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TERMINAL EQUIPMENTS

CHARACTERISTICS OF A 48-CHANNEL LOW BIT RATE ENCODING PRIMARY MULTIPLEX OPERATING AT 1544 kbit/s

ITU-T Recommendation G.724

(Extract from the *Blue Book*)

NOTES

1 ITU-T Recommendation G.724 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.724

CHARACTERISTICS OF A 48-CHANNEL LOW BIT RATE ENCODING PRIMARY MULTIPLEX OPERATING AT 1544 kbit/s

(Melbourne, 1988)

1 General

1.1 *Fundamental characteristics*

The 48-channel primary multiplexer provides conversion between 48 voice-frequency channels and one 1544 kbit/s ADPCM stream. In the 1544 kbit/s stream, the voice-frequency signals are coded according to the PCM encoding law defined in Recommendation G.711 and the ADPCM encoding law defined in Recommendation G.721. In addition, it may be arranged to provide limited 64 kbit/s unrestricted channel transfer capacity for baseband digital channel.

Figure 1/G.724 represents the nomenclature used.

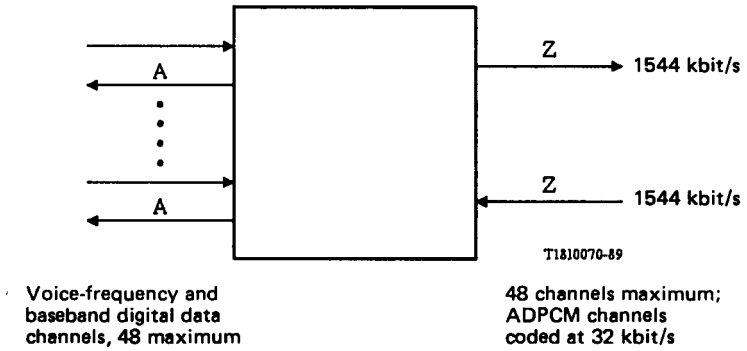

FIGURE 1/G.724

48-channel low bit rate encoding primary multiplex

The 1544 kbit/s stream associated with port Z can be partitioned into four independent 384 kbit/s entities defined as time-slot groupings. Each 384 kbit/s time-slot grouping consists of twelve 32 kbit/s time slots which can be used to transport up to 12 voice-frequency channels or 11 voice-frequency channels plus their channel associated a-b-c-d signalling information. Therefore, the 1544 kbit/s stream associated with port Z will have a maximum channel capacity of between 44 and 48 voice-frequency channels.

Note 1 - Administrations should take into account the guidance given in Recommendation G.721 concerning the use and transmission performance of 32 kbit/s ADPCM.

Note 2 - It should be noted that the primary multiplex equipment described in this Recommendation has a limited capability of transparently transporting 64 kbit/s data channel, and this should be taken into account in the planning of networks which are likely to evolve into an ISDN (see § 4.2).

1.2 *Timing signal*

It should be possible to derive the transmit timing signal from an incoming digital signal or from an external source.

2 Characteristics of port A interfaces

Analogue: Refer to § 3 of Recommendation G.712 and § 3 of Recommendation G.713.

Digital: Refer to § 1 of Recommendation G.703.

3 End-to-end analogue transmission performance

For further study.

4 Characteristics of a 1544 kbit/s signal organized in 32 kbit/s and/or 64 kbit/s timeslots (port Z)

4.1 *Interface Z*

The electrical characteristics of the 1544 kbit/s interface are in accordance with § 2 of Recommendation G.703.

4.2 *Frame structure*

4.2.1 *Frame structure at 1544 kbit/s*

Refer to § 3.2.1 of Recommendation G.704 for frame structure and use of derived channel time slots.

4.2.2 *Frame structure at 384 kbit/s*

Refer to § 3.2.3 of Recommendation G.704 for frame structure at 348 kbit/s.

4.3 *Loss and recovery of frame and multiframe alignment*

4.3.1 *Loss and recovery of 1544 kbit/s frame and multiframe alignment*

The criteria for loss and recovery of the frame alignment and multiframe alignment signal for port Z are in accordance with § 2.1 of Recommendation G.706 for the 24-frame multiframe and for the 12-frame multiframe.

4.3.2 *Loss and recovery of signalling grouping channel multiframe alignment*

The criteria for loss and recovery of the signalling grouping channel multiframe alignment signal are in accordance with § 3.2.6 of Recommendation G.704.

4.4 *Signalling*

Refer to § 3.2.4 of Recommendation G.704 for signalling in the 384 kbit/s stream.

5 Other characteristics of the low bit rate encoding primary multiplex equipment

5.1 *48-channel frame structure*

In the case where streams A are each carrying 48 voice-frequency signals and no channel associated signalling information is present, stream Z will transmit the full complement of 48 channels. When channel associated signalling is present, this is conveyed in the last 4-bit time slot of each time-slot grouping. Table 1/G.724 shows the correspondence between the VF channels and the 32 kbit/s ADPCM channels in stream Z.

5.2 *Direct time-slot transfer*

It should be possible to select and pass voice-frequency and baseband digital A streams through the Z stream at 64 kbit/s. Furthermore, it should be possible to pass through at least one such 64 kbit/s channel in each time-slot grouping in stream Z.

TABLE 1/G.724

Organization of the 1544 kbit/s frame for up to 48 channels at 32 kbit/s in stream Z

4-bit time slot of stream Z	1	2	3	4	5	6	7	8	9	10	11	12	Time-slot grouping 1
Voice-frequency channels of stream A	1A	2A	3A	4A	5A	6A	7A	8A	9A	10A	11A	12A or SGC	

4-bit time slot of stream Z	13	14	15	16	17	18	19	20	21	22	23	24	Time-slot grouping 2
Voice-frequency channels of stream A	13A	14A	15A	16A	17A	18A	19A	20A	21A	22A	23A	24A or SGC	

4-bit time slot of stream Z	25	26	27	28	29	30	31	32	33	34	35	36	Time-slot grouping 3
Voice-frequency channels of stream A	25A	26A	27A	28A	29A	30A	31A	32A	33A	34A	35A	36A or SGC	

4-bit time slot of stream Z	37	38	39	40	41	42	43	44	45	46	47	48	Time-slot grouping 4
Voice-frequency channels of stream A	37A	38A	39A	40A	41A	42A	43A	44A	45A	46A	47A	48A or SGC	

SGC Signalling grouping channel.

Note - Selection of the time-slot grouping format to include the signalling grouping channel is made on a per-time-slot grouping basis, independent of the other time-slot groupings.

5.3 *Signalling grouping channel alarm indications*

A time-slot grouping alarm is declared when the signalling grouping channel multiframe alignment signal is lost for an interval of between 2 to 3 seconds.

When signalling grouping channel multiframe alignment is lost (as per § 3.2.6 of Recommendation G.704), updating of the channel-associated signalling bits on the receive side of stream A will be disabled.

The time-slot grouping alarm is released when signalling grouping channel multiframe alignment has been re-acquired for an interval of between 10 to 20 seconds.

When signalling grouping channel multiframe alignment is declared (as per § 3.2.6 of Recommendation G.704, updating of the channel-associated signalling bits on the receive side of stream A will be enabled.

On the send side, M_1 is set to 1 to transmit a time-slot grouping alarm to the remote end when the near end is in time-slot grouping alarm. On the receive side, a remote time-slot grouping alarm is declared when M_1, M_2 or M_3 has been set for 335 to 1000 milliseconds. Remote time-slot grouping alarm is released when M_1, M_2 and M_3 has been reset for 20 to 1000 milliseconds.

5.4 *Fault conditions and consequent actions*

5.4.1 *1544 kbit/s fault conditions associated with stream Z*

A summary of the 1544 kbit/s fault conditions associated with the receive side of stream Z and the consequent actions are listed in Table 2/G.724.

The primary multiplex shall detect the following 1544 kbit/s fault conditions associated with stream Z:

i) loss of incoming signals at 1544 kbit/s;

ii) loss of 1544 kbit/s frame alignment;

iii) 1544 kbit/s alarm indication signal (AIS) received;

iv) 1544 kbit/s alarm indication received from the remote end.

5.4.2 *Consequent actions associated with stream Z*

Upon detection of 1544 kbit/s fault conditions in stream Z, appropriate actions should be taken which are in accordance with § 4.2 of Recommendation G.733. In addition, the following consequent actions should be taken as indicated in Table 2/G.724:

i) declare a 1544 kbit/s alarm on the receive side of port Z;

ii) send a 1544 kbit/s alarm indication to the remote end on the send side of port Z in accordance with § 4.2.4 of Recommendation G.733;

iii) declare a remote 1544 kbit/s alarm on the receive side of port Z.

5.4.3 *Fault conditions associated with the signalling grouping channel*

A summary of the signalling grouping channel fault conditions associated with the receive side of stream Z and

the consequent actions are listed In Table 3/G.724.

The transcoder shall detect the following signalling grouping channel fault conditions associated with stream Z.

i) loss of signalling grouping channel multiframe alignment on a single time-slot grouping;

ii) remote time-slot grouping alarm indication (M_1) receive from the remote end on a single time-slot grouping;

iii) signalling grouping channel AIS (M_2) receive from the remote end on a single time-slot grouping;

iv) Remote signalling grouping channel AIS (M_3) received from the remote end on a single time-slot grouping.

TABLE 2/G.724

1544 kbit/s fault conditions associated with stream Z and consequent actions

Consequent actions / Fault conditions	Declare 1544 kbit/s alarm on Z (i)	Send 1544 kbit/s alarm indication to remote end on Z (ii)	Declare remote 1544 kbit/s alarm on Z (iii)
Loss of incoming signal at 1544 kbit/s (i)	Yes	Yes	
Loss of 1544 kbit/s frame alignment (ii)	Yes	Yes	
1544 kbit/s AIS received (iii)	Yes	Yes	
1544 kbit/s alarm indication received from remote end (iv)			Yes

5.4.4 *Consequent actions associated with the signalling grouping channel*

Upon detection of signalling grouping channel fault conditions in stream Z, the following consequent actions shall be taken as indicated in Table 3/G.724:

i) declare a time-slot grouping alarm on the associated time-slot grouping;

ii) send a time-slot grouping alarm indication to the remote end by forcing the M_1 bit within the affected signalling grouping channel to 1;

iii) condition the data in the affected channels on the receive side of streams A to provide a signal that is compatible with downstream equipment;

iv) condition the channel-associated signalling in affected channels on the receive side of stream A to provide a signalling that is compatible with downstream equipment;

v) declare a remote time-slot grouping alarm condition on the associated time-slot grouping to indicate the reception of a remote time-slot grouping alarm indication to the M_1 bit of the affected signalling grouping channel;

vi) declare a signalling grouping channel AIS condition on the associated time-slot grouping to indicate the reception of a signalling grouping channel AIS indication in the M_2 bit of the affected signalling rouping channel;

vii) declare a remote signalling grouping channel AIS condition on the associated time-slot grouping to indicate the reception of a remote signalling grouping channel AIS indication in the M_3 bit of the affected signalling grouping channel.

5.5 *Jitter*

For further study.

TABLE 3/G.724

Signalling grouping channel fault conditions associated with stream Z and consequent action

Consequent actions / Fault conditions	Declare time-slot grouping alarm (i)	Send time-slot grouding alarm indication to remote end (ii)	Condition affected channels on A (iii)	Condition signalling in affected channels on A (iv)	Declare remote time-slot grouping alarm (v)	Declare signalling grouping channel AIS (vi)	Declare remote signalling grouping channel AIS (vii)
Loss of signalling grouping channel multiframe alignment (single time-slot grouping) (i)	Yes	Yes	Yes	Yes			
Remote time-slot grouping alarm indication received (single time-slot grouping) (ii)			Yes	Yes	Yes		
Signalling grouping channel AIS received (single time-slot grouping) (iii)			Yes	Yes		Yes	
Remote signalling grouping channel AIS received (single time-slot grouping) (iv)			Yes	Yes			Yes