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SERIES M: TMN AND NETWORK MAINTENANCE: INTERNATIONAL TRANSMISSION SYSTEMS, TELEPHONE CIRCUITS, TELEGRAPHY, FACSIMILE AND LEASED CIRCUITS

International data transmission systems

Maintenance of international leased circuits that are supported by international data transmission systems

ITU-T Recommendation M.1385

(Formerly CCITT Recommendation)

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ITU-T Recommendation M.1385

Maintenance of international leased circuits that are supported by international data transmission systems

Summary

This ITU-T Recommendation is only applicable to international leased circuits that are supported by a data transmission system. The requirements described in this ITU-T Recommendation should ensure that an international leased circuit meets performance limits and is fully tested prior to restoration into service after a fault.

The Maintenance tests described in this ITU-T Recommendation should ideally include periods of normal industrial activity to be representative of typical network conditions. This ITU-T Recommendation has been developed to be consistent with ITU-T Recommendation M.1375 that describes the Maintenance of international data transmission systems.

ITU-T Recommendation M.1380 covers Bringing-Into-Service issues for international leased circuits that are supported by a data transmission system.

This ITU-T Recommendation addresses the Maintenance requirements of leased circuits with a PDH digital presentation at the Customer's premises. Another ITU-T Recommendation is being developed for Bringing-Into-Service and Maintenance procedures for SDH leased circuits.

For leased circuits with an analogue presentation, the Maintenance procedures given in ITU-T Recommendation M.1060 apply, with performance achievement in accordance with ITU-T Recommendations M.1020, M.1025 or M.1040 as appropriate.

Source

ITU-T Recommendation M.1385 was revised by ITU-T Study Group 4 (1997-2000) and approved under the WTSC Resolution 1 procedure on 4 February 2000.

Keywords

Exchange of information, fault localization, fault reporting procedure, in-service monitoring, international data transmission system, international leased circuit, maintenance records, maintenance tests, planned maintenance, restoration procedure.

FOREWORD

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ITU-T Recommendation M.1385

Maintenance of international leased circuits that are supported by international data transmission systems

1 Scope

This ITU-T Recommendation describes the Maintenance procedures for an international leased circuit that is supported by a data transmission system. The circuit will have a digital presentation, normally in the PDH domain, at the Customer's premises, but in some cases may be terminated in the SDH domain. This case of mixed PDH/SDH leased circuit needs further study. The provisions of this ITU-T Recommendation should be considered in conjunction with those of ITU-T Recommendation M.1375 [12] for international data transmission systems

This ITU-T Recommendation does not cover the Maintenance requirements of leased circuits with an analogue presentation at the Customer's premises. Such leased circuits are described in ITU-T Recommendation M.1060 [8].

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; all users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published.

[1] ITU-T Recommendation G.701 (1993), *Vocabulary of digital transmission and multiplexing, and Pulse Code Modulation (PCM) terms*.

[2] ITU-T Recommendation M.60 (1993), *Maintenance terminology and definitions*.

[3] CCITT Recommendation M.80 (1988), *Control stations*.

[4] CCITT Recommendation M.90 (1988), *Sub-control stations*.

[5] CCITT Recommendation M.1012 (1988), *Circuit control stations for leased and special circuits*.

[6] CCITT Recommendation M.1013 (1988), *Sub-control station for leased and special circuits*.

[7] ITU-T Recommendation M.1045 (1996), *Preliminary exchange of information for the provision of international leased circuits and international data transmission systems*.

[8] CCITT Recommendation M.1060 (1988), *Maintenance of international leased circuits*.

[9] ITU-T Recommendation M.1300 (1997), *Maintenance of International data transmission systems operating in the range 2.4 kbit/s to 140 Mbit/s*.

[10] ITU-T Recommendation M.1340 (1996), *Performance objectives, allocations and limits for international data transmission links and systems*.

[11] ITU-T Recommendation M.1370 (1998), *Bringing-into-service of international data transmission systems*.

[12] ITU-T Recommendation M.1375 (1998), *Maintenance of international data transmission systems*.

[13] ITU-T Recommendation M.1380 (2000), *Bringing-into-service of international leased circuits that are supported by international data transmission systems*.

[14] ITU-T Recommendation M.1400 (1997), *Designations for international networks*.

[15] CCITT Recommendation M.1510 (1992), *Exchange of contact point information for the maintenance of international services and the international network*.

[16] ITU-T Recommendation M.1530 (1999), *Network maintenance information*.

[17] ITU-T Recommendation M.1535 (1996), *Principles for maintenance information to be exchanged at customer contact point (MICC)*.

[18] ITU-T Recommendation M.1537 (1997), *Definition of maintenance information to be exchanged at customer contact point (MICC)*.

[19] ITU-T Recommendation M.1539 (1999), *Management of the grade of network maintenance services at the maintenance service customer contact point (MSCC)*.

[20] ITU-T Recommendation M.1540 (1994), *Exchange of information for planned outages of transmission systems*.

[21] CCITT Recommendation M.1560 (1992), *Escalation procedure for international leased circuits*.

3 Terms and definitions

ITU-T Recommendation M.1300 [9] provides general descriptions of international data transmission systems. Terminology and definitions relating to this ITU-T Recommendation are provided in ITU-T Recommendations G.701 [1] and M.60 [2]. For the purposes of this ITU-T Recommendation, the following definitions of an international digital leased circuit and Service Level Agreement (SLA)/Contract apply:

3.1 An **international digital leased circuit**: Is the digital path between two Network Terminating Equipments (NTEs). The digital leased circuit may be bidirectional or unidirectional and its end points are at the boundaries between the Network Operator/Service Provider and the Customer. The NTEs may be owned by the Network Operator/Service Provider or owned by the Customer.

3.2 An **SLA/Contract**: Is a set of appropriate procedures and targets formally or informally agreed between Network Operators/Service Providers or between Network Operators/Service Providers and Customers, in order to achieve and maintain specified Quality of Service (QoS) in accordance with ITU (ITU-T and ITU-R Recommendations). The SLA may be an integral part of the Contract. These procedures and targets are related to specific circuit/service availability, error performance, Ready for Service (RFS) date, Mean Time Between Failures (MTBF), Mean Time to Restore Service (MTRS), Mean Time to Repair (MTTR).

4 Abbreviations

This Recommendation uses the following abbreviations:

BIS Bringing-Into-Service

CSES Consecutive Severely Errored Second

ES Errored Second

ISM In-Service Monitoring

MTBF Mean Time Between Failures

MTRS Mean Time to Restore Service

MTTR Mean Time To Repair

NTE Network Terminating Equipment

PCM Pulse Code Modulation

PDH Plesiochronous Digital Hierarchy

RFS Ready for Service

SDH Synchronous Digital Hierarchy

SEP Severely Errored Period

SES Severely Errored Second

SLA Service Level Agreement

TMN Telecommunications Management Network

UTC Co-ordinated Universal Time

5 Performance limits and objectives

Performance limits should be consistent with those used during Bringing-Into-Service (see ITU-T Recommendation M.1380 [13]). For short duration tests the limits given in clause 7/M.1340 [10] are appropriate. For all performance tests described in this ITU-T Recommendation, the Errored Second (ES) and Severely Errored Second (SES) limits should be met simultaneously for the test result to be considered acceptable.

Network Operators/Service Providers should be aware that periods of Consecutive Severely Errored Seconds (CSES), of between 3 and 9 seconds, called a "Severely Errored Period (SEP)", can have a severe impact on some Customers' leased circuit applications. CSESs are critical for some Customers' leased circuit applications because they require the application to be restarted completely, since the installation's own recovery system is no longer sufficient to cover the circuit interruption time.

Performance limits and objectives for SEPs are for further study.

6 Maintenance records

Network Operators/Service Providers should ensure that up-to-date information is held on file to assist maintenance activities. Clause 6/M.1370 [11] and clause 6/M.1380 [13] provide details of information that should be available. In addition, a record should be kept of any particular maintenance agreement with the Customer, including for example SLA (Service Level Agreement). See also ITU-T Recommendations M.1510 [15], M.1530 [16], M.1535 [17], M.1537 [18] and M.1539 [19] for further information. Maintenance staff should refer to such agreements when dealing with a fault reported by the Customer.

During maintenance operations, reference should be made to previous test results that are applicable to the circuit under test. Original BIS test results should be available for all leased circuits.

Network Operators/Service Providers should also keep a log of circuit interruptions, over an adequate period, with a view to meeting any claims from Customers.

7 Fault reporting procedures

7.1 Control and sub-control status

A dual control or a control and sub-control relationship will have been agreed at the BIS stage. See clause 10/M.1300 [9], item ix) of clause 6/M.1370 [11] and 7.1/M.1375 [12].

Where a control and sub-control relationship exists, responsibilities will be as described in ITU-T Recommendations M.80 [3], M.90 [4], M.1012 [5] and M.1013 [6].

Where a dual control relationship has been established, Network Operators/Service Providers should have agreed an effective mechanism for coordinating maintenance activities. Under this arrangement, to avoid confusion, it is essential that the terminal stations inform each other of maintenance activities as rapidly as possible, in accordance with the performance agreed within the SLA/Contract, (see also ITU-T Recommendations M.1510 [15], M.1530 [16], M.1535 [17], M.1537 [18] and M.1539 [19]).

It is possible for a third-party centre to be designated as the control station. In this situation the leased circuit may not be routed via this centre, nor need this centre be situated in a terminal or transit country of the circuit. An example is when a "one-stop maintenance" type arrangement is set up.

7.2 Initial reception of a fault report

In general, fault information relating to an international leased circuit can originate from a number of sources:

– a Customer (due to the failure or degraded performance of the circuit);
– the Network Operator providing the circuit (due to the failure or degraded performance of the network supporting the circuit);
– a connecting Network Operator providing part of the circuit (due to the failure or degraded performance of the network);
– a third-party centre, as described in 7.1 above.

It is assumed that the Customer has carried out the following requisite checks to determine that the fault stems from the leased circuit for which the Network Operator/Service Provider is responsible:

– results from the application's monitoring and control system;
– information from the Network Operator/Service Provider's TMN system, if available.

When fault information is received (especially a fault report from a Customer), the following information should be obtained:[1]

– name, title and contact details for the person reporting the fault;
– the Customer identifier;
– time of fault report, recorded in UTC;
– international designation of the faulty circuit (see ITU-T Recommendation M.1400 [14]);
– symptoms of the fault and if possible, the probable cause;
– the time the fault was first observed, recorded in UTC;
– any associated information that may assist with fault clearance.

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[1] Some Network Operator/Service Providers have introduced computerized documentation and exchange of work orders and set up a Leased Circuits "help-desk", which considerably facilitates operations.

The Customer should be given a fault reference, which can be used in future communications. They may also wish to know:

– where the fault is located;
– the nature of the fault;
– above all, when the circuit will be restored, either by fault rectification or by restoration.

Prior to undertaking corrective maintenance (for example loop-tests), the Customer must be asked to give permission for the circuit to be withdrawn from service.

Following corrective maintenance, the Customer should be asked to confirm that their application is functioning correctly.

8 Fault localization

It may be useful to reference Figure 1/M.1375 [12] for guidance with fault localization. TMN data, which may be available at various locations within the Network Operator/Service Provider's network, may be used to assist with fault localization.

Initial localization should seek to establish whether a fault exists and to determine if it is located within the Customer's premises, the national circuit portion or elsewhere. The use of the following information may assist:

– whether the fault is intermittent or permanent;
– network alarm information;
– performance management information obtained from the network;
– results of the tests up to the Customer connection point, i.e. up to the point where the Network Operator/Service Provider is responsible.

Where a fault is localized outside of the national circuit portion (i.e. within the international portion or distant national portion), it should be referred to a fault reporting point that has responsibility for international maintenance activities. This will typically be the fault reporting point that has responsibility for the international data transmission system.

When a fault is referred to another fault reporting point, the information given in 7.2 above should be exchanged. Further localization should seek to identify the faulty element as quickly as possible. Where fault localization (or confirmation of it) is not achieved in a time consistent with the time to remove the fault or restore the circuit as specified in the SLA/Contract, Network Operators/Service Providers shall invoke the agreed escalation procedure (see ITU-T Recommendation M.1560 [21]) to assist progress.

9 Maintenance tests

For maintenance intervention tests, the circuit shall only be withdrawn from service with the Customer's agreement, unless the circuit is completely interrupted. The use of In-Service Monitoring (ISM) is thus highly advisable. Maintenance tests should be kept as short as possible to avoid significantly extending the out-of-service time.

Customer service may be improved by using 24-hour "help desks" and TMN facilities in order to schedule tests from a central location. Information about the fault condition detected, and the countermeasures planned, should be given promptly to the Customer, in order to respect any contractual commitments.

Any loopback facilities that may be available should be used when appropriate. Care must be taken to avoid the simultaneous operation of multiple loopbacks on a particular circuit. Once the need for a loopback no longer exists, then care should be taken to ensure that it is removed.

If both Network Operators have compatible equipment, then it may be possible to test the end-to-end continuity of a digital leased circuit. This may be possible using the TMN to apply a loopback condition. However this type of testing requires the agreement of the Customer, since their circuit cannot be used at that time.

Where an ISM capability is available for in-service observation of the circuit signal, then it should be used to assist maintenance operations. It should be noted that, for more extensive measurements involving intrusive testing, the circuit will be interrupted.

The duration of maintenance intervention tests will be dependent upon the nature of the fault report that has been received.

1) Where the circuit has a failure, a short test of basic integrity should be performed. See clause 7/M.1340 [10] for suitable limits.

2) Where there has been an overall degradation of service, but that the circuit is not interrupted, a longer duration test will be appropriate. Network Operators/Service Providers should agree a suitable test date and time with the Customer. The Customer may wish to retain access to the circuit until a more convenient time when a substantial out-of-service period may be more tolerable. When a 24-hour test is performed, Network Operators/Service Providers should use the same limits that were developed for initial BIS tests (see ITU-T Recommendation M.1380 [13]).

3) For a repetitive fault, or a fault requiring special investigation, a longer duration test, as described above, should be used. Reference can also be made to the fault history, performance information from an ISM system, circuit topology, and the Customer's application to determine the cause of the repetitive fault.

In all cases, returning-to-service tests should be of a duration that is appropriate to the nature of fault that has been cleared. Where a fault had caused a general degradation of service, a returning-to-service test with a short duration (e.g. 15 minutes) may not be appropriate and a longer-term test (e.g. 1 hour or 24 hours) should be used.

10 Temporary service restoration procedures

Temporary service restoration may be used when a network failure is localized to either the national or the international network, and this is affecting circuits supported by a data transmission system. Typical international network failures that may require the use of temporary service restoration include the loss of an undersea cable system or satellite system.

Temporary service restoration should only be used when it is clear that international network restoration or repair will not be achieved in a reasonable time (see Annex D/M.1560 [21]).

10.1 Mechanisms for implementing temporary service restoration

Two basic mechanisms have been identified as follows:

1) To use a dedicated restoration facility:

   The dedicated restoration facility for the circuit will typically be via a data transmission system which may follow a different physical route. If both of the following criteria are met, the dedicated restoration facility may be used:

   a) a network failure has occurred and it is observed that restoration will not be achieved in a time consistent with the SLA/Contract; and

   b) a dedicated restoration facility is available.

2) To use temporary restoration capacity:

The temporary restoration capacity would typically be found within other data transmission systems that connect to the same destination, which may follow a different physical route within the network. If each of the following criteria is met, the temporary restoration capacity may be used:

a) a network failure has occurred and it is observed that restoration will not be achieved in a time consistent with the SLA/Contract; and

b) any dedicated restoration facility that may have been provided is not available; and

c) spare restoration capacity (at the channel level) is available;

d) the Network Operators/Service Providers involved have the technical capability and operating procedures to support the temporary switching of channels between data transmission systems.

10.2 Time to restore service

Network Operators/Service Providers should take into account the urgency for restoration of leased circuits within each particular data transmission system as mentioned in the preliminary exchange of information for its provision (see ITU-T Recommendations M.1045 [7] and M.1400 [14]). Where time to restore service seems to be unacceptable in accordance with the SLA/Contract, Network Operators/Service Providers shall invoke the agreed escalation procedure (see ITU-T Recommendation M.1560 [21]).

10.3 Restoration procedure

The following outline procedure is for guidance only. Detailed operating procedures will need to be agreed between the Network Operators/Service Providers involved, taking account of the network infrastructure that is available. This may include the use of a TMN X-interface.

When a data transmission system failure occurs and the basic restoration criteria have been met (see 10.1 above), the Network Operators/Service Providers involved will confirm that some form of temporary service restoration is to be used and agree how this is to be achieved. Service can be restored using the following procedure:

a) confirm that the data transmission link is faulty;

b) confirm that both Network Operators/Service Providers agree that the restoration time is inconsistent with the SLA/Contract;

c) implement recovery mechanisms;

d) confirm with the Customer that the affected leased circuits have been successfully restored and record the time of restoration in UTC.

10.4 Returning to normal routing

When service can be restored via its normal route, this should be done as soon as practically possible, with agreement from the Customer in accordance with the terms of the SLA/Contract, or as a planned outage (see Recommendation ITU-T M.1540 [20]).

10.5 Information that should be exchanged

Dependent upon the proposed restoration method that is to be used, Network Operators/Service Providers shall ensure that suitable preliminary information has been exchanged (e.g. designations and routings for any data transmission systems that may be used for dedicated service restoration). Additionally, records shall be kept of which circuits have been routed on the temporary restoration capacity.

11 Planned maintenance

In cases of planned maintenance, either at the network or circuit level, impacting on the Network Operator/Service Provider's installations (transmission equipment, power equipment, cabling, etc.) which would cause or risk some performance degradation or unavailability of the digital leased circuit, reference is to be made to ITU-T Recommendation M.1540 [20] and the terms of the SLA/Contract with the Customer.

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