I at the 34 368 kbit/s output of the multiplexer.

2.5.2.3 AIS (see Notes 1 and 2 below) applied to all four 8448 kbit/s tributary outputs from the demultiplexer.

2.5.2.4 AIS (see Notes 1 and 2 below) applied to the 34 368 kbit/s output of the multiplexer.

2.5.2.5 AIS (see Note 2 below) applied to time slots of the 34 368 kbit/s signal at the output of the multiplexer, corresponding to the relevant 8448 kbit/s tributary.

The method of transmitting the AIS at the output port of the multiplexer in time slots corresponding to a faulty input tributary should be such that the status of the justification control digits is controlled so as to ensure that the AIS is within the tolerance specified for that tributary.

Note 1 - The bit rate of the AIS at the output of the multiplexer equipment or at the output of the demultiplexer equipment should be in accordance with the interface specifications.

Note 2 - The equivalent binary content of the AIS (AIS) at 8448 kbit/s and 34 368 kbit/s is nominally a continuous stream of 1s. 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 $1 \cdot 10^{-3}$. However a signal with all bits except the frame alignment signal in the 1 state, should not be mistaken as an AIS.

2.5.3 *Time requirements*

The fault detection and the application of the consequent actions given in §§ 2.5.2.2 to 2.5.2.5, including the detection of AIS, should be completed within a time limit of 1 ms.

TABLE 3/G.751

Fault conditions and consequent actions

Equipment part	Fault condition (see § § 2.5.1 or 3.5.1)	Consequent actions (see §§ 2.5.2 or 3.5.2)				
		Prompt maintenance alarm indication generated	Alarm indication to the remote multiplex equipment generated	AIS applied		
				To all the tributaries	To the composite signal	To the relevant time slots of the composite signal
Multiplexer and demultiplexer	Failure of power supply	Yes		Yes, if practicable	Yes, if practicable	
Multiplexer only	Loss of incoming signal on a tributary	Yes				Yes
Demultiplexer only	Loss of incoming signal	Yes	Yes	Yes		
	Loss of frame alignment	Yes	Yes	Yes		
	Alarm indication received from the remote multiplex equipment					

Note - A *Yes* in the table signifies that a certain action should be taken as a consequence of the relevant fault condition. An *open space* in the table signifies that the relevant action should *not* be taken as a consequence of the relevant fault condition, if this condition is the only one present. If more than one fault condition is simultaneously present the relevant action should be taken if, for at least one of the conditions, a *Yes* is defined in relation to this action.

3 Digital multiplex equipment operating at 139 264 kbit/s and multiplexing four tributaries at 34 368 kbit/s

3.1 *Multiplexing*

The multiplexing for the 139 264 kbit/s bit rate should be in accordance with § 1.5 above.

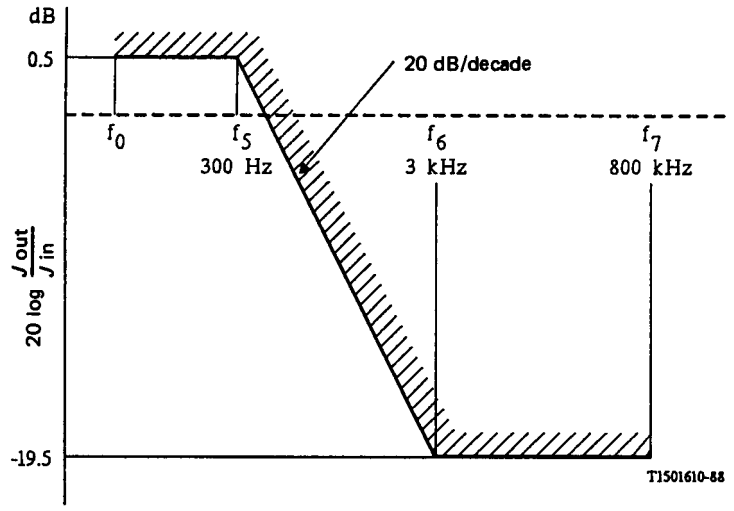
3.2 *Digital interfaces*

The digital interfaces at 34 368 kbit/s and 139 264 kbit/s should be in accordance with Recommendation G.703.

3.3 *Jitter*

3.3.1 *Jitter transfer characteristic*

A 34 368 kbit/s signal, modulated by sinusoidal jitter, should be subject to a muldex jitter transfer characteristic within the gain/frequency limits given in Figure 2/G.751. The equivalent binary content of the test signal should be 1000.



Note 1 - The frequency f_0 should be less than 20 Hz and as low as possible (e.g. 10 Hz), taking into amount the limitations 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.

Note 3 - The need to tolerate spurious responses greater than -19.5 dB in the frequency range f_6 to f_7 is for further study.

FIGURE 2/G.751

3.3.2 *Tributary output jitter*

The peak-to-peak jitter at a tributary output in the absence of input jitter should not exceed 0.3 UI when measured in the frequency range up to 800 kHz.

When measured with an instrument incorporating a bandpass filter having a lower cutoff frequency of 10 kHz, a rolloff of 20 dB/decade and an upper limit of 800 kHz, the peak-to-peak output jitter should not exceed 0.05 UI with a probability of 99.9% during a measurement period of 10 s.

3.3.3 *Multiplex signal output jitter*

In the case where the transmitting timing signal is derived from an internal oscillator, the peak-to-peak jitter at the 139 264 kbit/s output should not exceed 0.05 UI when it is measured within the frequency range from f_1 = 200 Hz to f_4 = 3500 kHz.

3.4 *Timing signal*

If it is economically feasible, it may be desirable to be able to derive the multiplexer timing signal from an external source as well as from internal source.

3.5 *Fault conditions and consequent actions*

3.5.1 *Fault conditions*

The digital multiplex equipment should detect the following fault conditions:

3.5.1.1 Failure of power supply.

3.5.1.2 Loss of an incoming signal at 34 368 kbit/s at the input of the multiplexer.

3.5.1.3 Loss of the incoming signal at 139 264 kbit/s at the input of the demultiplexer.

Note - The detection of this fault condition is required only when it does not result in an indication of loss of frame alignment.

3.5.1.4 Loss of frame alignment.

3.5.1.5 Alarm indication received from the remote multiplex equipment at the 139 264 kbit/s input of the demultiplexer (see § 3.5.2.2 below).

3.5.2 *Consequent actions*

Further to detection of a fault condition actions should be taken as specified by Table 3/G.751. The consequent actions are as follows:

3.5.2.1 Prompt maintenance alarm indication generated to signify that performance is below acceptable standards and maintenance attention is required locally. When the Alarm Indication Signal (AIS) (see Note 2 below) at 139 264 kbit/s is detected at the input to the demultiplexer, the prompt maintenance alarm indication associated with loss of frame alignment should be inhibited, while the rest of the consequent actions are in accordance with those associated in Table 3/G.751 with the fault condition.

3.5.2.2 Alarm indication to the remote multiplex equipment generated by changing from the state 0 to the state 1 bit 13 of Set I at the 139 264 kbit/s output of the multiplexer.

3.5.2.3 AIS (see Notes 1 and 2 below) applied to all four 34 368 kbit/s tributary outputs from the demultiplexer.

3.5.2.4 AIS (see Notes 1 and 2 below) applied to the 139 264 kbit/s output of the multiplexer.

3.5.2.5 AIS (see Note 2 below) applied to time slots of the 139 264 kbit/s signal at the output of the multiplexer corresponding to the relevant 34 368 kbit/s tributary.

The method of transmitting the AIS at the output port of the multiplexer in time slots corresponding to a faulty input tributary should be such that the status of the justification control digits is controlled so as to ensure that the AIS is within the tolerance specified for the tributary.

Note 1 - The bit rate of the AIS at the output of the multiplexer equipment or at the output of the demultiplexer equipment should be in accordance with the interface specifications.

Note 2 - The equivalent binary content of the AIS at 34 368 kbit/s and 139 264 kbit/s is nominally a continuous stream of 1s. 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 $1 \cdot 10^{-3}$. However a signal, with all bits except the frame alignment signal in the 1 state, should not be mistaken for an AIS.

3.5.3 *Time requirements*

The fault detection and the application of the consequent actions given in §§ 3.5.2.2 to 3.5.2.5, including the detection of AIS, should be completed within a time limit of 1 ms.

4 Digital multiplex equipment operating at 139 264 kbit/s and multiplexing sixteen tributaries at 8448 kbit/s

4.1 *Multiplexing*

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

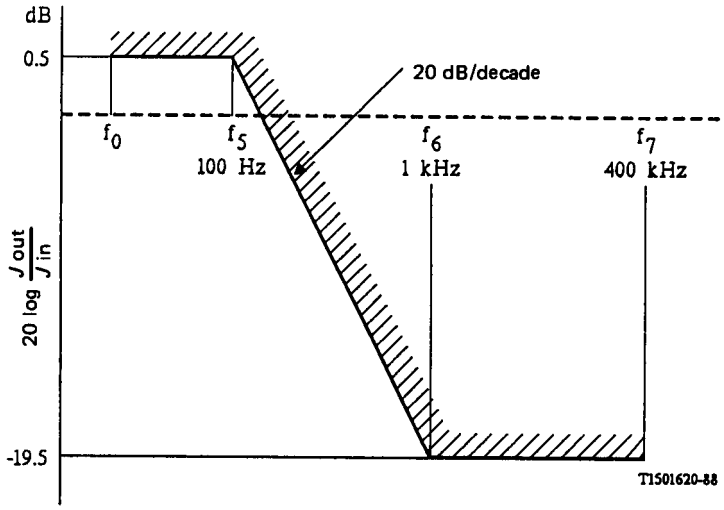
4.2 *Digital interfaces*

The digital interfaces at 8448 kbit/s and 139 264 kbit/s should be in accordance with Recommendation G.703.

4.3 *Jitter*

4.3.1 *Jitter transfer characteristic*

A 8448 kbit/s signal, modulated by sinusoidal jitter, should be subject to a muldex jitter transfer characteristic within the gain/frequency limits given in Figure 3/G.751. The equivalent binary content of the test signal should be 1000.



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 limitations 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.

Note 3 - The need to tolerate spurious responses greater than -19.5 dB in the frequency range f_6 to f_7 is for further study.

FIGURE 3/G.751

4.3.2 *Tributary output jitter*

The peak-to-peak jitter at a tributary output in the absence of input jitter should not exceed 0.35 UI when measured in the frequency range up to 400 kHz.

When measured with an instrument incorporating a bandpass filter having a lower cutoff frequency of 3 kHz, a rolloff of 20 dB/decade and an upper limit of 400 kHz, the peak-to-peak output jitter should not exceed 0.05 UI with a probability of 99.9% during a measurement period of 10 s.

Note - For interfaces meeting the national low Q option, detailed in Recommendation G.703, the lower cutoff frequency for the above measurement should be 80 kHz.

4.3.3 *Multiplex signal output jitter*

In the case where the transmitting timing signal is derived from an internal oscillator, the peak-to-peak jitter at the 139 264 kbit/s output should not exceed 0.05 UI when it is measured within the frequency range from f_1 = 100 Hz to f_4 = 3500 kHz.

4.4 *Timing signal*

If it is economically feasible, it may be desirable to be able to derive the multiplexer timing signal from an external source as well as from an internal source.

4.5 *Fault conditions and consequent actions*

4.5.1 *Fault conditions*

The digital multiplex equipment should detect the following fault conditions:

4.5.1.1 Failure of power supply.

4.5.1.2 Loss of an incoming signal at 8448 kbit/s at the input of the multiplexer.

Note - Where separate circuits are used for the digital signal and the timing signal then loss of either or both should constitute loss of the incoming signal.

4.5.1.3 Loss of the incoming signal at 139 264 kbit/s at the input of the demultiplexer.

Note - The detection of this fault condition is required only when it does not result in an indication of loss of frame alignment.

4.5.1.4 Loss of frame alignment of the signal at 139 264 kbit/s at the input of the demultiplexer.

4.5.1.5 Loss of frame alignment of a signal at 34 368 kbit/s within the demultiplexer.

4.5.1.6 Alarm indication received from the remote multiplex equipment at the 139 264 kbit/s input of the demultiplexer (see § 4.5.2.2 below).

4.5.1.7 Alarm indication received from the remote multiplex equipment on a signal at 34 368 kbit/s within the demultiplexer (see § 4.5.2.3 below).

4.5.2 *Consequent actions*

Further to detection of a fault condition, actions should be taken as specified by Table 4/G.751. The consequent actions are as follows:

4.5.2.1 Prompt maintenance alarm indication generated to signify that performance is below acceptable standards and maintenance attention is required locally. When the Alarm Indication Signal (AIS) (see Note 2 below) at 139 264 kbit/s or 34 368 kbit/s is detected by the demultiplexer, the prompt maintenance alarm indication associated with the corresponding loss of frame alignment should be inhibited, while the rest of the consequent actions are in accordance with those associated in Table 4/G.751 with the fault condition.

Note - The location and provision of any visual and/or audible alarms activated by the maintenance alarm indication is left to the discretion of each Administration.

4.5.2.2 Alarm indication on the 139 264 kbit/s signal to the remote multiplex equipment generated by changing from the state 0 to the state 1 bit 13 of Set I at the 139 264 kbit/s output of the multiplexer.

4.5.2.3 Alarm indication on a 34 368 kbit/s signal to the remote multiplex equipment generated by changing from the state 0 to the state 1 bit 11 of Set I on the 34 368 kbit/s signal into the multiplexer.

4.5.2.4 AIS (see Notes 1 and 2 below) applied to all sixteen 8448 kbit/s tributary outputs from the demultiplexer.

4.5.2.5 AIS (see Notes 1 and 2 below) applied to all four 8448 kbit/s relevant tributary outputs from the demultiplexer.

4.5.2.6 AIS (see Notes 1 and 2 below) applied to the 139 264 kbit/s output of the multiplexer.

4.5.2.7 AIS (see Note 2 below) applied to the time slot of the 139 264 kbit/s at the output of the multiplexer, corresponding to the relevant 8448 kbit/s tributary.

The method of transmitting the AIS at the output port of the multiplexer in time slots corresponding to a faulty input tributary, should be such that the status of the justification control digits is controlled so as to ensure that the AIS is within the tolerance specified for that tributary.

Note 1 - The bit rate of the AIS at the output of the multiplexer equipment or at the output of the demultiplexer equipment should be in accordance with the interface specifications.

Note 2 - The equivalent binary content of the AIS at 8448 kbit/s, 34 368 kbit/s and 139 264 kbit/s is nominally a continuous stream of 1s. 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 $1 \cdot 10^{-3}$. However a signal with all bits except the frame alignment signal in the 1 state, should not be mistaken for an AIS.

4.5.3 *Time requirements*

The fault detection and the application of the consequent actions given in §§ 4.5.2.2 to 4.5.2.7, including the detection of AIS, should be completed within a time limit of 1 ms.

TABLE 4/G.751

Fault conditions and consequent actions

Equipment part	Fault condition (see § 4.5.1)	Consequent actions (see § 4.5.2)						
		Prompt maintenance alarm indication generated	Alarm indication on the 139 264 kbit/s signal to the remote multiplex equipment generated	Alarm indication on a 34 368 kbit/s signal to the remote multiplex equipment generated	AIS applied			
					To all the 16 tributaries at 8448 kbit/s at the output of the demultiplexer	To the 4 relevant tributaries at 8448 kbit/s at the output of the demultiplexer	To the composite signal at 139 264 kbit/s at the output of the multiplexer	To the relevant time slot of the composite signal
Multiplexer and demultiplexer	Loss of power supply	Yes			Yes, if practicable		Yes, if practicable	
Multiplexer only	Loss of incoming signal on a tributary	Yes						Yes
Demultiplexer only	Loss of incoming signal at 139 264-kbit/s	Yes	Yes		Yes			
	Loss of frame alignment on the 139 264 kbit/s signal	Yes	Yes		Yes			
	Alarm indication received from the remote multiplex equipment on the 139 264 kbit/s signal							
	Loss of frame alignment on a 34 368 kbit/s signal	Yes		Yes		Yes		
	Alarm indication received from the remote multiplex equipment on a 34 368-kbit/s signal							

Note - A *Yes* in the table signifies that a certain action should be taken as a consequence of the relevant fault condition. An *open space* in the table signifies that the relevant action should *not* be taken as a consequence of the relevant fault condition, if this condition is the only one present. If more than one fault condition is simultaneously present the relevant action should be taken if, for at least one of the conditions, a *Yes* is defined in relation to this action.