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SPECIFICATIONS OF SIGNALLING SYSTEM No. 7

SIGNALLING SYSTEM No. 7 TEST SPECIFICATION – GENERAL DESCRIPTION

ITU-T Recommendation Q.780

(Previously “CCITT Recommendation”)

FOREWORD

The ITU-T (Telecommunication Standardization Sector) is a permanent organ of the International Telecommunication Union (ITU). The ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Conference (WTSC), which meets every four years, establishes the topics for study by the ITU-T Study Groups which, in their turn, produce Recommendations on these topics.

The approval of Recommendations by the Members of the ITU-T is covered by the procedure laid down in WTSC Resolution No. 1 (Helsinki, March 1-12, 1993).

ITU-T Recommendation Q.780 was revised by ITU-T Study Group 11 (1993-1996) and was approved under the WTSC Resolution No. 1 procedure on the 17th of October 1995.

NOTE

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

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SUMMARY

This Recommendation is an introductory overwiew of Signalling System No. 7 test specifications contained in Recommendations Q.781 to Q.788. It defines the scope and purpose of those test specifications. It also propose both general guidelines and guidelines specific to the particular protocol under test.

SIGNALLING SYSTEM NO. 7 TEST SPECIFICATION – GENERAL DESCRIPTION

(Melbouurne, 1988; modified at Helsinki, 1993; revised in 1995)

1 General

This Recommendation is an introductory Recommendation to the test specifications of Signalling System No. 7. The test specifications are contained in Recommendations Q.781 to Q.788. This Recommendation defines the scope and purpose of the test specification and identifies guidelines that are either specific to the particular protocol under test, or are more general. In addition, it identifies functional requirements imposed by the test specification.

2 General principles of test specifications

There are two types of testing – validation and compatibility. Validation testing aims to verify a given implementation of a protocol in accordance with the relevant Recommendation. Compatibility testing aims to verify the proper interworking of two or more protocol implementation. The specification is independent of a given implementation and does not generally imply any modification of the signalling point under test. However, it is recognized that certain tests require capabilities of the system that are not explicitly defined in the relevant Recommendation, and these capabilities may not be present in all implementations. As a consequence, certain tests may not be possible in all implementations. Therefore, for validation testing individual Administrations may unilaterally choose the tests to be performed, for compatibility testing bilateral agreement is required.

3 Scope of the test specification

The test specification is intended to cover all aspects of Signalling System No. 7. The following Recommendations are initially produced as follows:

- Q.781 covers MTP Level 2. See Q.703.
- Q.782 covers MTP Level 3. See Q.704-Q.707.
- Q.783 covers TUP. See Q.721-Q.724.
- Q.784 covers ISDN User Part for basic call control part. See Q.761-Q.764.
- Q.785 covers ISDN User Part for supplementary service part. See Q.730.
- Q.786 covers SCCP. See Q.711-Q.714.
- Q.787 covers TC. See Q.771-Q.775.
- Q.788 covers UNI to UNI compatibility testing. See Q.699, Q.767 and Q.931.

The test specification is not a definition of the protocol. The protocol Recommendations are as noted above.

4 Field of application

The test specification applies in the international network, and if appropriate in the national network. In the international network, the actual tests to be performed will be the subject of appropriate bilateral agreements between the two or more Administrations/ROAs concerned.

5 Method of application

The test specifications fulfil the requirements for both validation and compatibility testing and are specific to only the given protocol under test. This clause further identifies the principles and configurations as well as the structure of the test specifications themselves.

5.1 Test principles

For a given protocol test specification, it is assumed that the underlying layers have been implemented correctly and therefore the tests specified are only concerned with the given protocol under test. In so far as is practical, tests are intended to test the major aspects of the given protocol and associated call control functions including normal and abnormal behaviour. It is understood that testing all aspects of abnormal behaviour is not realizable.

Compatibility aspects include the processing of spare fields as defined in 6.2/Q.701, and validation tests should be made to check that they are ignored when received.

The following criteria are used in defining test requirements in subsequent Recommendations:

a) *Tests should not imply an implementation*

To improve the functional description and understanding of the behaviour of the signalling system, the test specifications model the internal behaviour of the protocols using functional groupings. The functional groupings are only used to facilitate understanding and do not impose constraints on an implementation.

Compatibility is only measured against the external behaviour of the protocol, as described in the protocol specifications. If exceptions to this rule are identified they are specified in the corresponding test specification.

b) *Testing requirements should be independent from the testing environment*

Test requirements are not meant to dictate a specific test environment. Hence, those executing tests should not feel constrained to any specific test generation mechanism (see Recommendation Q.755), traffic simulator or monitoring equipment solely because of the given test specification.

c) *Test Recommendations are intended to be test specification guidelines*

It is possible to extract from a test Recommendation, a subset of the tests which are appropriate for testing within a selected domain of functionality. These tests may need to be supplemented with specific user/system tests. In order to achieve this, guidance is given to the tester wherever possible, e.g. the purpose of the test, how it could be performed, how tests are selected, etc. Tests which are conditional on the presence of optional items should also be identified.

5.2 Categories of tests

The test specification fulfils the requirements for both validation and compatibility testing. All tests are identified as either Validation Tests (VAT) and/or Compatibility Tests (CPT). All tests in the test specification are validation tests (VAT), and in addition those marked with an asterisk are also Compatibility Tests (CPT). Since the UNI-to-UNI tests in Recommendation Q.788 are all compatibility tests, the asterisk is implied. The explanation of these categories follows.

5.2.1 Validation testing

The function of validation testing is to give a level of confidence that a given implementation in accordance with the relevant Recommendations of the Signalling System No. 7. These validation tests could apply both in the national and international networks. The validation test is a prerequisite of compatibility testing (see 5.2.2) and is performed under the responsibility of each Administration/ROA. These tests will generally be performed without the cooperation of another Administration/ROA, although this is not precluded should this arrangement prove convenient. Validation testing will be performed on a signalling point that is not in service.

The validation test is performed on a signalling point. In the case of SCCP, testing is performed on a signalling node.

It is suggested that the validation test, or subset, is repeated when the implementation is upgraded or modified in any functional way.

Validation testing may require the use of a simulator to check the operation of the signalling point/node under test. The specification of this simulator is not explicitly covered by these Recommendations although the general requirements are implicit in the test specification.

In validation testing, the signalling point/node under test is called SP "A".

5.2.2 Compatibility testing

The objective of compatibility testing is to give a level of confidence that two different implementations are able to interwork. To perform compatibility testing, the various nodes involved are interconnected. The specification is written for the interconnection of two given implementations for the first time. For subsequent interconnections of the same two implementations, a subset of tests may prove sufficient. These tests will not only be performed on a new signalling point/node, but also on a signalling point/node already in service.

Each Recommendation identifies a list of tests that may be suitable for compatibility testing, but the actual tests to be performed will be bilaterally agreed between the Administrations/ROAs concerned.

Certain of the tests identified in the test list as compatibility tests may disturb the operation of the exchange, whereas others may not. Any tests which may cause disturbance to the exchange should be carefully selected to meet the operational criteria of the two Administrations/ROAs.

The satisfactory completion of compatibility testing should be bilaterally agreed.

When a change to the signalling network is made, tests selected from those identified as compatibility tests may be appropriate. In general the tests performed under these circumstances will be the minimum number to ensure that compatibility between points in the network is still maintained.

In compatibility testing, all signalling points/nodes are simultaneously under test.

5.3 Structure of test Recommendations

The individual test Recommendations should contain the following:

- Introduction – This clause describes the outline of the individual test specification.
- Scope of test – This clause mentions the functions to be tested.
- Objective of test – This clause explains the basic concept for deciding test items or test configurations.
- Test environment – This clause describes the nature of the facilities necessary to perform testing such as traffic generator/terminator and logging equipment for test traffic.
- Test configuration – This clause describes the configurations of SPs and link(s) or signalling relations which are necessary to perform tests.
- Presentation of test traffic – This clause illustrates the format of the messages for testing such as address type and the content of individual data fields.
- Test list – This clause presents test items categorized on a certain criterion.
- Test script – This clause illustrates the flows of messages transferred to perform the required test. It includes test numbers, reference to protocol Recommendations, title, subtitle, purpose, pre-test conditions, configuration, SP types, test type, message sequence described by arrow diagrams and test description.

5.4 Test configurations

The test configurations required for both types of tests are similar but not identical.

5.4.1 Validation test configuration

For validation testing, the point under test is connected to the test environment and becomes part of the "test configuration". The test configuration satisfies all of the following three criteria:

- the point under test will be connected by one or more signalling link sets (real or simulated), which may or may not be interconnected;
- the capability of generation and reception of test traffic, where applicable;
- the ability to perform the described test, notably the facility to store and analyse messages to the appropriate degree.

5.4.2 Compatibility test configuration

For compatibility testing all the signalling points are combined into one large system under test satisfying all of the following four criteria:

- the nodes of the system under test will be interconnected by one or more real signalling link sets;
- the capability of generation and reception of test and real traffic, where applicable;
- the ability to perform the described test, notably the facility to store and analyse messages to the appropriate degree;
- the ability to monitor call control and circuit supervision activities, where applicable.

6 Functional requirements imposed by the test specification

The functional description that follows is intended to identify the functional requirements imposed by the test specification. It does not imply any physical partitioning of equipment in real systems. See also 2.2.1/Q.701.

6.1 MTP Level 1

The test specification assumes the availability of a suitable signalling data link with the parameters identified in the relevant Q. Recommendations, e.g. Q.702 (referring to Recommendation G.821).

In validation testing the signalling data link may be a pseudo-signalling data link, in which case it should preferably have similar/identical characteristics to the signalling data links likely to be encountered in service. Simulation of deterioration of the transmission link may not be necessary if the emulator includes the capability to simulate abnormal conditions on the signalling data link.

In compatibility testing, the signalling data link is a real signalling data link.

6.2 MTP Level 2

6.2.1 MTP Level 2 validation testing

The MTP Level 2 validation test environment consists of the following items (see Figure 1):

- the MTP Level 3 simulator;
- the test simulator;
- the signalling link monitor (see clause 7);
- the signalling data link.

6.2.2 MTP Level 2 compatibility testing

MTP Level 2 compatibility testing assumes both MTP Level 2 implementations have been validated.

The MTP Level 2 compatibility test environment consists of the following items (see Figure 2):

- MTP Level 3 simulators;
- MTP Level 2 implementations A and B;
- the signalling link monitor;
- the signalling data link.

6.2.3 MTP Level 3 simulator

During the MTP Level 2 tests, it is necessary to inject signalling messages and indications to and from the MTP Level 2 under test. It is desirable that the MTP Level 3 function used is the actual MTP Level 3 of the MTP with some additional functions for test purposes.

6.2.4 Test simulator

During MTP Level 2 testing it is necessary to inject some abnormal signal units (as well as normal signal units) to fully test the MTP Level 2 under test, the test simulator should have this function. In addition, the simulator should have the capability to receive and check signal units from the MTP Level 2 under test. The generation of certain abnormal sequences of signal units should also be a capability of the test simulator.

6.3 MTP Level 3

6.3.1 MTP Level 3 validation testing

The MTP Level 3 validation test specification assumes that the MTP Level 2 has already been tested satisfactorily. However, certain tests will in addition explicitly test the MTP Level 2/3 interface.

The MTP Level 3 tests environment consists of the following items (see Figure 3):

- the simulator of upper levels;
- simulated network including test simulator and signalling data links;
- the signalling link monitor(s) (see clause 7).

6.3.2 MTP Level 3 compatibility testing

The MTP Level 3 compatibility test specification assumes that the MTP Level 2 implementations have already been tested satisfactorily.

The MTP Level 3 compatibility tests assume both MTP Level 3 implementations have been validated.

The MTP Level 3 compatibility test environment consists of the following items (see Figure 4):

- simulators of upper levels;
- MTP Level 2 implementations A and B;
- MTP Level 3 implementations A and B;
- signalling data links;
- signalling link monitor(s).

6.3.3 Simulator of upper levels

During MTP Level 3 testing it is necessary to inject signalling messages into MTP Level 3 for testing, e.g. message loss during changeover. It is desirable that the simulator used should be as close as possible to the actual upper level to be used. In addition, an MML interface is assumed. The MTP Level 3 under test must use an already tested MTP Level 2.

6.3.4 Simulated network including test simulator

During MTP Level 3 testing it is necessary to inject some abnormal messages (as well as normal messages) to check the MTP Level 3 under test, the simulated network including test simulator should have this function. In addition, the test simulator should have the capabilities to receive and check messages from the MTP Level 3 under test. The generation of certain abnormal sequences of messages should also be a capability of the test simulator. The test simulator must include an already tested MTP Level 2.

6.4 TUP

The TUP test specification assumes a tested MTP for compatibility tests but no assumption is made about message transfer between the TUP under test and the TUP tester for validation tests.

6.4.1 TUP validation testing

The TUP validation test environment consists of three items (see Figure 5):

- the TUP tester;
- a stable signalling relation and telephone circuits;
- a monitor of TUP messages and telephone circuits.

6.4.2 TUP compatibility testing

The TUP compatibility test specification assumes that both TUP implementations have been validated.

The TUP compatibility test environment consists of three items (see Figure 6):

- TUP implementations A and B;
- a stable signalling relation and telephone circuits;
- a monitor/tester of TUP messages and telephone circuits.

6.4.3 TUP tester

The TUP tester is required to simulate TUP protocol operations and some exchange call control operations.

6.4.4 Monitor

The monitor is required to monitor and record TUP message sequences and to monitor the result of call control operations on the controlled telephone circuits. This includes checking that tones are correctly received and that speech/information transfer is possible.

6.5 ISDN User Part

The ISDN User Part test specifications assumes a tested MTP for compatibility tests but no assumption is made about message transfer between the ISDN User Part under test and the ISDN User Part tester for validation tests.

6.5.1 ISDN User Part validation testing

The ISDN User Part validation test environment consists of three items (see Figure 5):

- the ISDN User Part Tester;
- a stable signalling relation and user information transfer circuits;
- a monitor of ISDN User Part messages and user information transfer circuits.

6.5.2 ISDN User Part compatibility testing

The ISUP compatibility test specification assumes that both ISUP implementations have been validated.

The ISDN User Part compatibility test environment consists of three items (see Figure 6):

- ISUP implementations A and B;
- a stable signalling relation and user information transfer circuit;
- a monitor/tester of ISDN User Part messages and user information transfer circuits.

6.5.3 ISDN User Part Tester

The ISDN User Part Tester is required to simulate ISDN User Part protocol operations and some exchange call control operations.

6.5.4 Monitor

The monitor is required to monitor and record ISDN User Part message sequences and parameters and to monitor the result of call control operations on the controlled user information transfer circuits. For compatibility testing, the monitor may also observe relevant actions within the national networks. This includes checking that the tones, if necessary, are correctly received and user information transfer is possible.

6.5.5 User information transfer circuits

User information transfer circuits are required to check the connectivity of all types of bearer services. The following types of user information transfer circuits are established:

- user information transfer circuits which convey all types of bearer services using DCME functions; or
- user information transfer circuits which consist of some circuit groups according to the type of bearer service.

6.6 UNI-to-UNI

6.6.1 UNI-to-UNI compatibility testing

The UNI-to-UNI compatibility test specifications assume that each network has already been validated. ISC-to-ISC circuit supervision testing per Recommendation Q.784 is also assumed.

The UNI-to-UNI compatibility test environment consists of four items (see Figure 7):

- national Network A access tester;
- a monitor of ISDN User Part messages and user information transfer circuits;
- national Network B access tester;
- stable signalling relations and user information transfer circuits from UNI A-to-UNI B.

6.6.2 National network access tester

During UNI-to-UNI compatibility tests it is necessary to generate appropriate stimuli at the UNI (e.g. DSS 1 S/T interface) and monitor the resulting response. Simulators or actual terminal equipment may be used.

6.7 SCCP

The Signalling Connection Control Part Test Specifications are composed to validate routing/addressing and data transfer capabilities by monitoring and analysing SCCP messages and their contents.

The test environment assumes that SCCPs under test are using previously tested and compatible MTPs. The test environment consists of the following test configurations in Recommendation Q.786:

- the SCCP Tester;
- a stable signalling relation between SCCP termination points;
- a monitor of SCCP messages.

6.7.1 SCCP Tester

The SCCP Tester is required to simulate SCCP protocol operations and generate SCCP unit data messages. SCCP management and connection-oriented procedure simulation are for further study.

6.7.2 Monitor

The monitor is required to monitor and record SCCP message sequences, parameters for normal and abnormal system operations. This includes verifying appropriate return of messages if return options are requested, etc. for correct operation.

6.8 TC

The Transaction Capabilities Test Specifications are composed to validate transaction, component and dialogue handling mechanisms and data transfer capabilities by monitoring and analysing TC messages and their contents.

The test environment assumes that TCs under test are using previously tested and compatible SCCPs. The test environment consists of the following:

- the TC Tester;
- a stable signalling relation and SCCP data transfer capability between termination points;
- a monitor of TC messages.

6.8.1 TC Tester

The TC Tester is required to simulate a TC user in order to stimulate the generation of TC dialogues. This may be in the form of a TC testing ASE or other real applications which generate the required message sequences.

6.8.2 Monitor

The monitor is required to monitor and record TC messages and message sequences and to monitor the results of component and transaction dialogues. This includes verifying construction and sequences of invokes, return results and return errors at the component level as well as begins, continues and ends at the transaction level, etc.

7 Signalling link monitor(s)

The test specification assumes the availability of a signalling link monitor and a suitable access point for connection of the monitor as specified in clause 4/Q.702.

The test specification does not attempt to specify what a signalling link monitor should be, but instead, the functional requirements are identified in general terms. A signalling monitor will be used for decoding of signal unit sequences during testing and to give the operator confidence that the signalling protocol has been correctly observed.

The requirements imposed on a signalling link monitor will be different for the two types of testing. For validation testing detailed decoding down to a field level will be required, but for compatibility testing decoding down to a message MTP level may be adequate.

In addition, it should be noted that compatibility testing will be a function performed numerous times on a signalling point, whereas validation testing will be performed once only, except under certain circumstances of upgrading of the signalling point.

NOTE – It should be observed that implementations may include a signalling link monitor as an intrinsic part of the signalling point. However, for validation testing, this cannot necessarily be relied upon. In addition, the test specification does not attempt to perform the function of testing the accuracy of any signalling link monitor implemented in the signalling point. However, certain conclusions will inevitably be made from the performance of validation testing.

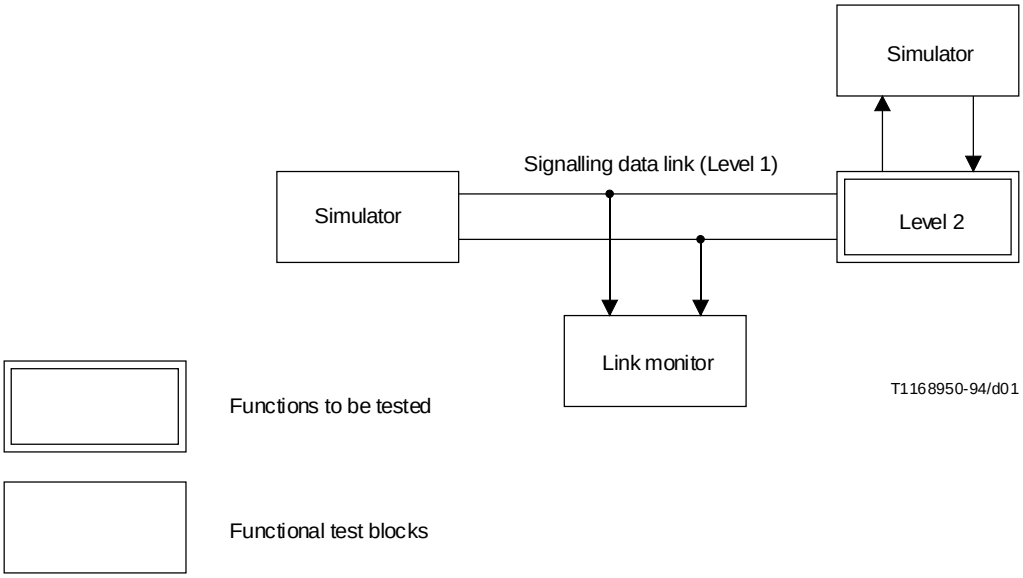

FIGURE 1/Q.780

MTP Level 2 validation test environment

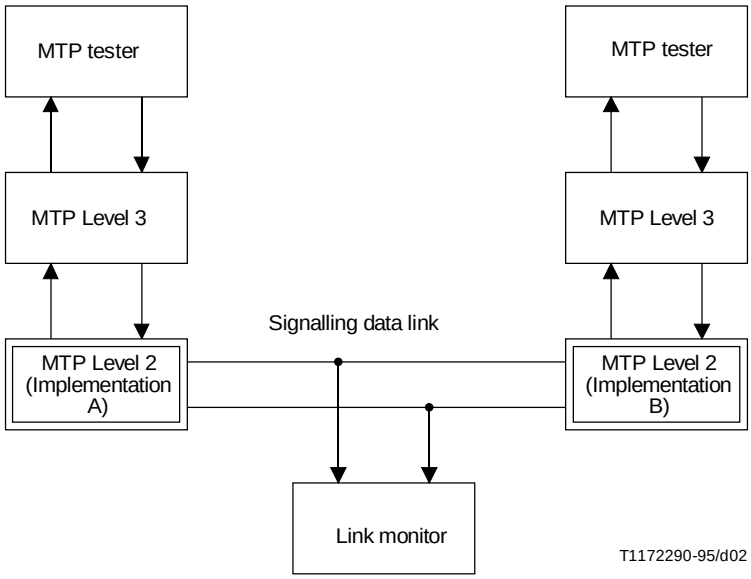

FIGURE 2/Q.780

Example of MTP Level 2 compatibility test environment

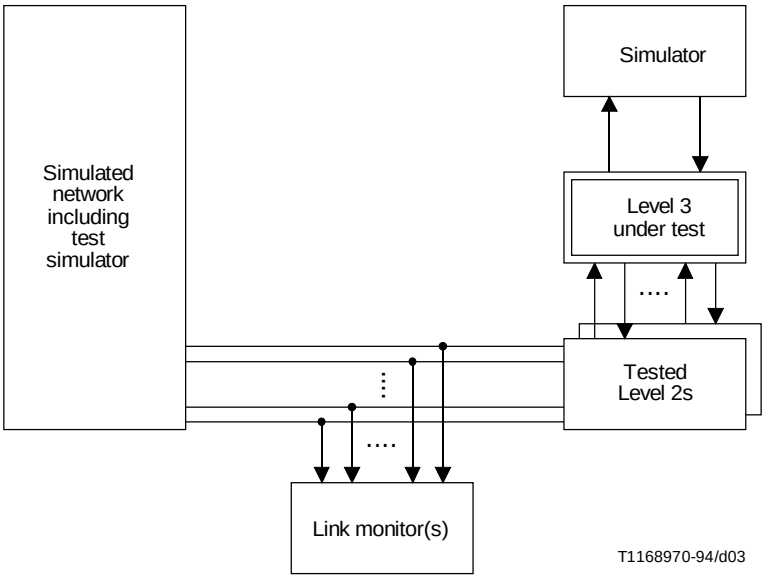

FIGURE 3/Q.780

MTP Level 3 validation test environment

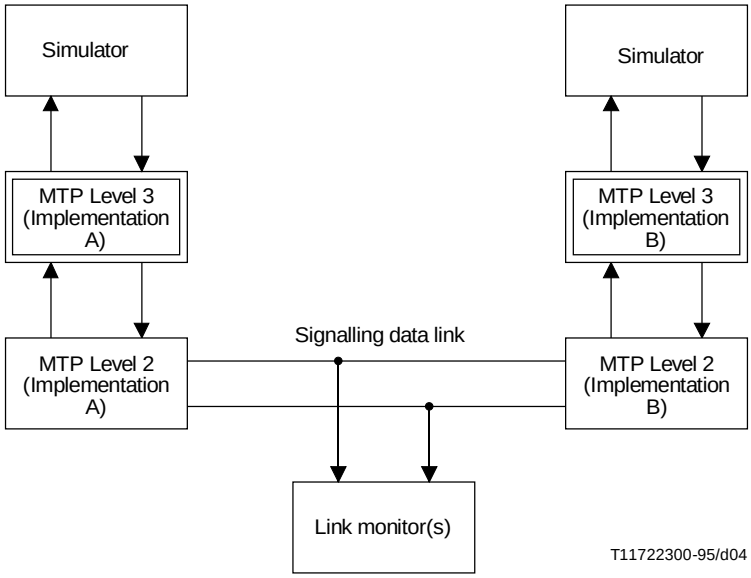

FIGURE 4/Q.780

MTP Level 3 compatibility test environment

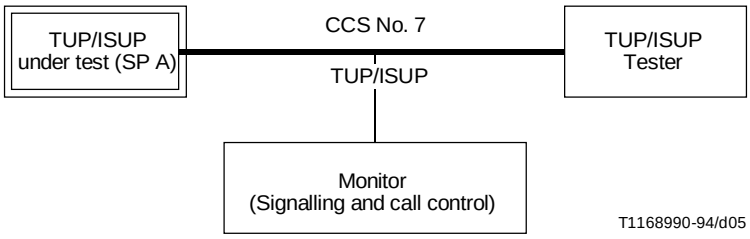

FIGURE 5/Q.780

TUP/ISUP validation test environment

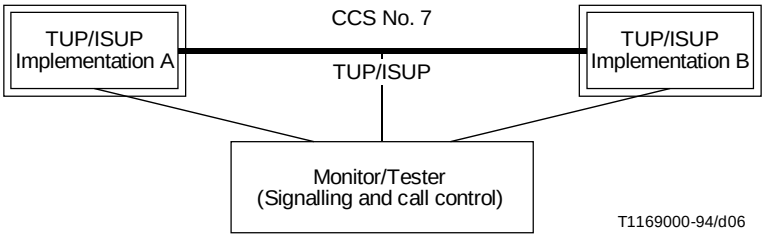

FIGURE 6/Q.780

TUP/ISUP compatibility test environment

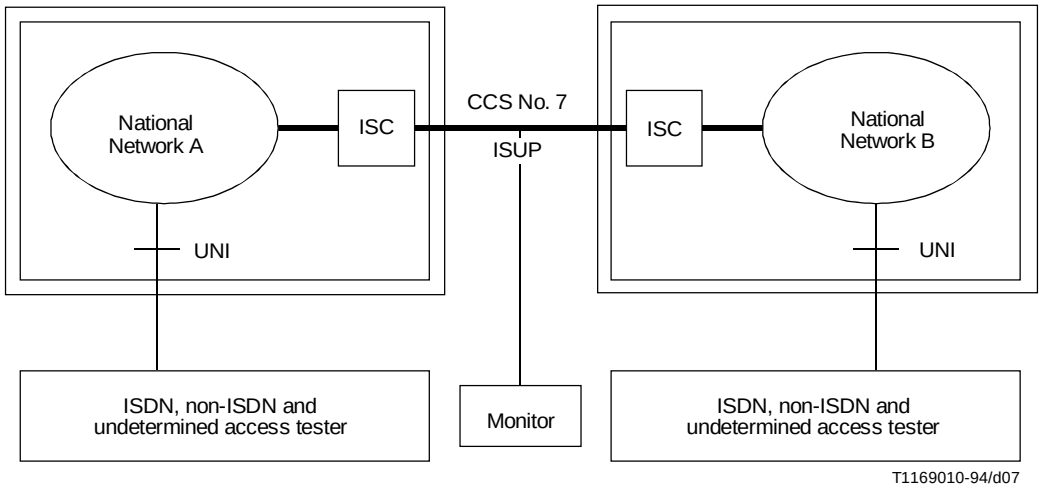

FIGURE 7/Q.780

UNI-to-UNI compatibility test environment