_MultiFailure of _ YesYes, if _ Yes, if
_plexer _powerpracticable_practi
_and _supplycable
_demulti
_plexer
++++++
_MultiLoss of in Yes Yes _
_plexer _coming
_only _signal on a
tributary
+++++
_+
_ Loss of in- Yes Yes Yes _ Yes
_ coming
signal
_only _alignment
-only _anglinicit
<del>-</del>
Alarm
Alarm
_ indication
indication
indication
indication
indication
indication
indication

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.

Table 2/G.755.

Note 1 - The concept and definition of prompt maintenance alarm indication is given in Recommendation M.20.

Note 2 - When the alarm indication signal (AIS) 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 2/G.755 with the fault condition.

10.2.1Alarm indication to the remote multiplex equipment should be generated by changing bit 4 of Set IV (see Table 1/G.755) from the state 0 to the state 1.

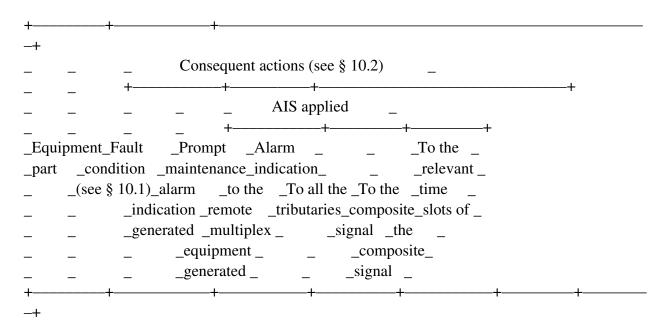
10.2.2AIS should be applied to the following as specified in Table 2/G.755:

- all three 44736 kbit/s tributary outputs from the demultiplexer;
- 139 264 kbit/s output of the multiplexer;
- the time slots of the 139 264 kbit/s signal at the output of the multiplexer, corresponding to the relevant 44736 kbit/s tributary.

<u>Note</u> - The equivalent binary content of the AIS at 44736 kbit/s is a signal with a valid frame alignment signal, parity and justification control bits as defined in Table 2/G.752, with the tributary bits being set to a 1010... sequence, starting with a binary 1 after each frame alignment, multiframe alignment and justification control bit, and with all justification control bits being set to binary 0.

#### **TABLE 2/G.755**

## Fault conditions and consequent actions



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

### 9. Service digits

Six bits per frame are available for service functions (see Table 1/G.755): bit 4 of Set IV is used to transmit an alarm indication to the remote multiplex equipment when specific fault conditions are detected in the multiplex equipment (see section 10 below); bit 5 of Set IV may be used for parity check; bits 6 to 9 of Set IV are reserved for future use.

# 10. Fault conditions and consequent actions

#### 10.1Fault conditions

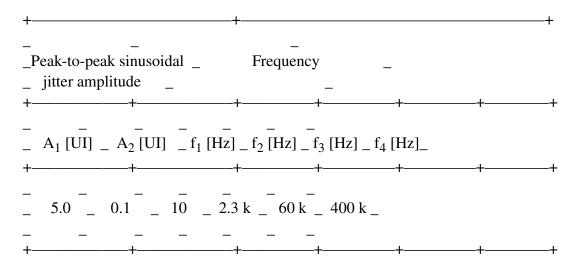
- 10.1.1The digital multiplex equipment should detect the following fault conditions:
- 1) failure of power supply;

2)loss of an incoming 44736 kbit/s tributary signal at a multiplexer input port;

- 3) loss of an incoming 139 264 kbit/s multiplex signal at a demultiplexer input port;
  - <u>Note</u> The detection of this fault condition is required only when it does not result in an indication of loss of frame alignment.
- 4) loss of frame alignment signal at a demultiplexer input port;
- 5) detection of an alarm indication received from the remote multiplex equipment at a demultiplexer input port;
- 6) detection of alarm indication signal (AIS) at a demultiplexer input port.
- Note 1 The equivalent binary content of the AIS at 139 264 kbit/s should be a continuous stream of binary ones (marks) as recommended in Recommendation M.20.
- Note 2 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 frame alignment signal in the state of 1, should not be mistaken as an AIS.
- 10.1.2The need to monitor the degradation of the incoming 139 264 kbit/s signal for the purpose of end-to-end error performance monitoring of the 139 264 kbit/s digital block as well as the procedure for detecting such degradation are for further study.

# 10.2Consequent actions

Further to the detection of a fault condition, the appropriate actions should be taken as specified in



**FIGURE 2/G.755** 

# Lower limit of maximum tolerable sinusoidal input jitter at 44736 kbit/s

#### 6.3.2 <u>Demultiplexer input jitter</u>

The 139 264 kbit/s input port should be capable of accommodating levels of input jitter up to the limits given in Recommendation G.823.

<u>Note</u> - The jitter accommodation requirement should be met when the jittered input signal is composed of the multiplexed tributary signals having any value of jitter allowed for the 44736 kbit/s level.

### 7. Digital interfaces

The digital interfaces at 44736 kbit/s and 139 264 kbit/s should be in accordance with Recommendation G.703.

#### 8. Timing signal

<u>Note</u> - The frequency  $f_O$  should be as low as possible, taking into account the limitations of measuring equipment. In any case  $f_O$  should be no greater than 10 Hz.

The selective measurement method should be used.

#### **FIGURE 1/G.755**

#### Demultiplexer tributary jitter transfer characteristic

#### 6.2Output jitter

# 6.2.1 Tributary output jitter

With no jitter applied to the input ports of the multiplexer and with the multiplexer directly connected to the demultiplexer, the peak-to-peak jitter at the tributary output port should not exceed 0.3 UI when measured over a one minute interval within the frequency range from  $f_1 = 10$  Hz to  $f_4 = 400$  kHz.

When measured with an instrument incorporating a bandpass filter having a lower cutoff frequency of  $f_3 = 60$  kHz, a roll-off of 20 dB/decade and an upper limit of  $f_4 = 400$  kHz, the peak-to-peak output jitter should not exceed 0.05 UI when it is measured over a one minute interval.

#### 6.2.2Multiplexer output jitter

The peak-to-peak jitter at the 139 264 kbit/s output port should not exceed 0.05 UI when it is measured over a one minute interval within the frequency range from 200 Hz to 3 500 kHz.

#### 6.3Input jitter

# 6.3.1 Tributary input jitter

The 44736 kbit/s input port should be capable of accommodating levels of input jitter up to the limits given in Figure 2/G.755.

<u>Note</u> - Current Recommendation G.703 does not refer to the jitter to be tolerated at the digital distribution frame at 44736 kbit/s nor at the input port of equipment connected to this distribution frame.

+------+------

+

Note 1 - See section 10.2.1.

Note 2 - The parity bit = 1 if the number of marks in all tributary bits including the bits in the justifiable time-slots in the preceding frame is odd; the parity bit = 0 if the number of marks in all tributary bits including the bits in the justifiable time-slots in the preceding frame is even.

<u>Note 3</u> - It is recognized that existing multiplex equipment installed prior to adoption of this Recommendation do not insert the parity bit.

Note 4 - The implementation and the use of this parity bit procedure are for further study.

Note 5 - These bits should be set to 1 when not used.

Note 6 -  $C_{ii}$  (j=1,2,3; i=1,2,3,4,5) indicates the ith justification control bit of the jth tributary.

6.Jitter

#### 6.1 Demultiplexer tributary jitter transfer characteristic

The demultiplexer 44736 kbit/s tributary jitter transfer characteristic should meet the gain/frequency limits given in Figure 1/G.75x. The equivalent binary content of the test signal used should result in a tributary output signal of 1000.

<u>Note 1</u> - This characteristic is usually measured between the high speed and low speed interfaces of the demultiplexer and the measurements are taken in unit intervals. It is then necessary to introduce a correction factor to account for the difference in the size of unit intervals.

Note 2 - In addition, the need to specify a muldex jitter transfer characteristic is for further study.

Note 3 - It is recognized that the existing multiplex equipment designed prior to the adoption of this Recommendation might need tributary test signals incorporating the 44736 kbit/s frame structure defined in G.752.

Table 1/G.755 gives the maximum justification rate per tributary and the nominal justification ratio.

# TABLE 1/G.755

# 139 264 kbit/s multiplexing frame structure

	<del></del>
Nominal tributary bit rate (kbit/s) Number of tributaries	_44736 _ _3 _
_	_
Frame structure	_Bit number _
	<del>-</del>
	_
Se	
Frame alignment signal (111110100000	
Bits from tributaries	_13 to 159 _
	et II _
Justification control bits $C_{j1}$ (Note 6)	_1 to 3 _
Bits from tributaries	_4 to 159 _
_ <u>Se</u>	et III _
Justification control bits C <sub>j2</sub> (Note 6)	_1 to 3 _
Bits from tributaries	_4 to 159 _
<u>_Se</u>	et IV _
Justification control bits C <sub>j3</sub> (Note 6)	_1 to 3 _
Alarm indication to the remote multiplex	x equipment (Note 1)_4
Parity bit (Notes 2, 3 and 4)	_5 _
Bits reserved for future use (Note 5)	_6 to 9 _
Bits from tributaries	_10 to 159 _
<u>_S</u> e	et V _
Justification control bits C <sub>j4</sub> (Note 6)	_1 to 3 _
Bits from tributaries	_4 to 159 _
<u>_Se</u>	et VI _
Justification control bits C <sub>j5</sub> (Note 6)	_1 to 3 _
Bits from tributaries available for justific	cation _4 to 6 _
Bits from tributaries	_7 to 159 _
	 +
Frame length (bits)	_954 _
Bits per tributary in a frame (bits)	
Maximum justification rate per tributary	
Nominal justification ratio	_0.545 _

#### 14.Recommendation G.755

# DIGITAL MULTIPLEX EQUIPMENT OPERATING AT 139 264 KBIT/S AND MULTIPLEXING THREE TRIBUTARIES AT 44736 KBIT/S

#### 1.General

The digital multiplex equipment described in this Recommendation is intended for use between networks using different digital hierarchies as specified in Recommendations G.702 and G.802.

#### 2.Bit rate

The bit rates of the tributary and multiplex signals should be 44736 kbit/s - +20 ppm and 139 264 kbit/s - +15 ppm, respectively, as specified in Recommendation G.703.

#### 3.Frame structure

Table 1/G.755 gives the recommended 139 264 kbit/s multiplexing frame structure.

## 4.Loss and recovery of frame alignment and consequent action

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 correct 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.

<u>Note</u> - 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.

#### 5. Multiplexing and justification methods

Cyclic bit interleaving in the tributary numbering order and positive justification are recommended.

The justification control signal should be distributed and use the  $C_{ji}$ -bits (J=1,2,3; i=1,2,3,4,5) (see Note 6 to Table 1/G.75x).

Positive justification should be indicated by the justification control signal 11111 and no justification by the signal 00000. Majority decision is recommended.