



INTERNATIONAL TELECOMMUNICATION UNION

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G.706

THE INTERNATIONAL
TELEGRAPH AND TELEPHONE
CONSULTATIVE COMMITTEE

**GENERAL ASPECTS OF DIGITAL
TRANSMISSION SYSTEMS;
TERMINAL EQUIPMENTS**

**FRAME ALIGNMENT AND CYCLIC
REDUNDANCY CHECK (CRC) PROCEDURES
RELATING TO BASIC FRAME STRUCTURES
DEFINED IN RECOMMENDATION G.704**

Recommendation G.706



Geneva, 1991



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FOREWORD

The CCITT (the International Telegraph and Telephone Consultative Committee) is a permanent organ of the International Telecommunication Union (ITU). CCITT is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The Plenary Assembly of CCITT which meets every four years, establishes the topics for study and approves Recommendations prepared by its Study Groups. The approval of Recommendations by the members of CCITT between Plenary Assemblies is covered by the procedure laid down in CCITT Resolution No. 2 (Melbourne, 1988).

Recommendation G.706 was prepared by Study Group XVIII and was approved under the Resolution No. 2 procedure on the 5th of April 1991.

CCITT NOTES

- 1) In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication Administration and a recognized private operating agency.
- 2) A list of abbreviations used in this Recommendation can be found in Annex D.

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Recommendation G.706**FRAME ALIGNMENT AND CYCLIC REDUNDANCY CHECK (CRC) PROCEDURES
RELATING TO BASIC FRAME STRUCTURES DEFINED IN RECOMMENDATION G.704***(Melbourne, 1988, revised 1990)***1 General**

This Recommendation relates to equipment which receives signals with basic frame structures as defined in Recommendation G.704. It defines the frame alignment, the cyclic redundancy check (CRC) multiframe alignment and CRC bit error monitoring procedures to be used by such equipment. Annex A contains background information about the use of the CRC procedures and their limitations.

Annex B gives details of a modified CRC-4 multiframe alignment algorithm which allows automatic interworking between equipment with and without a CRC-4 capability. Annex C gives details regarding the updating of CRC-4 information when an intermediate equipment (i.e. between true path terminating equipments) has a write-access to a message-based data-link facility (see Recommendation G.704, § 2.3.3.5.4).

2 Frame alignment and CRC procedures at 1544 kbit/s interface**2.1 Loss and recovery of frame alignment**

There are two alternative multiframe structures at the 1544 kbit/s interface:

- a) 24-frame multiframe, and
- b) 12-frame multiframe.

2.1.1 Loss of frame alignment

The frame alignment signal should be monitored to determine if frame alignment has been lost. Loss of frame alignment should be detected within 12 ms. Loss of frame alignment must be confirmed over several frames to avoid the unnecessary initiation of the frame alignment recovery procedure due to transmission bit errors. The frame alignment recovery procedure should commence immediately once loss of frame alignment has been confirmed.

Note – For the 12-frame multiframe described in Recommendation G.704, loss of multiframe alignment is deemed to occur when loss of frame alignment occurs.

2.1.2 Recovery of frame alignment**2.1.2.1 Frame alignment recovery time**

The frame alignment recovery time is specified in terms of the maximum average reframe time in the absence of errors. The maximum average reframe time is the average time to reframe when the maximum number of bit positions must be examined for locating the frame alignment signal.

- a) *24-frame multiframe*

The maximum average reframe time should not exceed 15 ms.

Note – Some existing designs of equipment were designed to a limit of 50 ms.

b) *12-frame multiframe*

The maximum average reframe time should not exceed 50 ms.

Note – These times do not include the time required for the CRC procedure for false frame alignment verification defined in § 2.2.2.

2.1.2.2 *Strategy for frame alignment recovery*a) *24-frame multiframe*

Frame alignment should be recovered by detecting the valid frame alignment signal. When the CRC-6 code is utilized for error performance monitoring (see § 2.2.3), the CRC-6 information may be coupled with the framing algorithm to ensure that a valid frame alignment signal contained within the 24 F-bits is the only pattern onto which the reframe circuit can permanently lock. This procedure is illustrated in Figure 1/G.706.

b) *12-frame multiframe*

Overall frame alignment should be recovered by way of simultaneous detection of the frame alignment signal and the multiframe alignment signal, or of frame alignment followed by multiframe alignment.

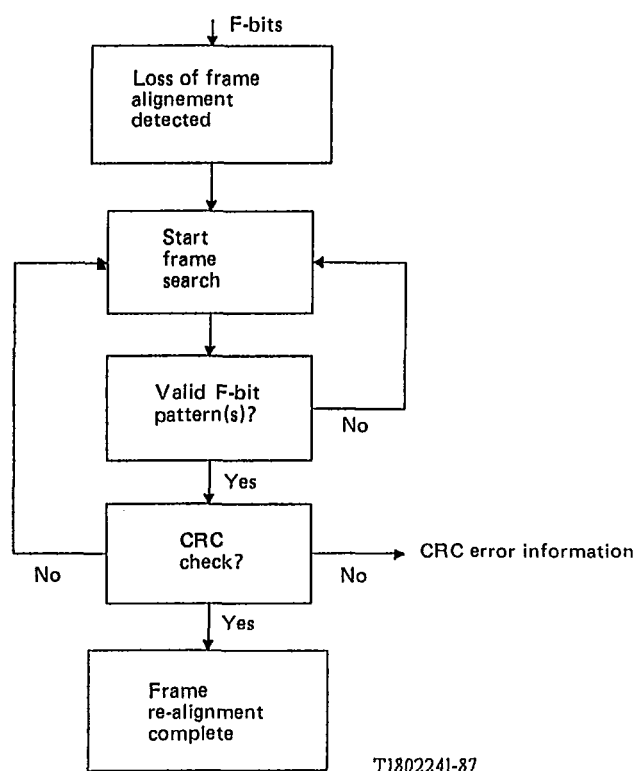


FIGURE 1/G.706

False frame alignment protection using a cyclic redundancy check (CRC) (1544 and 6312 kbit/s)

2.2 *CRC bit monitoring*

Error monitoring by CRC-6 assumes a signal quality sufficient for frame alignment to be established so that CRC-6 bits can be correctly accessed.

2.2.1 *Monitoring procedure*

- i) A received CRC message block (CMB) is acted upon by the multiplication/division process defined in Recommendation G.704 after having its F-bits replaced by binary 1s.
- ii) The remainder resulting from the division process is then stored and compared on a bit-by-bit basis with the CRC bits received in the next CMB.
- iii) If the remainder exactly corresponds to the CRC bits contained in the next CMB of the received signal, it is assumed that the checked CMB is error-free.

2.2.2 *Monitoring for false frame alignment (see § A.1.1)*

In the case of the 24-frame multiframe, when the CRC-6 code is utilized for error performance monitoring, it may also be used to provide immunity against spurious frame alignment signals. The procedure described in § 2.1.2.2 a) should be followed.

2.2.3 *Error performance monitoring using CRC-6 (see § A.1.2)*

For the purpose of error performance monitoring, it should be possible to obtain indications of each CRC message block which is received in error. The consequent error information should be used in accordance with the requirements to be defined in respective equipment Recommendations.

3 **Frame alignment and CRC procedures at 6312 kbit/s interface**

3.1 *Loss and recovery of frame alignment*

For the 6312 kbit/s hierarchical level, the term "frame alignment" is synonymous of "multiframe alignment". The last five bits of the 789-bit frame are designated as the F-bits (see Recommendation G.704) and are time-shared as a frame alignment signal and for other purposes.

3.1.1 *Loss of frame alignment*

The frame alignment signal should be monitored to determine if frame alignment has been lost. The loss of frame alignment is declared when seven consecutive incorrect frame alignment signals have been received.

The recovery of frame alignment procedure should start immediately once loss of frame alignment has been confirmed.