



INTERNATIONAL TELECOMMUNICATION UNION

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

G.743

**GENERAL ASPECTS OF DIGITAL TRANSMISSION
SYSTEMS**

TERMINAL EQUIPMENTS

**SECOND ORDER DIGITAL MULTIPLEX
EQUIPMENT OPERATING AT 6312 kbit/s AND
USING POSITIVE JUSTIFICATION**

ITU-T Recommendation G.743

(Extract from the *Blue Book*)

NOTES

1 ITU-T Recommendation G.743 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.743

SECOND ORDER DIGITAL MULTIPLEX EQUIPMENT OPERATING AT 6312 kbit/s AND USING POSITIVE JUSTIFICATION

(Geneva, 1972; further amended)

1 General

The second order digital multiplex equipment using positive justification described below, is intended for use on digital paths between countries using 1544 kbit/s primary multiplex equipments.

2 Bit rate

The nominal bit rate should be 6312 kbit/s.

The tolerance on that rate should be ± 30 parts per million (ppm).

3 Frame structure

Table 1/G.743 gives:

- the tributary bit rate and the number of tributaries;
- the number of bits per frame;
- the bit numbering scheme;
- the bit assignment;
- the distributed frame and multiframe alignment signals.

4 Loss and recovery of frame and multiframe alignment and consequent action

The frame alignment recovery time should not exceed 16 ms. The signal to be applied to the tributaries during the out-of-frame-alignment time should be studied.

Once frame alignment is established, multiframe alignment should be recovered in less than 420 microseconds.

5 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.743).

Positive justification should be indicated by the signal 111, no justification by the signal 000. Majority decision is recommended.

Table 1/G.743 gives the maximum justification rate per tributary and the nominal justification ratio.

6 Jitter

6.1 Specifications at the input ports

The digital signal presented at the input ports shall be as defined in Recommendation G.703 modified by the

transmission characteristic of the interconnecting cable. The input ports shall be able to tolerate a digital signal with these electrical characteristics but modified by sinusoidal jitter up to the limits specified by the amplitude frequency relationship in Figure 1/G.743. The equivalent binary content of the signal, with jitter modulation, applied to the inputs shall be a pseudo-random bit sequence of length $2^{15} - 1$.

Note - The signal with jitter modulation applied to the demultiplexer input shall contain the bits necessary for framing and justification in addition to information bits.

TABLE 1/G.743
6312-kbit/s multiplexing frame structure

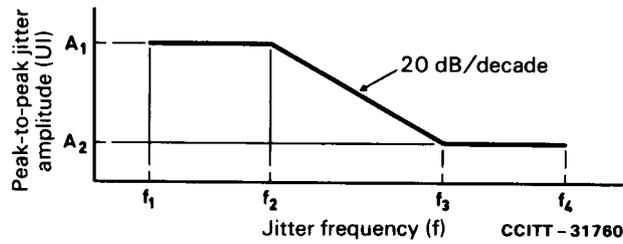
Tributary bit rate (kbit/s)	1544
Number of tributaries	4
Frame structure (see Notes 1 and 2)	Bit number
Bit for multiframe alignment signal (M_j) (see Note 1)	<i>Set I</i>
Bits from tributaries	1 2 to 49
1st bit for justification control signal (C_{j1})	<i>Set II</i>
Bits from tributaries	1 2 to 49
1st bit for frame alignment signal (F_0) (see Note 3)	<i>Set III</i>
Bits from tributaries	1 2 to 49
2nd bit for justification control signal (C_{j2})	<i>Set IV</i>
Bits from tributaries	1 2 to 49
3rd bit for justification control signal (C_{j3})	<i>Set V</i>
Bits from tributaries	1 2 to 49
2nd bit for frame alignment signal (F_1) (see Note 3)	<i>Set VI</i>
Bits from tributaries (see Note 4)	1 2 to 49
Frame length	294 bits
Multiframe length	1176 bits
Bits per tributary per multiframe (including justification)	288 bits
Maximum justification rate per tributary	5367 bit/s
Nominal justification ratio	0.334

Note 1 - This frame is repeated 4 times to form a multiframe with designated $j = 1, 2, 3, 4$. The multiframe alignment signal is a 011x-pattern. x may be used as an alarm service digit.

Note 2 - The bits from the second and fourth tributaries are inverted logically before multiplexing with the bits from the first and third tributaries.

Note 3 - The frame alignment is $F_0 = 0$ and $F_1 = 1$.

Note 4 - The bit available for the justification of tributary j is the first time slot of tributary j following F_1 in the j th frame.



Input	A ₁ (UI)	A ₂ (UI)	f ₁ (Hz)	f ₂ (Hz)	f ₃ (kHz)	f ₄ (kHz)
1544 kbit/s	2	0.05	10	200	8	40
6312 kbit/s (provisional)	8	0.05	10	200	32	160

UI Unit interval

FIGURE 1/G.743

Lower limit of maximum tolerable input jitter

6.2 *Multiplex signal output jitter*

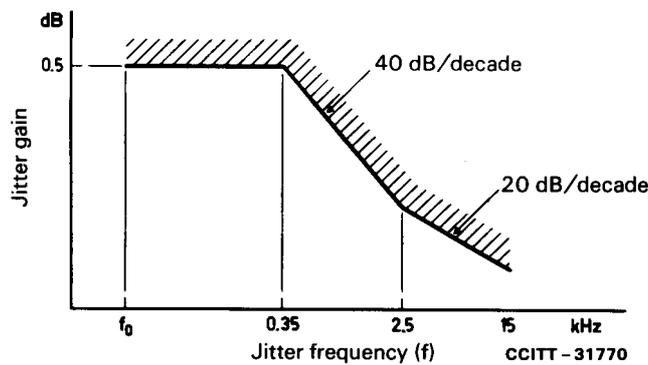
The jitter at the 6312 kbit/s output of the multiplexer should not exceed 0.01 UI rms.

6.3 *Demultiplexer output jitter with no multiplexer or demultiplexer input jitter*

With no jitter at the input to the multiplexer and demultiplexer, the jitter at the demultiplexer output should not exceed 1/3 unit intervals peak-to-peak.

6.4 *Demultiplexer jitter transfer characteristic*

The gain of the jitter transfer characteristic should not exceed the limits given in Figure 2/G.743.



Note - The frequency f_0 should be as low as possible taking into account the limitations of measuring equipment.

FIGURE 2/G.743

Demultiplexer transfer characteristic

7 Digital interfaces

The digital interfaces at 1544 kbit/s and 6312 kbit/s should be in accordance with Recommendation G.703.

8 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.

9 Service digits

The service digits are reserved for national use.

10 Fault conditions and consequent actions

10.1 Fault conditions

The digital multiplex equipment should detect the following fault conditions.

10.1.1 Failure of power supply.

10.1.2 Loss of frame alignment at the demultiplexer.

It may also be equipped to detect the following fault conditions.

10.1.3 Loss or degradation of incoming 1544 kbit/s signal.

10.1.4 Loss or degradation of incoming 6312 kbit/s signal.

10.1.5 Failure of the multiplex or demultiplex as evidenced by incorrect multiplexing or demultiplexing action.

10.1.6 Failure of standby (if the multiplex is so equipped).

10.2 Consequent actions

On the detection of a fault condition, the following appropriate actions should be taken:

10.2.1 For a multiplex equipped with automatic changeover, the consequent actions are specified in Table 2/G.743. For a multiplex so equipped, a switch to a standby is performed in the event of a failure of the multiplex equipment in service. A maintenance alarm is generated if a switch takes place, or if the standby fails. A prompt maintenance alarm is generated if an incoming signal fails, or if service is lost due to inability to complete automatic changeover to the standby.

10.2.2 For a multiplex not equipped with automatic changeover, a prompt maintenance alarm is generated in response to any fault condition detected. Such multiplexers will normally be equipped to detect power failure and loss or degradation of incoming signal at the demultiplexer.

10.2.3 The provision of an Alarm Indication Signal (AIS) to the 1544 kbit/s tributary outputs from the demultiplexer is under study. An AIS, suitable for use without special detectors at the primary PCM multiplex might be provided on an optional basis.

TABLE 2/G.743
Fault conditions and consequent actions for a multiplex equipped with automatic changeover

Equipment part	Fault condition (see § 10.1)	Consequent actions (see § 10.2.1)			
		Prompt maintenance alarm indication generated	Deferred maintenance alarm indication generated	Alarm indication to the remote multiplex equipment generated (if so equipped)	Automatic changeover actuated
Multiplexer demultiplexer	Failure of power supply	No	Yes		Yes
Multiplexer only	Loss or degradation of incoming signal on a tributary	Yes			No
Demultiplexer only	Loss or degradation of incoming signal at 6312 kbit/s		Yes	Yes	No
	Alarm indication received from the remote multiplex equipment (if so equipped)		Yes		

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.