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MAINTENANCE: ISDN

APPLICATION OF MAINTENANCE PRINCIPLES TO ISDN BASIC RATE ACCESS

Recommendation M.3603

FOREWORD

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Recommendation M.3603 was revised by Study Group IV and was approved under the Resolution No. 2 procedure on the 5th of October 1992.

CCITT NOTE

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized private operating agency.

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Recommendation M.3603

APPLICATION OF MAINTENANCE PRINCIPLES TO ISDN BASIC RATE ACCESS

(*Melbourne 1988 as Rec. I.603; revised and renumbered in 1992*)

Abstract

This Recommendation defines capabilities and functions used by the network to maintain the physical layer of ISDN basic rate access.

Keywords

– basic rate access;

– ISDN;

– maintenance.

1 Scope of application

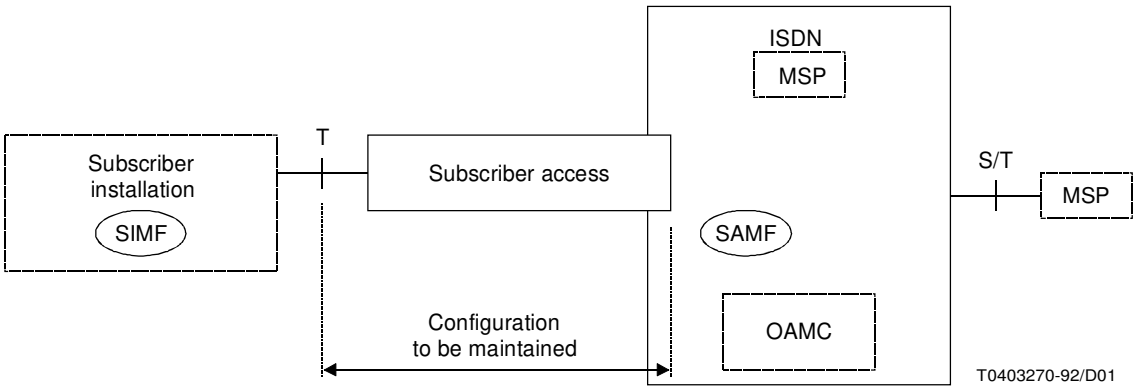
This Recommendation covers the maintenance of that part of the ISDN subscriber basic access which is controlled by the network. The Recommendation follows the maintenance principles as defined in Recommendation M.20 [1] and applies to the basic access directly connected to the local exchange without any multiplexer or concentrator.

The principle of controlled maintenance (as defined in Recommendation M.20 [1]) 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/M.3603 is the basis for the general maintenance principles of the subscriber access.



MSP Management Service Provider
OAMC Operation Administration Maintenance Centre
SAMF Subscriber Access Management Function
SIMF Subscriber Installation Management Function

For a detailed discussion of these terms, see Recommendation M.3600 [3].

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 are controlled by the subscriber installation (SIMF).

FIGURE 1/M.3603

Configuration for the maintenance of the basic rate 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. 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 [7].

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 [7];

– supervision of the power feeding;

– transmission performance monitoring.

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 *Transmission performance monitoring mechanisms*

Performance monitoring is provided in both directions of transmission. Specifically there will be error detection in each direction computed across the digital signal, for example, with a CRC or other error detection methods.

Transmission errors detected at the LT are converted to Near-End Error (NEE) indications. Transmission errors detected at the NT are converted to Far-End Error (FEE) indications and sent back to the LT. This enables performance for both directions to be assessed by the Administration.

A function of the C-channel (see Recommendation G.960 [6]) may provide support of maintenance functions such as loopback activation and performance monitoring data gathering.

3.2.1.3.1 *Performance monitoring capability (layer 1)*

It shall be possible to report the performance information from the exchange to the OAMC. It shall be possible to reset the parameter counts. Other issues under study include

- combining all links in subscriber access;
- parameter consistence;
- identifying maintenance phases affected by performance monitoring.

3.2.1.3.2 *Required performance monitoring parameters and history*

The following principles apply to performance monitoring parameters and history:

- parameters should be counted separately in each direction when feasible to help isolate troubles and to better estimate network service provided to users;
- to support different maintenance uses, parameters should be counted for short durations (e.g. 15 minutes to one hour) and longer durations (e.g. 24 hours) as specified in Recommendation M.2110 [5];
- a history of error counts should be stored to help deal with intermittent troubles;
- thresholding is covered in Recommendations M.34 [2] and M.2110 [5];
- performance information should be reported from the exchange to the OAMC
  - when thresholding crossing occurs;
  - on demand from the OAMC.

3.2.1.4 *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 outside 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 should be recorded as discussed in Recommendation M.3640 [4].

3.3 *Continuity test*

3.3.1 *General*

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

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

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. In this condition, removal of power from the line may be required.

5 Fault information

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

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

6 Fault localization

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

An automatic test procedure to confirm a detected possible fault 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 allow the exchange to verify that there is no fault within the network and that the failure condition, if any, is not of a temporary nature.

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

6.2 *Identification of the maintenance entity affected by a fault*

6.2.1 *General*

Identification should be made on demand or automatically following the indication of fault conditions by the network or following a subscriber complaint. Before undertaking the appropriate action, it is necessary to identify (i.e. to know) the maintenance entity affected by the fault.

6.2.2 *Objectives*

The main objective of this function, which is controlled by the SAMF is to indicate to the OAMC, if the fault is:

– within the ET and/or the LT;

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

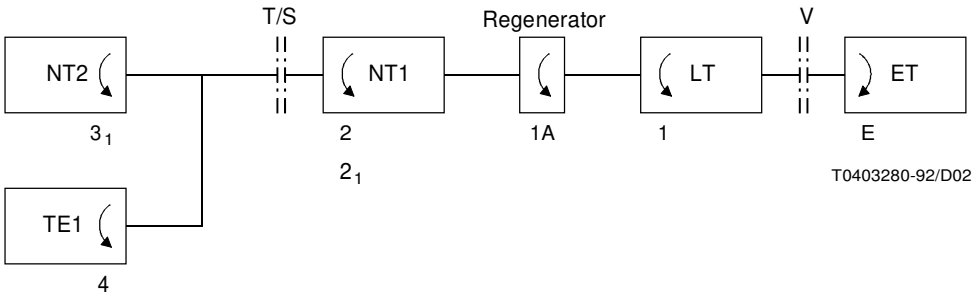
– within the subscriber installation.

6.3 *Loopbacks*

6.3.1 *Locations of loopbacks within the subscriber basic access*

Loopback locations for fault localization and verification controlled by the local exchange are shown in Figure 2/M.3603.

Note – Other loopbacks might be necessary.



Note – For an explanation of 1, 2, 2_1 , 3_1 , 4, C and E, see Table 1/M.3603.

FIGURE 2/M.3603

Loopback locations within the subscriber basic rate access

6.3.2 *Characteristics of loopbacks within the subscriber access*

The characteristics of loopbacks within the subscriber access are given in Table 1/M.3603. Other loopbacks used in support of maintaining the subscriber installation from within the subscriber installation are specified in Recommendation M.3602 [8].

TABLE 1/M.3603

Characteristics of loopbacks within the subscriber basic rate access

Loopback	Location	Channel(s) looped back	Loopback type	Control point	Control mechanism	Implementation
1	In LT, as near as possible to the line, towards the ET	Complete loopback (2B + D at least)	Complete, transparent or non-transparent (Note 1)	Under control of local exchange	Local maintenance	Recommended
1A	In the regenerator	Complete loopback (2B + D at least)	Complete, transparent or non-transparent (Note 1)	Under control of local exchange	Layer 1	Optional
2	In NT1, as near as possible to T reference point, towards ET (Note 2)	2B + D	Complete, transparent or non-transparent (Note 4)	Under control of local exchange	Layer 1	Recommended
2_1	In NT1, not impacting the network interface	B_1 B_2 (Note 3)	Partial, transparent or non-transparent	Under control of local exchange	Layer 3	Optional
3_1	In NT2, as near as possible to T reference point, towards T (Note 5)	B_1 B_2 (Note 3)	Partial, transparent or non-transparent	Under control of local exchange	Layer 3	Optional
4	In the TE or TA	B_1 B_2 (Note 3)	Partial, transparent or non-transparent	Under control of local exchange	Layer 3	Optional
E	In ET, towards the line	B_1 B_2 (Note 3)	Partial, transparent or non-transparent	Under control of NT2 or TE/TA	Layer 3	Optional

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 – In the case of a combined NT1 and NT2 (i.e. an NT12), loopback 2 is located at the position within the NT12 which equates to the T reference point.

Note 3 – The B_1 and B_2 channel loopbacks are controlled by separate control signals. However, both loopbacks may be applied at the same time.

Note 4 – In the case where transparent loopback 2 is applied, the NT1 should send INFO 4 frames toward the user with the D-echo channel bits set to binary ZERO.

Note 5 – Also see Table 1/M.3602 [8] for other loopbacks in the NT2.

Note 6 – A loopback within the ET towards the line may also be used as part of an ET self-test.

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 error report is given to the OAMC.

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

– either goes further in the identification of the maintenance entity affected by the fault (see § 6.2) and reports to the OAMC later once the failure has been identified; or

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

6.4 *Command controlled tests and measurements*

For more precise fault 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.

7 Logistic delay time

See Recommendation M.20 [1].

8 Fault correction

See Recommendation M.20 [1].

9 Verification

The verification that the fault has been corrected is made on request of the staff.

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

10 Restoration

After the fault 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 fault condition" or "degraded transmission" conditions), the access shall be returned into service. The mechanism/procedure (e.g. automatic or manual) for returning the access into service, is not a subject of this Recommendation.

11 Overall performance measurements

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

– concern a limited number of subscriber access 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 M.2110 [5].

References

[1] CCITT Recommendation M.20 *Maintenance philosophy for telecommunications networks*.

[2] CCITT Recommendation M.*34 Performance monitoring on international transmission systems and equipment*.

[3] CCITT Recommendation M.3600 *Principles for the maintenance of ISDNs*.

[4] CCITT Recommendation M.3640 *Management of the D-channel – Data link and network layer*.

[5] CCITT Recommendation M.2110 *Performance limits for bringing into service and maintenance of international digital paths, sections and transmission systems*.

[6] CCITT Recommendation G.960 *Digital section for ISDN basic rate access*.

[7] CCITT Recommendation I.430 *Basic user-network interface – Layer 1 specification*.

[8] CCITT Recommendation M.3602 *Application of maintenance principles to ISDN subscriber installations*.