



Q.33

GENERAL RECOMMENDATIONS ON TELEPHONE SWITCHING AND SIGNALLING

INTERNATIONAL AUTOMATIC AND SEMI-AUTOMATIC WORKING

PROTECTION AGAINST THE EFFECTS OF FAULTY TRANSMISSION ON GROUPS OF CIRCUITS

ITU-T Recommendation Q.33

(Extract from the *Blue Book*)

NOTES

1 ITU-T Recommendation Q.33 was published in Fascicle VI.1 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.

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PROTECTION AGAINST THE EFFECTS OF FAULTY TRANSMISSION ON GROUPS OF CIRCUITS

1 General

1.1 Although certain signalling systems may have the capability to provide an indication when an individual circuit is faulty, in order to maintain the required availability of the public network, it is considered necessary to provide alarm facilities to alert maintenance staff when a group of circuits provided by a multiplex transmission system is faulty.

1.2 An alarm indication can be initiated on failure of a FDM system by means of pilot supervision. On failure of a PCM system, and alarm indication initiated at both ends by the loss of frame alignment (or multiframe alignment as appropriate) [1],[2].

These failure indicators provide the means whereby the faulty circuits can be removed from service automatically and, when the fault condition no longer exists, be restored automatically by the switching control of an international exchange (see § 1.4 below).

Additionally, the existence of such failure indications allow an end-to-end indication of circuit availability which is a prerequisite to the operation of Signalling System No. 7 without a per call continuity check [see Recommendations Q.724 (TUP) and Q.764 (ISUP)].

1.3 Where transmission links comprise several transmission systems in tandem, the protection against the effects of faulty transmission on groups of circuits can only be maintained if the primary multiplex structure is maintained from end-to-end together with a transparency of alarm indications. In other cases the provisions of §§ 2 and 3 below apply.

1.4 Following a transmission failure a number of specific signalling actions are required to be carried out by the switching control of an international exchange. These actions are designed to:

- a) prevent failure of new call attempts;
- b) provide appropriate failure indications on established calls;
- c) provide a means of releasing circuit connections beyond the point of transmission failure.

Paragraph 4 below details the actions to be taken for circuits employing Signalling Systems Nos. 5, 6 and 7 (TUP and ISUP). For circuits employing Signalling System R2, Recommendation Q.416 details the actions to be taken.

1.5 The recognition time used by the international exchange to validate the alarm ON/alarm OFF states shall be 20 ± 10 milliseconds. The recognition time is defined as the duration that signals representing the alarm ON/OFF states must be present at the input of the exchange terminal equipment.

Following recognition of the alarm ON or alarm OFF states the exchange shall carry out the actions detailed in § 4.

2 Mixed transmission systems

2.1 Some transmission links comprise differing transmission systems which for maintenance purposes are treated separately (see Recommendation G.704). Examples of such transmission links are those with:

- analogue/digital conversion via transmultiplexers;
- conversion between 24 and 30 channel PCM systems;
- links via TDMA/DSI satellite systems.

In these cases, failure indications from the local multiplex equipment can be used, but alone these do not provide an end-to-end indication of circuit availability. Since the multiplex systems use different standards, it is usually impossible to provide a ready conversion of alarms from one system to another. In order to retain the benefits of the alarm indications for groups of circuits it is necessary to carry the fault indications on a circuit basis. This may be inherent in the normal circuit signalling (as in the case of the digital version of Signalling System R2) but in the general case some form of individual circuit supervision is required.

2.2 *Circuit supervision for digital systems*

2.2.1 *2048 kbit/s systems (Recommendations G.732, G.734)*

8448 kbit/s systems (Recommendation G.744)

In these systems there are two frame structure possibilities. One supports channel associated signalling, and the other is intended for common channel signalling which allows extra time-slots to be used for speech circuits. In order to provide circuit supervision it is necessary to use the frame structure for channel associated signalling, even in the case of voice frequency and common channel signalling systems. This implies a number of restrictions:

- in the 2048 kbit/s system time slot 16 is not available for speech. Additionally, the common channel signalling links of Systems No. 6 and No. 7 must use a time slot other than number 16;
- similarly, in the 8448 kbit/s system time slots 67-70 are required for the circuit supervision and cannot be used for speech.

Other systems of transmitting circuit supervision information (for example, using a common channel) are for further study.

2.2.2 *1544 kbit/s systems (Recommendations G.733, G.735)*

In this system the S bit is used for circuit supervision in a similar manner to its use for channel associated signalling.

2.2.3 *Non-standard systems*

In non-standard transmission systems it will often be necessary to provide a discrete signalling path for the transmission of circuit supervision indications. Annex A to this Recommendation describes the arrangements used for circuit supervision on TDMA/DSI satellite systems together with the interfacing with the terrestrial channels.

3 **Signalling of circuit supervision indications**

3.1 In integrated digital transmission systems interfacing directly with exchanges (e.g. Recommendations G.734, G.744) and where systems connect to the other Administrations, it is recommended that a standard form of circuit supervision be used. This is detailed below for 2048 kbit/s PCM systems and 1544 kbit/s PCM systems.

3.2 *2048 kbit/s PCM systems*

Signalling bits "a" and "b" of time slot 16 are used. Under abnormal (alarm) conditions both a and b bits are set to 1. The normal (no-alarm) condition is when "a" and "b" bits are not both equal to 1.

3.3 1544 kbit/s PCM systems

In this system the circuit supervision information is generated:

- by forcing bit 2 in every channel time slot to the value 0, or
- by modifying the S bit as described in § 3.1.3.2.2 of Recommendation G.704 for the 12 frame multiframe, or
- by sending a frame alignment alarm sequence (1111111100000000) as described in § 3.1.1.3 of Recommendation G.704 for the 24 frame multiframe¹⁾.

4 Actions in Signalling Systems Nos. 5, 6 and 7 when a transmission alarm occurs

This section details the actions which should be taken on circuits using Signalling Systems No. 5, No. 6 and No. 7 when a transmission alarm occurs concerning the speech path. This annex is intended to be applied to new exchange equipment only.

It is split into two broad areas dealing firstly with Signalling System No. 5 and then with Signalling Systems No. 6 and No. 7. This split is required because the actions taken for inband signalling systems is slightly different to that taken for common channel signalling systems.

4.1 Signalling System No. 5

The action taken if a transmission alarm occurs during the states shown below is as follows:

4.1.1 Outgoing circuit failure

4.1.1.1 IDLE STATE

Take the circuit out of service to outgoing traffic. Return to service when transmission is restored.

4.1.1.2 REGISTER STATE

The register state is assumed to start with sending of seizure signal and to end with sending of end of pulsing signal (ST).

- Send clear forward.
- Send a call unsuccessful indication on incoming circuit or possibly carry out a repeat attempt.
- If clear forward release guard sequence fails, inhibit the repeat clear forward sequence. Resume the repeat clear forward sequence when the transmission is restored limiting the number of simultaneous signals to a value which will prevent overload of the transmission system.
- If the clear forward release guard sequence is successful, take the circuit out of service to outgoing traffic.

4.1.1.3 SEIZED BUT AFTER REGISTER STATE

- Wait for calling party to clear and send clear forward.
- If answer signal has not been returned from called party, send a call unsuccessful indication on incoming circuit.
- If clear forward release guard sequence fails, inhibit the repeat clear forward sequence. Resume the repeat clear forward sequence when the transmission is restored limiting the number of simultaneous signals to a value which will not overload the transmission system.
- If clear forward release guard sequence is successful take the circuit out of service to outgoing traffic.

4.1.1.4 BLOCKED

- No special action required.

¹⁾ The third method proposed cannot ensure a proper end to end supervision if a TDMA system with multideestination of multiplexes or a CME is involved in the connection.

4.1.2 *Incoming circuit failure*

4.1.2.1 *IDLE STATE*

No special action required, respond to incoming call as normal.

4.1.2.2 *ALL OTHER STATES*

- In answered state no special action to be taken, send all signals as normal.
- If answer signal has not been returned from called party, start a time out device which after a certain interval clears the chain beyond the faulty circuit.

4.1.3 *Bothway circuit*

4.1.3.1 *IDLE STATE*

- Take the circuit out of service to outgoing traffic, respond normally to incoming signals.
- Return to outgoing service when transmission is restored.

4.1.3.2 *OUTGOING REGISTER STATE*

- See § 4.1.1.2.

4.1.3.3 *OUTGOING AFTER REGISTER STATE*

- See § 4.1.1.3.

4.1.3.4 *INCOMING ANY STATE*

- See § 4.1.2.

4.1.3.5 *BLOCKED*

- See § 4.1.1.4.

4.2 *Signalling System No. 6 or Signalling System No. 7*

The action taken per speech circuit is as follows.

4.2.1 *Outgoing circuit failure*

4.2.1.1 *IDLE STATE*

- Take the circuit out of service to outgoing traffic. Return to service when the transmission is restored.

4.2.1.2 *REGISTER STATE*

The register state is assumed to start with sending of Initial Address Message and to end with the receipt of an address complete message.

- Send clear forward.
- Send a call unsuccessful indication on incoming circuit or possibly carry out a repeat attempt to set up the call on another circuit.
- Following receipt of release guard signal, take the circuit out of service to outgoing traffic. Return to service when transmission is restored.
- Inhibit any repeat continuity check which may be taking place.