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SERIES I: INTEGRATED SERVICES DIGITAL NETWORK (ISDN)

Maintenance principles

Application of maintenance principles to ISDN basic accesses

Reedition of CCITT Recommendation I.603 published in the Blue Book, Fascicle III.9 (1989)

NOTES

1 CCITT Recommendation I.603 was published in Fascicle III.9 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 I.603

APPLICATION OF MAINTENANCE PRINCIPLES TO ISDN BASIC ACCESSES

(Melbourne, 1988)

1 Scope of application

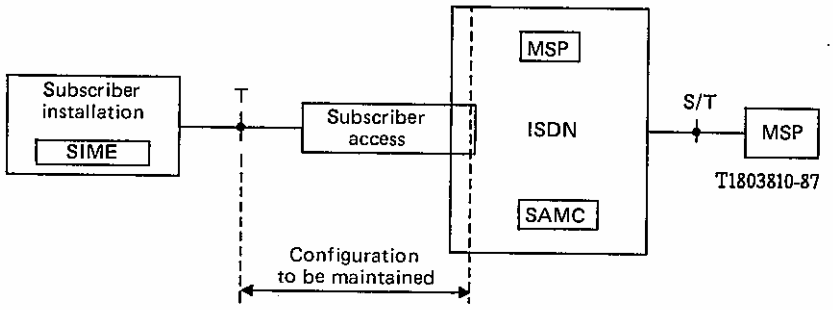
This Recommendation covers the maintenance of that part of the ISDN subscriber basic access which is controlled by the network. The Recommendation follows the maintenance principles as defined in Recommendation M.20 and applies to the basic access directly connected to the local exchange without any multiplexer or concentrator.

The principle of controlled maintenance (as defined in Recommendation M.20) is applied for maintaining the subscriber basic access.

Controlled maintenance is a method of sustaining a desired technical performance by the systematic application of supervision, testing and performance sampling in order to minimize preventive maintenance and to reduce corrective maintenance.

2 Network configuration for maintenance activities

Figure 1/I.603 is the basis for the general maintenance principles of the subscriber access.



SAMC Subscriber access maintenance centre
SIME Subscriber installation maintenance entities
MSP Maintenance service provider

Note 1 – The subscriber access contains a digital section which can use different varieties of transmission techniques and may also include a regenerator.

Note 2 – In some countries certain maintenance functions within the subscriber access may be controlled by the subscriber installation (SIME).

FIGURE 1/I.603

Configuration for the maintenance of the basic access

3 Failure detection

3.1 *General*

When the digital section (as seen by the exchange) of the ISDN subscriber basic access is in the active state, automatic supervision of the correct functioning of the layer 1 up to the NT1 is operating. This supervision is called continuous automatic supervision on layer 1.

When the ISDN subscriber basic access is in the active state (as seen by the exchange), automatic supervision of the correct functioning of the D-channel layers 2 and 3 is also operating. This supervision is called automatic supervision on layers 2 and 3 of the D-channel protocol.

When the ISDN subscriber basic access is not in an active state (as seen by the exchange), the subscriber access may be periodically tested by the exchange. This is called the continuity test.

3.2 *Automatic supervision*

3.2.1 *Continuous automatic supervision of layer 1*

3.2.1.1 *Objectives*

This supervision is realized by permanent automatic mechanisms located in the pieces of equipment of the subscriber basic access (see definition in Figure 1/I.601). These automatic mechanisms are continuously operational during the active period of the subscriber basic access. They are designed to detect malfunctioning of particular items, e.g. power supply, quality level of transmission, incoming signal, frame alignment.

The continuous automatic supervision mechanism should be in operation even if there is no subscriber installation connected to the T reference point. For this, it must be possible for the digital section to be placed in a state where the automatic supervision can be performed continuously although the T reference point may not be capable of full activation according to Recommendation I.430.

3.2.1.2 *Digital section functions*

Functions, which are allocated to the digital section are listed below:

– detection of loss of frame alignment within the digital system;

– detection of loss of frame alignment on the user-network interface as defined in Recommendation I.430;

– supervision of the power feeding;

– transmission performance monitoring.

Transmission performance monitoring mechanisms are for further study.

Note – In case the digital section has its own failure detection mechanism, failure indication signals may be sent to, and received by, the local exchange termination. Alternatively, the detection mechanisms are included in the exchange termination.

3.2.1.3 *Exchange termination functions*

Functions which are allocated to the exchange termination are listed below:

– supervision of information related, to or received from, the digital section;

– transmission performance evaluation.

The transmission performance evaluation is based on a permanent processing of the elementary results presented by the continuous error monitoring of the digital section.

The result of the processing will give information on at least one transmission quality level.

Definition of quality levels and evaluation of timing conditions are out of the scope of this Recommendation.

3.2.2 *Automatic supervision of layers 2 and 3 of the D-channel protocol*

This activity covers supervision of activities of layers 2 and 3 of the D-channel protocol. Automatic supervision on layers 2 and 3 will be made by self-acting mechanisms implemented in the network (e.g. in the ET).

There are three categories of automatic supervision which may be performed by layers 2 and 3 of the D-channel protocols:

– service provision incapability detection (e.g. incapability of layer 2 to establish a data link connection);

– protocol misoperation detection (e.g. at layer 2, detection of dual TE1 assignment);

– error monitoring (e.g. the layer 2 CRC check procedure can detect the occurrence of an errored frame).

These events (defined in Recommendations I.440 and I.450) should be recorded.

3.3 *Continuity test*

3.3.1 *General*

When the subscriber basic access is not active (normal case and/or unknown failure condition case) or has not been recently activated, a continuity test may be applied in order to detect a possible failure condition.

The test should be a simple go/no go test.

Note – The periodicity of testing on each access, if such test is performed on a periodical basis, shall be compatible with the failure detection time value (i.e. the time between failure occurrence and failure detection).

3.3.2 *Control of the continuity test*

The continuity test is based on a normal activation of layer 1. If the activation is confirmed by a positive result of the continuity test, the subscriber basic access is declared to be in good order for operation. No report is given to the SAMC.

If the activation is not confirmed by a positive result of the continuity test, or if a failure condition is detected during the process, then the exchange will automatically enter into the failure localization process, and will report to SAMC.

The result of the continuity test should be judged to be positive if the NT1 has the capability to signal that there is no failure on the subscriber basic access.

4 System protection

When a failure is detected which has an adverse effect on the availability and/or functionality of network equipment, the access is considered ”out of service due to failure” and call attempts may be rejected to prevent further damage or to remove the adverse effect (see Recommendation I.601). In this condition, removal of power from the line may be required.

5 Failure information

A failure confirmed by the exchange and related to a subscriber basic access and/or subscriber installation shall be reported to the SAMC in a message.

The message could be presented after an automatic identification of a failed maintenance entity (ME) has been made (see § 6).

6 Failure localization

6.1 *Automatic confirmation of failure within the subscriber basic access*

An automatic test procedure to confirm a detected possible failure condition within the subscriber basic access should be provided. It should be initiated by an automatic reaction of the exchange, following abnormal conditions which have been detected by the processes presented above, i.e. continuous supervision, supervision on layer 2 and layer 3, continuity test.

The process is based on loopback techniques which allows the exchange to verify that there is no failure within the network and that the failure condition, if any, is not of a temporary nature.

If failures are detected in the D-channel layers 2 and 3 communication, clear differentiation between failures within the subscriber installation and within the subscriber access should be possible.

6.2 *Failed maintenance entity identification*

6.2.1 *General*

Such a function has to be made on demand or automatically following the indication of failed conditions by the network or following a subscriber complaint. It is necessary, before undertaking the appropriate action, to identify (i.e., to know) the maintenance entity affected by the failure.

6.2.2 *Objectives*

The main objective of this function, which is controlled by the SAMC is to indicate to the SAMC, if the failure is:

– within the ET and/or the LT;

– within the line and/or the NT1, the localization specified between NT1 or line if possible;

– within the subscriber installation.

6.3 *Loopbacks*

6.3.1 *Locations of loopbacks within the subscriber basic access*

Loopback locations for failure localization and verification controlled by the local exchange are shown in Figure 2/I.603.

Note – Other loopbacks might be necessary.

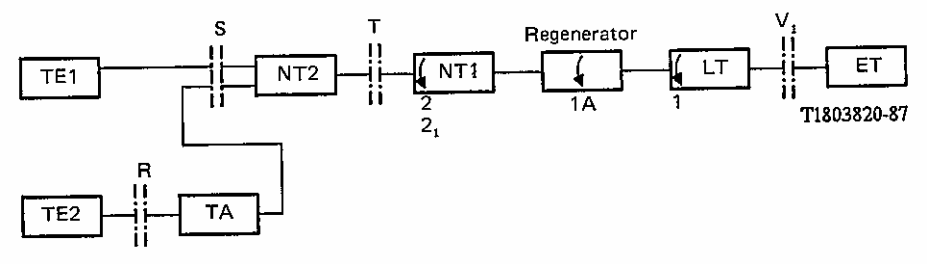


FIGURE 2/I.603

Loopback locations within the subscriber basic access

6.3.2 *Characteristics of loopbacks within the subscriber access*

The characteristics of loopbacks within the subscriber access are given in Table 1/I.603. Other loopbacks used in support of maintaining the subscriber installation from within the subscriber installation are specified in Recommendation I.602.

6.3.3 *Use of loopbacks*

If the loopback 2 is established, the network part of the subscriber basic access is considered to be correctly functioning. No report is given to the SAMC.

If loopback 2 cannot be established and/or if faulty network conditions are detected, the exchange:

– either goes further in the identification of the failed maintenance entity (see § 6.2) and reports to the SAMC later once the failed maintenance entity has been identified; or

– informs the SAMC that the network is affected by a failure, in the case where the non-automatic identification process of the failed maintenance entity is implemented.

6.4 *Command controlled tests and measurements*

For more precise failure localization, it would be necessary to obtain line parameter measurements indicating that the value of an electrical parameter is within a certain margin or showing the precise value of the parameter.

For further study.

TABLE 1/I.603

Characteristics of loopbacks within the subscriber access

Loop-back	Location	Channel(s) looped back	Loopback type	Control point	Control mechanism	Application	Implementation
1	In LT, as near as possible to the line, towards the ET	Complete loopback (2 B + D at least)	Complete, transparent or non-trans-parent (Note 1)	Under control of local exchange	Layer 1 signals	Failure localization + verification	Recom mended
1A	In the regenerator	Complete loopback	Complete, transparent or non-trans-parent (Note 1)	Under control of local exchange	Layer 1 signals	Failure localization	Optional
2	See Appendix I of Recommendation I.430						
2_1	See Appendix I of Recommendation I.430						

Note 1 – Whether the loopback is transparent or non-transparent is for further study. Whether or not a transparent loopback is used, the loopback should not be affected by configurations and conditions beyond the point at which the loopback is provided, e.g. by the presence of short circuits, open circuits or foreign voltages.

Note 2 – Network control signals for loopbacks may not be harmonized.

7 Logistic delay time

See Recommendation M.20.

8 Failure correction

See Recommendation M.20.

9 Verification

The verification that the failure has been corrected is made on demand of the staff.

Tests described in §§ 3, 6 and 11 may be used.

10 Restoration

After the failure has been rectified and the correct operation of the access verified (during which time the access will be in either the “out of service due to failure” or “degraded transmission” conditions), the access shall be returned to the “in service” condition. The mechanism/procedure for returning the access to the “in service” condition (e.g. automatic or manual) is not a subject of this Recommendation (see Recommendation I.601).

11 Overall performance measurements

Overall performance measurements could, from the point of view of the exchange:

– concern a limited number of subscriber accesses at the same time;

– be made only on demand.

These tests and/or measurements shall not influence the conditions of the subscriber installation for incoming and outgoing calls. This gives the advantage of enabling measurement of the performance independently of the activity in the different channels of the subscriber basic access and also over a long period of time.

For the performance evaluation of a digital transmission system (over a long period of time, with permanent activation of the subscriber basic access) the network Administration shall have arrangements for the calculation of the performance levels according to Recommendation G.821.

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