INTERNATIONAL TELECOMMUNICATION UNION

ITU-T

G.181

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OF ITU

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GENERAL CHARACTERISTICS OF INTERNATIONAL TELEPHONE CONNECTIONS AND INTERNATIONAL TELEPHONE CIRCUITS

CHARACTERISTICS OF 1 + 1 TYPE RESTORATION SYSTEMS FOR USE ON DIGITAL TRANSMISSION LINKS

ITU-T Recommendation G.181

(Previously "CCITT Recommendation")

FOREWORD

The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of the International Telecommunication Union. The ITU-T 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 World Telecommunication Standardization Conference (WTSC), which meets every four years, established the topics for study by the ITU-T Study Groups which, in their turn, produce Recommendations on these topics.

ITU-T Recommendation G.181 was revised by the ITU-T Study Group XV (1988-1993) and was approved by the WTSC (Helsinki, March 1-12, 1993).

NOTES

1 As a consequence of a reform process within the International Telecommunication Union (ITU), the CCITT ceased to exist as of 28 February 1993. In its place, the ITU Telecommunication Standardization Sector (ITU-T) was created as of 1 March 1993. Similarly, in this reform process, the CCIR and the IFRB have been replaced by the Radiocommunication Sector.

In order not to delay publication of this Recommendation, no change has been made in the text to references containing the acronyms "CCITT, CCIR or IFRB" or their associated entities such as Plenary Assembly, Secretariat, etc. Future editions of this Recommendation will contain the proper terminology related to the new ITU structure.

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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Recommendation G.181

CHARACTERISTICS OF 1 + 1 TYPE RESTORATION SYSTEMS FOR USE ON DIGITAL TRANSMISSION LINKS

(Melbourne, 1988; amended at Helsinki, 1993)

1 General

Transmission restoration functions are often implemented in the modern telecommunication network to improve the availability and quality of services, by minimizing the effects or potential effects of a transmission failure, and to make the maintenance operations easier.

The terminology and general principles of transmission restoration are described in Recommendation M.495. The functional organization for automatic transmission restoration is described in Recommendation M.496.

2 Object of Recommendation

This Recommendation specifies the characteristics of equipment for 1 + 1 type transmission restoration systems (protection link switching) for digital transmission links (see Recommendation G.701). The general arrangement of a system of this type is shown in Figure 1. It uses hybrid on the send side, splitting the input path into two output paths. On the receive side the two paths are supervised and are connected further by a switch automatically controlled by the received signals. The switch may additionally be operated manually or by some kind of remote procedure. The two transmission directions are handled independently.

This Recommendation refers to the equipment labelled as H (hybrid) RSE (restoration switching equipment) and RSCE (restoration switching control equipment).

This Recommendation does not cover the restoration systems fully embedded in transmission systems.

The hierarchical level at interface T is 2048 kbit/s.

3 Equipment specifications

Equipment H and RSE (see Figure 1) may be of the regenerative or non-regenerative type.

3.1 Interfaces

3.1.1 Transmission path interfaces (T)

For H and RSE equipment of the regenerative type the interfaces shall be as specified in Recommendation G.703. The intrinsic output jitter should be not greater than 0.05 UI (measurement filter bandwidth: 20 Hz to 100 kHz).

Interface characteristics for H and RSE equipment of the non-regenerative type are at present not covered by this Recommendation.

3.1.2 Control interface (X)

The control interface X is not at present standardized by CCITT. However in the future it may be specified as a Q interface (see Recommendation G.773).

3.2 Operational aspects

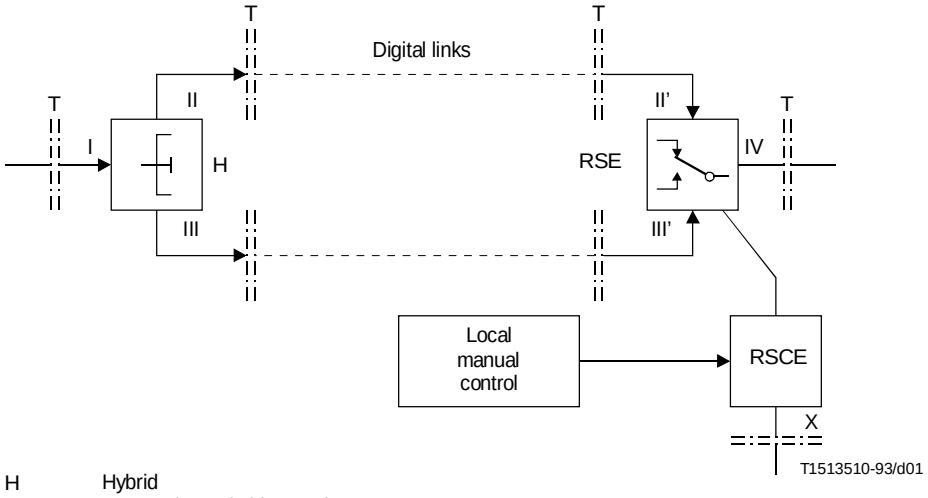
3.2.1 Transfer of the switched signals

For H and RSE equipment of the regenerative type the jitter transfer gain should be not greater than 0.5 dB.

The transfer characteristics for H and RSE equipment of the non-regenerative type are at present not covered by this Recommendation.

3.2.2 Response

Switching between the two paths occurs only on the receive side, as indicated in Figure 1.



H Hybrid
RSE Restoration switching equipment
RSCE Restoration switching control equipment
T Transmission interface
X Control interface

NOTES

1 The two digital links can be in the same cable or follow different routes.

2 The interface between the RSCE and the local manual control is not standardized and it is not covered by this Recommendation.

FIGURE 1/G.181

1 + 1 transmission restoration system

One of the two paths may be the path with the primary right, e.g. path II/II'. If this path fails the switch is operated to path III/III'. After restoration of path II/II' the switch will automatically be set back to this path.

If the two paths have the same right the switch will remain in the last position even after restoration of a failed path. This is the preferred method.

NOTE 1 – Paths II/II' and III/III' have the same performance under normal planning conditions of transmission routes and systems. The "method of the same right" reduces the frequency of switching and resynchronization by a factor of 2.

Switching to a failed path must be avoided.

The RSCE should operate the switch:

- automatically according to the criteria expressed by Tables 1 and 2, based on AIS reception and loss of incoming signal or (as an option) on transmission quality (see Note 2);
- manually on command from the local manual control;
- under a request coming from interface X.

NOTE 2 – As an option the switching can be based on transmission quality as defined in Recommendation G.821 and by agreement between Administrations. In this case the transmitted signals need to have a standard frame structure in accordance with Recommendation G.704 which for 2048 kbit/s should also include the CRC4 option.

It is recommended that the time required for the above response actions, that is the "confirmation time" plus the "restoration transfer time" should be less than 10 ms for terrestrial routes and 500 ms for satellite routes.

TABLE 1/G.181

Response criteria for the hybrid H at the transmit side

Fault condition	Consequent action (signal at II and III)
No signal at I	AIS
AIS receive at I	AIS
Failure of power supply, system failure	AIS (if possible [a])
[a] The equipment may not be able to send AIS; this depends on the nature of the failure.	

TABLE 2/G.181

Switching criterion for the RSE at the receive side

Condition	Consequence action	Remark	
Received signal II' and III'	(See Note)	Signal at IV	
Received signal at II' AIS or no signal at III'	Switch to II'	Signal at IV	
Received signal at III' AIS or no signal at II'	Switch to III'	Signal at IV	
AIS at II' and III'	Switch to II' or III'	Received AIS is through-connected	
No signal at II' and III'	The switching equipment sends AIS at IV		
AIS at II' and no signal at III'	Switch to II'	Received AIS is	
AIS at III' and no signal at II'	Switch to III'	through-connected	
Correct signal at II' Bad quality at III'	Switch to II'	Correct signal at IV	Option
Correct signal at III' Bad quality at II'	Switch to III'	Idem	
Bad quality at II' AIS or no signal at III'	Switch to II'	Bad quality at IV	
Bad quality at III' AIS or no signal at II'	Switch to III'	Idem	
Bad quality at III' Bad quality at II'	(See Note)	Bad quality at IV	
Failure of power supply system failure	The switching equipment sends AIS (if possible) at IV		
NOTE – Switch to paths II/II' or III/III' if both paths have the same right. Switch to the path with the primary right if the other method is used (see 3.2.2).			