5i’

PART VI

I.600-Series Recommendations

MAINTENANCE PRINCIPLES

BLANC

Montage: **Page PAIRE = Blanche**

Recommendation I.601

GENERAL MAINTENANCE PRINCIPLES OF ISDN SUBSCRIBER ACCESS AND SUBSCRIBER INSTALLATION

(Melbourne, 1988)

1 Scope of application

1.1 This Recommendation outlines the general aspects and principles relating to the reference configurations and general architecture for each kind of subscriber access (basic, primary, multiplexed, higher rate) and associated subscriber installations. This is given in terms of the function groupings and the interconnecting communication parties.

Loopback definitions and their locations used in this Recommendation are also given.

1.2 Recommendation I.602 is concerned with the maintenance of the ISDN subscriber installation. The maintenance principles are given in a general way for functions which are dependent on the design of NT2 and TE and more precisely where it impacts directly on the S or T interface (i.e. in relation to Recommendations I.430, I.431). These functions are supervised and/or controlled by the subscriber installation.

The ISDN management protocols which provide this activity are contained in Recommendation Q.940 on ISDN user-network management and maintenance protocols.

1.3 Recommendation I.603 describes maintenance for the network portion of the ISDN basic access (144 kbit/s). A common format with other similar Recommendations, in conformance with Recommendation M.20, is used.

The functions performed by the digital transmission section and the exchange termination (ET) are identified. These functions are supervised

and/or controlled by the network or Administration (see § 3.3 of Recommendation I.601).

1.4 Recommendation I.604 describes maintenance of the network portion of the ISDN primary access (2048 and 1544 kbit/s) following the same principles as given in Recommendation I.603.

The functions provided by the digital transmission section and the exchange termination (ET) are identified. The functions are supervised and/or controlled by the network or Administration.

1.5 Recommendation I.605 describes the maintenance of a multiplexed basic rate system. Reference is made to Recommendations I.603 and I.604 when common mechanisms are applied.

The functions performed by the digital section of the ISDN basic rate access, the basic access multiplexer, the digital link, and the exchange termination (ET) are identified. These functions are supervised andB/For controlled by the network or Administration.

2 Objectives

In order to try and meet overall objectives, a number of points have been identified for Administrations and maintenance service providers (see § 3.2.2.3):

i) to detect fault conditions, identify the failed maintenance entity, take system protection actions, inform the maintenance staff of Administrations;

ii) to incorporate facilities to enable the failure to be located by the maintenance staff, so that failure correction is achievable by a single attendance to the failed location;

iii) to provide an appropriate maintenance organization and levels of staffing, so as to achieve goals for out-of-service repair times;

iv) to incorporate facilities to allow clear differentiation of failures between the subscriber installation and the network;

v) to incorporate facilities to allow clear differentiation between failures and normal subscriber activities.

3 Network reference model

3.1 *ISDN subscriber access and installation configuration*

Figure 1/I.601 shows the simplified ISDN subscriber access and installation configuration (based on Recommendations I.411 and Q.512).

The definitions contained in this figure are the ones used in the I.600-Series Recommendations.

Figure 1/I.601, p.

3.2 *Network configuration and definition for maintenance activities*

3.2.1 *Network configuration*

Figure 2/I.601 is the basis for the general maintenance principles of the ISDN access and subscriber installation.

Figure 2/I.601, p.

3.2.2 *Definitions*

3.2.2.1 **Subscriber Access Maintenance Centre (SAMC)**

A SAMC represents a group of functions, network equipment elements and staff controlled by the Administration, which together have the responsibility and capability for maintenance functions and maintenance actions within the subscriber access, such as defined in Figure 2/I.601.

The equipment and functions may be centralized or distributed in the network, local exchange and subscriber access. The architecture of the SAMC and its internal interface(s) between SAMC staff equipment(s) is presented in § 3.4. Conceptually, the SAMC is considered to be a single functional entity within an ISDN, as seen by the subscriber.

3.2.2.2 **Subscriber Installation Maintenance Entity (SIME)**

An SIME represents a group of dedicated functions contained within the functional groups (as specified in Recommendation I.411) of the subscriber installation which have the following purposes, e.g.:

— interaction with the (human) user;

— handling of the maintenance protocol from the subscriber installation and/or maintenance service provider ;

— control of internal testing and maintenance mechanisms.

It is considered that the functions of the SIME may be distributed throughout layers 1-3 and management/maintenance entities, including NT1 functions in some applications. However, the precise architecture and protocol of the SIME is not a subject of this Recommendation.

3.2.2.3 **Maintenance Service Provider (MSP)**

The MSP represents a group of functions, equipment and maintenance staff, which together have the responsibility for maintaining a subscriber installation or a part of the subscriber installation. A MSP cannot control the maintenance functions of the subscriber access. If authorized, it can request an SAMC to perform these functions.

Agreement and responsibility for maintenance between the subscriber and the MSP for each part or parts of the subscriber installation should be made at the time of subscription to the maintenance service (this may take the form of a commercial contract). In any case, provision to allow a customer to change the maintenance service provider(s) is recommended. The subscriber may choose not to make such an agreement with the MSP.

Maintenance service providers can be:

— private providers;

— the Administration.

Note — A subscriber can act as his own MSP.

A private maintenance service provider external to ISDN is connected to the ISDN via a recommended T reference point. An Administration’s maintenance service provider may be connected to the ISDN via a recommended T reference point or via an interface which is internal (outside the scope of this Recommendation) to the ISDN. More than one MSP may have the responsibility to maintain one subscriber installation. The responsibility for maintaining each equipment shall be unique. Other interfaces are for further study.

If authorized, the MSP can invoke maintenance function in the SIME. It is the sole responsibility of a subscriber installation and not of the network to ensure that an unauthorized MSP cannot get access to maintenance functions in the subscriber installation.

3.3 *Communication configurations*

3.3.1 *General*

The presentation of the relationships between the functional blocks SAMC, SIME and MSP and the configurations to be maintained have been completed by figures showing the various communication paths.

The communication paths are shown by bold lines within the Figures 3/I.601 to 7/I.601.

3.3.2 *Communication configuration for maintenance of a subscriber access by the SAMC*

Figure 3/I.601 shows the communication configuration between the subscriber access and the SAMC.

Figure 3/I.601, p.

3.3.3 *Communication configuration for maintenance of a subscriber access by a SAMC requested by an MSP*

Figure 4/I.601 shows the communication configuration between an MSP and a SAMC that allows the MSP to request maintenance information and actions related to the subscriber access.

Figure 4/I.601, p.

3.3.4 *Communication configuration for maintenance of a subscriber installation by an MSP within the ISDN*

Figure 5/I.601 shows the communication configuration between an MSP within the ISDN and the subscriber installation.

Figure 5/I.601, p.

3.3.5 *Communication configuration for maintenance of a subscriber installation by an MSP connected to the ISDN via an S or T reference point*

Figure 6/I.601 shows the communication configuration between an MSD at reference point S or T and the subscriber installation.

Figure 6/I.601, p.

3.4 *Management configurations*

3.4.1 *Relationships*

In Figure 7/I.601 the communication relationships between the management entities required to support the functions in this series of Recommendations are given. It does not imply any physical model of the network.

Figure 7/I.601, p.

The connections shown in Figure 7/I.601 represent the allowed communication paths that use the protocol architecture defined in Recommendation Q.940. These communications are subject to security procedures implemented by the receiver of the message.

The subscriber access maintenance entity (SAME) controls the subscriber access maintenance functions and provides communications for such activities. The SAMC functions might be distributed.

The operations administration and maintenance centre (OAMC) consists of a group of functions and staff. In the context of this Recommendation the OAMC is responsible for the communication with, and the controlling of, the subscriber access maintenance functions as provided by the SAME.

The OAMC may also be responsible for the communication with, and the controlling of, other maintenance functions as provided by other management

entities. Such functions are outside the scope of this Recommendation. Therefore, the SAMC can be considered as the grouping of the SAME, communication path and part of the OAMC.

3.4.2 *Security provisions*

To facilitate maintenance procedures and failure localization, management entities responsible for different control domains may communicate. However, since management and maintenance information is of critical importance to system integrity, access to management functions and information is subject to prior authorization and security restrictions.

The security restrictions are enforced by the recipient of the maintenance request and may include requirements for user authentication (identification), the use of passwords and/or limited access based on the originating call.

The use of adequate security mechanisms is especially important in the case of the OAMC since maintenance functions for many users may be affected by unauthorized access.

3.5 *Maintenance conditions for an ISDN subscriber access*

In general, a subscriber access can be considered to be in one of the following conditions for the purpose of explanation of the relationship between maintenance and trafficability in this Recommendation.

3.5.1 *In service*

3.5.1.1 *Correct functioning*

An access which is fully equipped has been allocated an ISDN number(s) and is correctly functioning (meeting all the network performance and operational requirements) is considered to be ‘‘in service’’. The access can be either busy or free in this condition.

3.5.1.2 *Degraded transmission*

An access is said to be in the ‘‘degraded transmission’’ condition when the transmission of the digital section has degraded sufficiently to cause the initiation of further maintenance activity. The amount of degradation at which the maintenance activity is initiated is service dependent.

In this condition call offering is not changed (i.e. the same as for the ‘‘in service’’ condition). The levels at which an access enters the degraded transmission condition may be dependent on the quality of service provided to the customer. These levels are found in other Recommendations.

3.5.2 *Out of service*

3.5.2.1 *Out of service due to failure (unavailability state)*

When a failure exists and has been detected such that the network performance is below an acceptable limit the access is considered to be ‘‘out of service due to failure’’. In such a condition call offering may be rejected or attempted as normal. In the latter case, the call offering may not be successful and normal clearing with cause may not be possible.

Examples of failure conditions are:

— unacceptable transmission performance;

— access in a failure condition;

— failure of subscriber installation;

— failure of the digital transmission section;

— failure within individual exchange subscriber equipment;

— local exchange failure.

3.5.2.2 *Out of service due to operational reasons*

This condition is included for information but is not considered further in this Recommendation.

An Administration may wish to mark an access ‘‘out of service due to operational reasons’’ due to, for example, payment deficiencies by the customer.

Call offering (either originating and/or terminating) may be rejected.

Note — In any of the conditions, testing (and/or measurements) may be in progress. The availability of the access call offering will be dependent on the specific test in progress. Whether the test or the call attempt is rejected (in the case of a collision) is dependent on the specific test and/or the Administration. Further study is required.

4 Control domain on the ISDN subscriber basic access

4.1 *General*

In Figure 8/I.601 the layered communication configuration is shown for the ISDN subscriber access showing also the SIME, SAMC and the OAMC.

Figure 8/I.601, p.

4.2 *Control domains*

The control domain is defined as the grouping of those protocol layer entities which are under the supervision and control of a management entity (e.g. SAME or SIME).

4.2.1 *The control domain of the SAME*

The control domain of the SAME is shown in Figure 9/I.601.

Since the SAME supervises the correct functioning of the peer-to-peer communication between protocol layer entities, failures outside its control domain will be recognized by the layer 2 and 3 processes in the ET and reported by it to the SAME (i.e. layers 2 and 3 failures in the B-channel entities of the subscriber installation, and layer 1 failures at the T reference point). Automatic additional failure localization may be necessary to have clear

differentiation between failures in the subscriber installation and the subscriber access.

Figure 9/I.601, p.

4.2.2 *The control domain of the SIME*

The control domain of the SIME is given in Figure 10/I.601.

Since the SIME supervises the correct functioning of the peer-to-peer communication between protocol layer entities, failures outside its control domain will be recognized by the layer 2 and 3 processes on the subscriber equipment and reported by them to the SIME [i.e. layers 2 and 3 failures in the D-channel entities of the exchange (ET), and layer 1 failures beyond the T reference point, as seen by the subscriber]. Automatic additional failure localization may be necessary to have clear differentiation between failures in the subscriber installation and the subscriber access.

Figure 10/I.601, p.

5 Loopbacks

5.1 *Use of loopbacks*

In general loopbacks are used for failure localization and verification as defined in Recommendation M.20.

The use of loopbacks should not result in unnecessary activity in the terminal layer 2 functions, which could cause possible error reporting by the terminal management function to the user or his MSP.

5.2 *Digital loopback mechanism definitions*

A **digital loopback** is a mechanism incorporated into a piece of equipment whereby a bidirectional communication path may be connected back upon itself so that some or all of the information contained in the bit stream sent on the transmit path is returned on the receive path.

The *loopback point* is the location of the loopback.

The *loopback control point* is the point which has the ability to directly control loopbacks and should be located as close as possible to the loopback point.

The loopback control point may receive requests for loopback operation from several loopback requesting points.

The *loopback requesting point* is the point which requests the loopback control point to operate loopbacks.

Note 1 — The generation of the test pattern used over the loopback may or may not take place at the control point.

Note 2 — Loopback requests should be subject to identification and authorization.

Note 3 — Possible locations of loopback requesting points are: the network, or a telecommunications management network (TMN), or a maintenance service providers (MSP).

The following three types of loopback mechanisms are defined:

a) *Complete loopback* — a complete loopback is a physical layer [1] mechanism which operates on the full bit stream. At the loopback point, the received bit stream shall be transmitted back towards the transmitting station without modification.

Note — The use of the term ‘‘complete loopback’’ is not related to implementation since such a loopback may be provided by means of active logic elements or controlled unbalance of hybrid transformers, etc. At the control point only the information channels may be available.

b) *Partial loopback* — partial loopback is a physical layer [1] mechanism which operates on one or more specified channels multiplexed within the full bit stream. At the loopback point, the received bit stream associated with the specified channel(s) shall be transmitted back towards the transmitting station without modification.

c) *Logical loopback* — a logical loopback acts selectively on certain information within a specified channel or channels and may result in some specified modification of the looped information. Logical at any layer 2 loopbacks may be defined to apply at any layer [Ref. 1], depending on the detailed maintenance procedures specified.

For each of the above three types of loopback mechanisms, the loopback may be further categorized as either transparent or non-transparent. (See Figures 11/I.601 and 12/I.601.)

i) A transparent loopback is one in which the signal transmitted beyond the loopback point (the forward signal) when the loopback is activated, is the same as the received signal at the loopback point.

Figure 11/I.601, p.

ii) A non-transparent loopback is one in which the signal transmitted beyond the loopback point (the forward signal) when the loopback is activated, is not the same as the received signal at the loopback point. The forward signal may be a defined signal or unspecified.

Figure 12/I.601, p.

Note — Whether or not a transparent loopback is used, the loopback should not be affected by facilities connected beyond the point at which the loop is provided, e.g. by the presence of short circuits, open circuits or foreign voltages.

5.3 *Loopback locations in the subscriber access and subscriber installation*

Figure 13/I.601 shows the numbering and location of loopbacks described in the I-Series of Recommendations.

The characteristics and implementation status of these loopbacks are given in the appropriate I.600-Series Recommendation.

Figure 13/I.601, p.

Reference

[1] CCITT Recommendation *Reference model of open system interconnection for CCITT applications* , Vol. VIII, Rec. X.200.

Recommendation I.602

APPLICATION OF MAINTENANCE PRINCIPLES TO ISDN SUBSCRIBER INSTALLATIONS

(Melbourne, 1988)

1 Scope of application

This Recommendation presents the possible elementary functions for the maintenance of the subscriber installation. The functions are to be considered as optional, except when needed to meet specific network interface requirements found in Recommendations I.430 and I.431.

These functions can be controlled by the local side (e.g. from the subscriber premises) and by a remote side [i.e. from an MSP (maintenance service provider), as described in Recommendation I.601].

It is the responsibility of the subscriber installation to ensure that only authorized MSPs are given access to the following functions.

2 Network configuration for maintenance activities

Figure 1/I.602 is the basis for the general maintenance principles of the ISDN subscriber installation.

Figure 1/I.602, p.

3 Automatic supervision

3.1 *Continuous automatic supervision on layer 1*

3.1.1 *General*

This supervision may be realized by permanent automatic mechanisms located in the pieces of equipment of the subscriber installation (see definition in Figure 1/I.602). These automatic mechanisms are 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.

3.1.2 *Subscriber installation functions*

The following functions may be supervised:

— monitoring of operation functions within the subscriber installation (e.g. power supply);

— supervision of information related to or received from the digital transmission section.

3.2 *Automatic supervision on layer 2 and layer 3 of the D-channel protocol*

This activity covers supervision of activities on layers 2 and 3 of the D-channel protocol. Automatic supervision on layers 2 and 3 may be made by self-acting mechanisms implemented in the subscriber installation.

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

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

— protocol misoperation detection;

— error monitoring (e.g. 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.

4 Internal tests

4.1 *Internal test of the TE1 and TA*

Some of the TEs/TAs may manage internal tests for all or parts of their functionalities. The internal tests may be activated either automatically by the TE and TAs or by a local command in the TE and TAs or by a remote request.

Some of these tests are dependent on the terminal type. Such tests shall not affect the user-network interface, i.e. no test signals shall be transmitted across the interface when a test is in operation.

The terminal equipment may have the ability to abort an internal test sequence, for example, in case of an incoming call attempt. If this test has been requested by an MSP, the subscriber installation should report the discontinuance of the test to the requesting MSP.

The result of an internal test procedure execution should be either *passed* | or *failed* , and in the latter case an additional diagnostic information may be given.

4.2 *Internal test of the NT2*

The subscriber should have facilities which can help to verify that the subscriber installation is not affected by a failure. Definitions of these procedures and functions require further study. The functionalities may be similar to the ones presented for the TE and TA in § 4.1.

The following internal tests of the NT2 have been identified:

4.2.1 *Continuity test*

The objective is to verify that the internal S interfaces of the NT2 can be activated. The mechanism which is implemented in the NT2 could be based on a normal activation of the layer 1 of the interfaces.

The principle for such a test is the same as the one defined for the local exchange function (see Recommendation I.603, § 3.3).

4.2.2 *S interface check using loopback 3*

The loopbacks are shown in § 7. The results could be used for failure localization, particularly in the case where the NT2 functions are distributed.

4.2.3 *Test call to the terminal equipment from the NT2*

An NT2 may address one particular terminal equipment of the installation. Thus, it easily controls a test call. This procedure would allow the NT2 to verify the connection of the TE or TA to the installation and also to check layers 1, 2 and 3 operating conditions (e.g. response time supervision).

The test call could be initiated by the SIME.

The test call could be a normal call made for maintenance purposes.

5 Test call from the MSP

Further study is required, especially concerning charging and authorization aspects.

6 Call to a test responder from the subscriber installation

The MSP may provide test responders that are accessed via normal call procedures. There may be test responders for various teleservices and bearer services.

The selection of the service involved with the test call is made using the lower layer and higher layer compatibility information elements as defined for the normal call control procedures.

7 Loopbacks

7.1 *Locations of loopbacks associated with the subscriber installation*

Loopback locations for failure localization and verification are shown in Figure 2/I.602.

Figure 2/I.602, p.

7.2 *Loopback characteristics for basic rate subscriber installations*

Characteristics of loopbacks are given in Table 1/I.602.

7.3 *Loopback characteristics for primary rate subscriber installations*

Characteristics of loopbacks are given in Table 2/I.602.

8 Status request

A piece of equipment, i.e. NT2, TE, TA may have different states regarding its operation and/or maintenance conditions, e.g. in service, out of service, under tests, etc. These states may be defined in the future.

An MSP may request a SIME in the subscriber installation to indicate the current status of a particular terminal and/or of the connected terminal equipment.

9 Failure report to MSP

A subscriber installation which has detected that a TE is in a failed condition (e.g. when it is detected that a threshold has been exceeded) may have the ability to inform (via the ISDN), immediately, the MSP responsible for the concerned TE.

After reception of such an information, the MSP may initiate a more precise failure localization.

10 Interrogation of parameter values and counters

A MSP may have the ability to access basic information, such as instantaneous value of a parameter or counter.

H.T. [T1.602]

TABLE 1/I.602

Characteristics of loopback mechanisms for basic rate subscriber installations

Loopback	Location	Channel(s) looped back	Loopback type	Control point	Control mechanism	Application	Implementation
3 See Appendix I of Recommendation I.430 }	{						
4 See Appendix I of Recommendation I.430 }	{						
5 Inside the TA, as near as possible to the R interface } Partial, partial transparent or non-transparent } NT2, remote maintenance server or remote user }	{ B 1, B 2 { Message from an MSP (Note 1)	{ Failure localization	Optional				
A See Appendix I of Recommendation I.430 }	{						
B 1 See Appendix I of Recommendation I.430 }	{						
B 2 See Appendix I of Recommendation I.430 }	{						
C	See Appendix I of Recommendation I.430						

Note 1 — This loop might also be controlled by signalling in the B-channel as specified in the X- and V-Series Recommendations.

Note 2 — Activation/deactivation of loopback 3 may be initiated by request from an MSP (by management messages carried via layer 3 in the D-channel). However, the generalization of the test pattern over the loopback would be by the NT2.

Note 3 — From a technical viewpoint it is desirable that loopback 3 can always be implemented (although not mandatory) and, therefore, the design of protocols for loopback control should include the operation of loopback 3.

Note 4 — Whether the loopback is transparent or non-transparent is an implementor's decision. 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.

Tableau 1/I.602 [T1.602], p.16

BLANC

H.T. [T2.602]
TABLE 2/I.602
Characteristics of optional loopbacks for primary rate

access

Loopback	Location	Channel(s) looped	Loopback type	Control point	Control mechanism	Implementation
C 23 | + D or 24 | channels (Note 5) 30 | + D or 31 | channels (Note 6) } Complete, non-transparent (Note 4) }	Inside the NT1 { TE, NT2	{ Layer 1 (Note 1)	 Optional			
B 1 Inside the NT2, at subscriber side (Note 2) } Partial, transparent or non-transparent }	{ B, H 0, H 1 (Note 3) TE, NT2	 { Layer 1 or Layer 3	 Optional			

Tableau 2/I.602 [T2.602], p.17

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.

Figure 1/I.603, p.

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, p.

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.

H.T. [T1.603]
TABLE 1/I.603
Characteristics of loopbacks within the subscriber access

Loopback	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 | + D at least) } Complete, transparent or non-transparent (Note 1) } Under control of local exchange } Failure localization + verification }	{ { { { Layer 1 signals Recommended	{					
1A Complete, transparent or non-transparent (Note 1) } Under control of local exchange }	In the regenerator { Layer 1 signals	Complete loopback Failure localization	{ Optional				

Tableau 1/I.603 [T1.603], p.20

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.

Recommendation I.604

APPLICATION OF MAINTENANCE PRINCIPLES TO ISDN | PRIMARY RATE ACCESSES

(Melbourne, 1988)

1 Scope of application

This Recommendation covers the maintenance of that part of the ISDN subscriber primary rate access which is controlled by the network. The Recommendation follows the maintenance principles as defined in Recommendation M.20 and applies to the primary rate access connected to the local exchange.

The scope of this Recommendation is to describe the minimum functions required to maintain the subscriber primary rate access applicable to any primary rate access

The principle of controlled maintenance (as defined in Recommendation M.20) is applied for maintaining the subscriber primary rate 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.604 gives the basis for the general maintenance principles of the subscriber access, in accordance with Figure 2/I.601 which defines the ISDN subscriber access.

3 Failure detection

3.1 *General*

Unlike the ISDN basic access, the digital section of the ISDN subscriber primary rate access is never deactivated (as seen by the exchange); continuous automatic supervision of the correct functioning of layer 1 up to NT2 is always operating. This supervision is called continuous automatic supervision of layer 1.

Automatic supervision of the correct functioning of the D-channel layers 2 and 3 is also operating. This supervision is called automatic supervision of layers 2 and 3 of the D-channel protocol.

3.2 *Automatic supervision*

3.2.1 *Objectives*

This supervision is realized by continuous automatic mechanisms located in various pieces of equipment of the ISDN primary rate access.

Figure 1/I.604, p.21

Figure 2/I.604, p.22

These automatic mechanisms are never deactivated and are generally based on the operation of CRC information which is given by the CRC procedure associated with the link between the customer and the local exchange. These

mechanisms are complemented by the detection of malfunctioning of particular items, e.g. loss of power supply, loss of incoming signal, loss of frame alignment. Minimum functions which could be allocated to the subscriber installation and exchange termination are listed below. Further details of these functions and those of the digital section are found in Annex A, where various options concerning the handling of CRC functions are described.

3.2.2 *NT2 termination functions*

The functions allocated to the NT2 are listed below:

— detection of loss of incoming signal;

— detection of loss of frame alignment;

— detection of AIS and RAI;

— generation of frame signal;

— CRC code generation;

— RAI generation;

— CRC monitoring of the incoming signal (network-to-user);

— detection of CRC error information (user-to-network);

— CRC error reporting to the network (optional in 1544 kbit/s).

3.2.3 *Exchange termination (ET) functions*

The functions which are allocated to the ET are listed below:

— detection of loss of incoming signal;

— detection of loss of frame alignment;

— detection of AIS, generation of AIS (optional in 1544 kbit/s);

— detection of RAI;

— generation of frame signal;

— CRC code generation;

— RAI generation;

— CRC monitoring of the incoming signal (user-to-network);

— detection of the CRC error information (network-to-user);

— CRC error reporting to the user (optional in 1544 kbit/s).

The exchange termination may optionally detect the CRC error information reported by the user side.

The RAI is generated towards NT2 upon detection by the ET of a fault in the input direction (loss of signal, loss of frame alignment, detection of AIS).

The exchange termination has the option to evaluate the transmission performance based on the statistical treatment of the local and remote CRC error reports and on the fault indications.

The transmission performance evaluation is based on a permanent processing of the elementary results presented by the continuous error monitoring of the digital transmission link. The result of this processing will give information on the transmission quality level (normal quality, degraded quality, unacceptable quality) and on the unavailability of the access (see § 5.6).

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

This covers supervision of activities of layers 2 and 3 of the D-channel protocol. Automatic supervision of 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 layer 2 and layer 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;

— 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.

4 System protection

When a confirmed fault 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).

5 Failure indication

5.1 *Default indication signals*

a) AIS — as defined in Recommendation I.431.

b) RAI — as defined in Recommendation I.431.

5.2 *State tables*

State tables associated with failures in the primary rate access are given in Recommendation I.431.

5.3 *Generation of defect indication signals by the NT2*

The NT2 functions are listed in § 3.2.2.

The generation of RAI toward the ET is used to indicate the loss of incoming layer 1 capability.

5.4 *Generation of defect indication signals by the subscriber access*

The digital link functions are listed in Annex A for each option within the access.

5.5 *Generation of defect indication signals by the exchange termination*

The exchange termination functions are listed in § 3.2.3.

The generation of RAI toward the NT1 is used to indicate the loss of incoming layer 1 capability.

5.6 *Transmission quality monitoring by the exchange*

5.6.1 *Error performance parameters*

According to Recommendations M.20 and M.550, the anomaly and defect indications are treated on a statistical basis.

5.6.2 *Error performance evaluations*

The access is considered by the local exchange to be ‘‘unavailable’’, ‘‘unacceptable’’ or ‘‘degraded’’ according to Recommendation M.550.

5.7 *Failure information from the exchange*

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

The detection of a degraded or unacceptable quality level or of the unavailability of the access by the exchange 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).

5.8 *Failure information to the subscriber installation*

The detection of a degraded or unacceptable quality level by the exchange may be reported to the user by the transmission of a state indication.

6 Failure localization

6.1 *Automatic confirmation of failure within the subscriber primary rate access*

An automatic test procedure to confirm a detected possible failure condition within the subscriber access should be provided. It shall 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 of layer 1, supervision of layers 2 and 3 of the D-channel protocol.

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 failure 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 whether the failure is:

— within the ET;

— within the digital transmission link (NT1 to LT);

— within the subscriber installation.

6.3 *Loopbacks for maintenance of the subscriber primary rate access*

6.3.1 *Location of loopbacks*

Possible loopback locations for failure localization and verification controlled by the SAMC are shown in Figure 3/I.604.

Figure 3/I.604, p.

6.3.2 *Characteristics of loopbacks*

The characteristics of the loopbacks are given in Table 1/I.604.

H.T. [T1.604]
TABLE 1/I.604
Characteristics of the loopbacks for primary rate subscriber access

Loopback	Location	Channel(s) looped back	Loopback type	Control point	Control mechanism	Application	Implementation
0 In ET, as close as possible to V 3 }	{ Part of ET self-test	 Optional					
1 In LT, as near as possible to the line, towards LT } Failure localization and verification }	{ Complete loopback Optional	Complete	FS	Layer 1 signals (Note 1)	{		
1A In the regenerator, towards V 3 } Failure localization and verification }	{ Complete loopback Optional	Complete	FS	Layer 1 signals (Note 1)	{		
2 In NT1, as near as possible to T, towards ET (Note 2) } Failure localization and verification }	{ Complete loopback Optional	Complete	FS	Layer 1 signals (Note 2)	{		
2 1	In NT1	Per channel FS	FS	FS	FS	FS	FS

FS Further study required.

Note 1 — These layer 1 signals may not be in the frame signals. They may be line signals.

Note 2 — In the case of using existing digital systems, a manual loopback may replace loopback 2. This loopback is implemented between NT2 and NT1 and is controlled by the user on demand of the network staff.

Table 1/I.604 [T1.604], p.

6.4 *Failure localization mechanisms*

See Figure 4/I.604.

If a subscriber access failure is confirmed by the exchange and if the failure is not located in the exchange, then:

— either the loopback 2 can be established under control of the exchange, in which case:

i) if the loopback 2 is successful, the exchange considers the subscriber access to be functioning correctly;

ii) if the loopback 2 is unsuccessful, the exchange reports to the OAMC;

— or, if the loopback 2 cannot be established under control of the exchange, then the exchange informs the OAMC that the digital link is affected by a failure.

In the case of a failed maintenance entity being detected, an automatic localization process is initiated. This process could localize the failure within the digital link by the use of loopbacks or subscriber access fault information.

Figure 4/I.604, p.

6.4.1 *Initial failure localization performed by the ET and/or NT2 (TE)*

The initial failure localization capability depends on the CRC option used in the network. For further information about different CRC options which may be applied in the access, see Annex A.

In general, CRC error information and fault indication signals may be used by either the NT2 or ET to deduce the location of some failures in operational conditions.

Failure localization in the case of option 2 refers to the capability to distinguish between a failure occurring either:

— between NT2 and NT1; or

— between NT1 and ET.

Failure localization in the case of option 3 refers to the capability to distinguish between a failure occurring either:

— between NT2 and NT1; or

— between NT1 and LT; or

— between LT and ET.

Failure localization in the case of option 4 refers to the capability to distinguish between a failure occurring either:

— between NT2 and NT1; or

— between NT1 and ET.

This localization may be achieved by either the NT2 or the ET obtaining additional information from the NT1. The means to obtain this information is for further study.

6.4.1.1 *Failure localization performed by the NT2*

In options 2 and 3 the combination of CRC error information and RAI received from the interface allows the NT2 to localize a fault in the upstream direction of the access as follows:

— receipt of RAI by the NT2 with no, or a very small number of, reported CRC errors indicates a failure inside the network; or

— receipt of RAI by the NT2 with constantly, or a very high number of, reported CRC errors indicates a fault between NT2 and NT1.

This capability is not provided by option 1.

Concerning the downstream direction of the access, failure localization can be made in options 1, 2 and 3 by distinguishing between the following conditions at the receiving side of the NT2:

— AIS, indicating a fault inside the network; or

— loss of incoming signal or loss of frame alignment, indicating a failure between NT1 and NT2.

6.4.1.2 *Failure localization performed by the ET*

The failure localization capability of the ET depends on the CRC option used in the access, on the fault detection and reporting capability of the equipment installed and the provision of optional loopbacks as given in Table 1/I.604. For further information about different CRC options applied in the access, see Annex A.

6.4.2 *Further failure localization*

For more precise localization, further techniques may be necessary, e.g. line parameter measurements.

This is for further study.

6.4.3 *Additional signals*

The use and definition of additional signals for transmission direction indication, extension of remote CRC reporting mechanisms and specific equipment signals is for further study.

7 Logistic delay time

See Recommendation M.20.

8 Failure connection

See Recommendation M.20.

9 Verification

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

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

10 Restoration

After a 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.

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 or outgoing calls. This gives the advantage of enabling measurement of the performance independently of the activity in the different channels of the subscriber access and also over a long period of time.

For the performance evaluation of a digital transmission system (over a long period of time) the Administration network shall have arrangements for calculating the performance levels according to Recommendation G.821.

ANNEX A

(to Recommendation I.604)

Subscriber access option

A.1 *Digital link without CRC processing (option 1)*

A.1.1 *Definition*

The transmission equipment used between interfaces at the T and V reference points (multiplexers, NT1-LT) could be existing equipment which have standard functions of supervision and detection of defects and faults.

In this case, the digital link is said to be ‘‘without CRC processing’’: the CRC procedure is between the ET and NT2 (see Figure A-1/I.604).

Figure A-1/I.604, p.

A.1.2 *Digital link functions*

Functions allocated to the digital link are listed below:

— detection of loss of incoming signal on either side and inside the transmission section, and generation of AIS ‘‘downstream’’;

— detection of AIS inside the transmission section and generation of AIS ‘‘downstream’’;

— detection of defects and anomalies in the digital link.

A.1.3 *NT2 functions*

Functions allocated to the NT2 are given in § 3.2.2.

A.2 *Digital link with CRC processing in the NT1 (option 2)*

A.2.1 *Definition*

The transmission equipment used between interfaces at the T and V reference points could be new equipment with CRC processing in the NT1 (see Figure A-2/I.604). In this case, the digital link is said to be with ‘‘CRC processing in the NT1’’.

Figure A-2/I.604, p.

A.2.2 *Digital link functions*

Functions allocated to the digital link are listed below:

— detection of loss of signal at either side of the NT1 or inside the transmission section;

— detection of loss of frame alignment at either side of the NT1;

— generation of AIS downstream in the direction to the user;

— supervision of power supply (optional);

— CRC generation towards the user and towards the ET;

— CRC monitoring at both sides of the NT1 and detection of CRC blocks received with error;

— when a block with CRC error is received from NT2, transmission of CRC error information towards NT2 (Note);

— when a block with CRC error is received from ET, transmission of CRC error information towards ET;

— when a block with CRC error is received from ET, transmission of CRC error information towards NT2 (optional);

— detection of defect and anomaly in the digital link.

Note — To fulfill the requirement of failure localization, the NT1 has to report the CRC error information toward the NT2 even when loss of frame alignment has occurred. This is different from the procedure described in Recommendation G.706.

A.2.3 *NT2 functions*

Functions allocated to the NT2 are given in § 3.2.2.

A.3 *Digital link with CRC processing in the LT and NT1 (option 3)*

A.3.1 *Definition*

The transmission equipment used between interfaces at the T and V reference points may be new equipment with CRC processing, treatment and reporting of the results of that processing in the NT1 and LT (see Figure A-3/I.604). In this case the digital link is said to be with

Figure A-3/I.604). In this case the digital link is said to be with ‘‘CRC processing and reporting in the NT1 and the LT’’.

Figure A-3/I.604, p.

A.3.2 *LT functions*

Functions allocated to the LT are listed below:

- detection of loss of signal at either side of the LT;
- detection of loss of frame alignment at either side of the LT;
- detection of RAI at either side of the LT;
- generation of AIS downstream in the direction of the NT1;
- supervision of power supply (optional);
- generation of CRC towards NT1 and ET;
- monitoring of CRC from both sides of the LT and detection of CRC blocks received with error;
- when a block with CRC error is received from NT1, transmission of CRC error information toward NT1;
- when a block with CRC error is received from ET, transmission of CRC error information toward ET;
- when a block with CRC error is received from ET, transmission of CRC error information toward NT1 (optional);
- supervision of the numbers of CRC blocks received with error, from ET and from NT1 separately;
- checking thresholds corresponding to errored seconds, severely errored seconds and degraded minutes;
- reporting errored seconds, severely errored seconds and degraded minutes.

A.3.3 *NT1 functions*

Functions allocated to the NT1 are listed below:

- detection of loss of signal at either side of the NT1;
- detection of loss of frame alignment at either side of the NT1;
- detection of RAI at either side of the NT1;
- generation of AIS downstream in the direction of the NT2;
- supervision of power supply (optional);
- generation of CRC towards NT2 and LT;
- monitoring of CRC from both sides of the NT1 and detection of CRC blocks received with error;
- when a block with CRC error is received from NT2, transmission of CRC error information toward NT2;
- when a block with CRC error is received from LT, transmission of CRC error information toward LT;
- when a block with CRC error is received from LT, transmission of CRC error information toward NT2 (optional);
- supervision of the numbers of CRC blocks received with error, from LT and NT2 separately;
- checking thresholds corresponding to errored seconds, severely errored seconds and degraded minutes;
- reporting errored seconds, severely errored seconds and degraded minutes.

A.4 *Digital link with CRC monitoring in the NT1 (option 4)*

A.4.1 *Definition*

The transmission equipment used between interfaces at the T and V reference points could be new equipment with CRC monitoring in the NT1 (see Figure A-4/I.604). In this case, the digital link is said to be ‘‘with CRC monitoring in the NT1’’.

Figure A-4/I.604, p.

A.4.2 *NT1 functions*

Functions allocated to the NT1 are listed below:

— detection of loss of signal or loss of frame alignment at either side;

— generation of AIS toward either side when signal or frame alignment on opposite side is lost;

— monitor CRC from both directions;

— store information derived from the CRC monitoring.

The information derived from the CRC monitoring and stored in the NT1 may be retrieved from either the NT2 or ET. The means of this retrieval is for further study.

A.4.3 *NT2 function*

In addition to the functions described in § 3.2.2, NT2s may also, optionally, have the capability of retrieving from the NT1 the stored information derived from CRC monitoring.

A.4.4 *ET function*

In addition to the functions described in § 3.2.3, ETs may also, optionally, have the capability of retrieving from the NT1 the stored information derived from CRC monitoring.

Recommendation I.605

APPLICATION OF MAINTENANCE PRINCIPLES TO STATIC MULTIPLEXED ISDN BASIC ACCESSES

(Melbourne, 1988)

1 Scope of application

This Recommendation covers the maintenance of the static multiplexed basic rate access, controlled by the network, and describes the operations and maintenance aspects of the V_4 interface

The V_4 interface is defined in Recommendation Q.512. The specification of the operations and maintenance aspects of the V_4 interface is the subject of this Recommendation.

This Recommendation follows the maintenance principles as defined in Recommendation M.20 and applies to the basic rate access connected to the exchange via a multiplexer.

The principle of controlled maintenance is applied for maintaining the static multiplexed basic rate 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.605 shows the general reference configuration of the multiplexed basic rate access, connected via a digital link to the Exchange Termination (ET).

Figure 1/I.605, p.

3 Relationship to the maintenance of the basic rate access

The same principles as given in Recommendation I.603 for the ISDN basic rate accesses directly connected to the local exchange, should be applied. Therefore, the NT1 and LT for the basic rate accesses connected via a static basic access multiplexer to the local exchange must have the same functions as NT1 and LT for the basic rate accesses connected directly to the local exchange.

(The loopback mechanism must be implemented according to Recommendation I.603.)

In order to support these principles, operation and maintenance information has to be exchanged between the digital section for the ISDN basic rate access and the exchange termination (ET). This information is conveyed in the CV1-channel , which is defined in Recommendation Q.512. This CV1-channel is shown in Figure 2/I.605.

Figure 2/I.605, p.

The functions which are allocated within this CV1-channel are defined in Recommendation G.960 on the digital section for the ISDN basic rate access.

These functions can be classified according to:

— activation/deactivation procedures;

— error and status reporting to the ET;

— failure localization within the digital section for the ISDN basic rate access;

— conveyance of control information from the ET to the digital section of the ISDN basic rate access.

4 Maintenance of the digital link and basic access multiplexer

4.1 *Failure detection*

Unlike the ISDN basic access, the digital link and basic access multiplexer are always in the active state (as seen by the exchange). Continuous automatic supervision, supervising the correct functioning of layer 1 up to the basic access multiplexer, is operating. This supervision is called continuous automatic supervision on layer 1

4.1.1 *Functions applied to the ET*

The functions which are allocated to the ET are listed below:

- detection of loss of incoming signal;
- detection of loss of frame alignment;
- detection of AIS;
- detection of RAI;
- generation of the frame signal;
- CRC code generation;
- RAI generation;
- CRC monitoring of the incoming signal (basic access multiplexer to the ET);
- detection of CRC error information;
- CRC error reporting (ET to the basic access multiplexer) (optional);
- AIS generation.

The implementation of these functions should be the same as for the ET in the ISDN primary rate access, as defined in Recommendation I.604 for the exchange termination (ET).

4.1.2 *Functions applied to the static basic access multiplexer*

The functions which are allocated to the basic access multiplexer are listed below:

- detection of loss of incoming signal;
- detection of loss of frame alignment;
- detection of AIS;
- detection of RAI;
- generation of the frame signal;
- CRC code generation;
- CRC monitoring of the incoming signal (network to basic access multiplexer) and detection of CRC error information (if provided from the ET);
- CRC error reporting (basic access multiplexer to the ET).

The implementation of these functions should be the same as for the NT2 in the primary rate access, as defined in Recommendation I.604.

In addition, the following functions are allocated to the basic access multiplexer:

- sending of AIS on the V_4 interface, in case of a defect in the basic access multiplexer between the V_1 reference point and the V_4 interface of the multiplexer;
- signalling to all the basic rate accesses the condition ‘‘out of service due to failure’’, in the case of a defect occurring in the basic access multiplexer, between the V_1 reference point and the V_4 interface of the multiplexer, and in the digital link.

4.1.3 *Functions allocated to the digital links*

The functions, which are allocated to the digital links are:

— detection of loss of incoming signal on either end and within the digital link;

— generation and transmission of AIS within the digital link.

4.2 *System protection*

When a defect is detected in the digital link or basic access multiplexer, which has an adverse effect on the availability and/or functionality of all the ISDN basic rate accesses, all the ISDN basic rate accesses connected via this digital link and basic access multiplexer are considered to be ‘‘out of service due to failure’’ and call attempts may be rejected.

When a defect is detected in the digital link or basic access multiplexer, which has an adverse efect on the availability and/or functionality of only one basic rate access, then this particular basic access is considered to be ‘‘out of service due to failure’’ and call attempts may be rejected.

4.3 *Failure information*

When a defect is detected in the basic access multiplexer or digital links, this should be reported to the SAMC by a message.

4.4 *Failure localization*

When a defect is detected in the digital link, additional information for failure localization may be required from other network management entities.

4.5 *Logistic delay time*

See Recommendation M.20.

4.6 *Failure correction*

See Recommendation M.20.

4.7 *Verification*

The verification that the failure has been corrected is performed on demand of the SAMC.

4.8 *Restoration*

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

4.9 *Overall performance measurements*

See Recommendation I.603 for the performance related to the digital section of the basic rate access, and Recommendation I.604 for the V_4 digital section.

BLANC