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SPECIFICATIONS OF SIGNALLING SYSTEMS No. 7

SIGNALLING SYSTEM No. 7 MANAGEMENT

SIGNALLING SYSTEM No. 7 PROTOCOL TESTS

ITU-T Recommendation Q.755

(Previously "CCITT Recommendation")

FOREWORD

The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of the International Telecommunication Union. 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, established the topics for study by the ITU-T Study Groups which, in their turn, produce Recommendations on these topics.

ITU-T Recommendation Q.755 was prepared by the ITU-T Study Group XI (1988-1993) and was approved by the WTSC (Helsinki, March 1-12, 1993).

NOTES

1 As a consequence of a reform process within the International Telecommunication Union (ITU), the CCITT ceased to exist as of 28 February 1993. In its place, the ITU Telecommunication Standardization Sector (ITU-T) was created as of 1 March 1993. Similarly, in this reform process, the CCIR and the IFRB have been replaced by the Radiocommunication Sector.

In order not to delay publication of this Recommendation, no change has been made in the text to references containing the acronyms "CCITT, CCIR or IFRB" or their associated entities such as Plenary Assembly, Secretariat, etc. Future editions of this Recommendation will contain the proper terminology related to the new ITU structure.

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

CONTENTS

Recommendation Q.755

SIGNALLING SYSTEMS No. 7 PROTOCOL TESTS

(Helsinki, 1993)

1 Introduction

The protocol testers may be used as an aid when testing the Message Transfer Part (MTP and the Signalling Connection Control Part (SCCP) of Signalling System No. 7 (SS No. 7), either when performing validation testing of an implementation or compatibility testing between two implementations. The tester's main function is simulation of an ordinary user part or sub-system, as seen from the MTP or SCCP respectively, for the generation of test traffic.

Recommendations I.320 and I.321 specify the ISDN protocol reference model to be used for N-ISDN and B-ISDN. User plane (U-plane), Control plane (C-plane) and Management plane (M-plane) are identified. The layering principles apply in each of these planes. The U-plane provides the user information flow transfer with associated controls. The C-plane handles the call and connection control information. The M-plane is divided into two portions, the Layer Management functions and the Plane Management functions. The Plane Management performs management functions related to a system as a whole, it provides coordination between all the planes and has no layered structure. The Layer Management plane contains Layer Management Entities (LME). Each of them provides management functions relating to resources and parameters residing in its own protocol entity. Layer Management handles the operation and maintenance information flows. The interface between adjacent layers within a plane and between LME and its associated layer have to be defined in terms of service primitives. The interface between the LMEs and Plane Management has not to be specified, it is implementation dependent.

Thus the MT is contained in the LME of the MTP-3 (MTP-3 LME) and the ST is within the LME of the SCCP (SCCP LME). The service primitives between MTP-3 LME and the MTP-3, and between SCCP LME and the SCCP is described, as well as the procedures, the messages and the MT and ST substructures. The undefined primitives between the Plane Management (MIB) and the MT and ST are only required to activate/deactivate the concerned testing functions (see Figure 1).

2 MTP tester (MT)

The MT is connected to the MTP as a user part, i.e. identified by a service indicator. It generates Message Signal Units (MSUs) containing a serial number (and possibly additional information) in the Signalling Information Field (SIF). On reception of these messages a check is performed to verify that the messages are delivered according to the defined performance criteria for the MTP.

2.1 Functions

2.1.1 Objectives and scope

The MT is:

- a possible tool for validation testing when traffic generation is needed whilst performing tests. However, other traffic generators may be used and not all test cases may be covered with the MT when performing validation tests;
- the preferred traffic generator for compatibility tests between different network operators. However, other traffic generators may be used for compatibility testing between different versions of the same system inside one national network;
- a useful possible tool when performing network performance verification tests for SS No. 7 networks which are in service. If international network performance verification should be needed, it would be the preferred traffic generator.

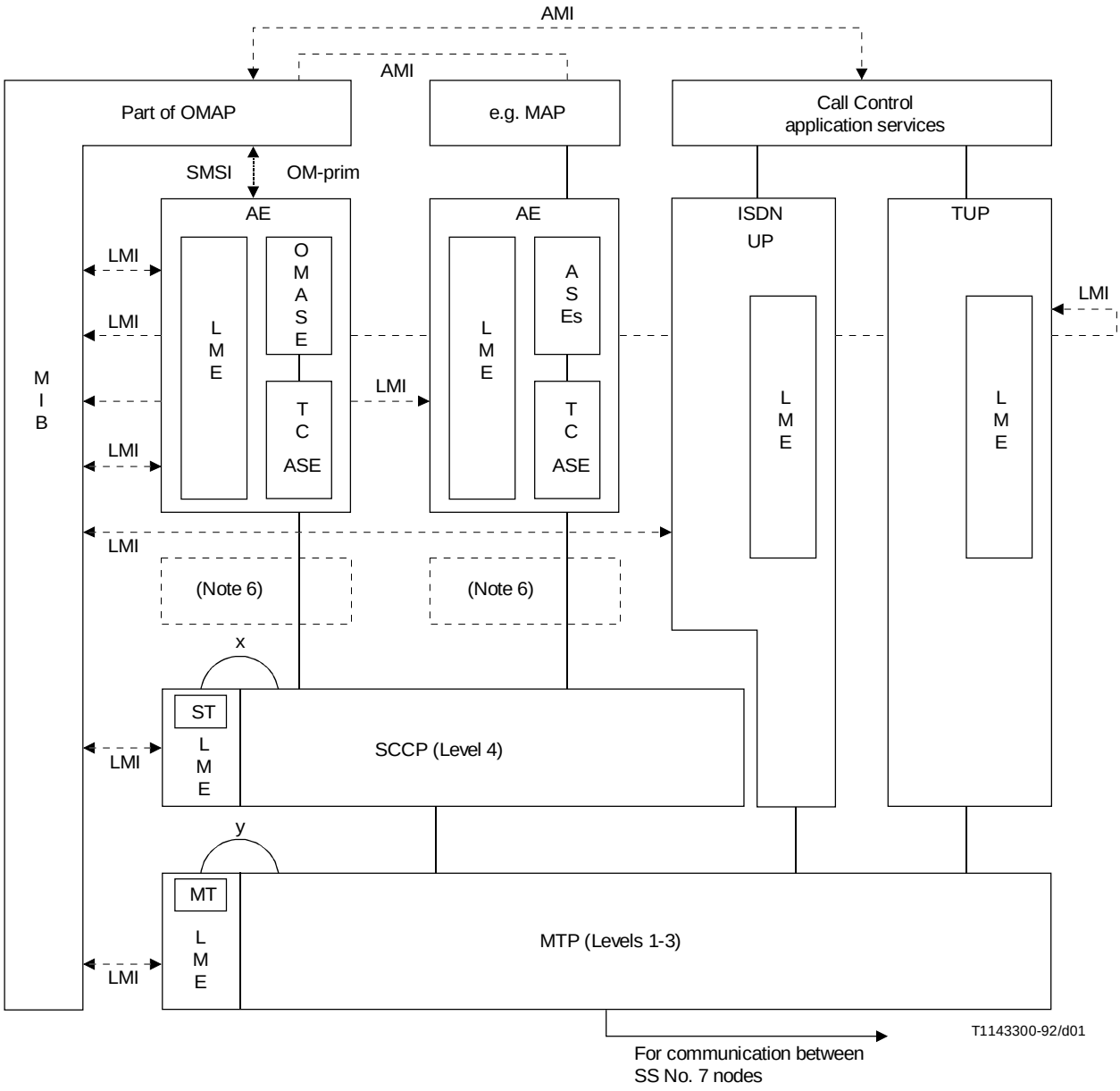
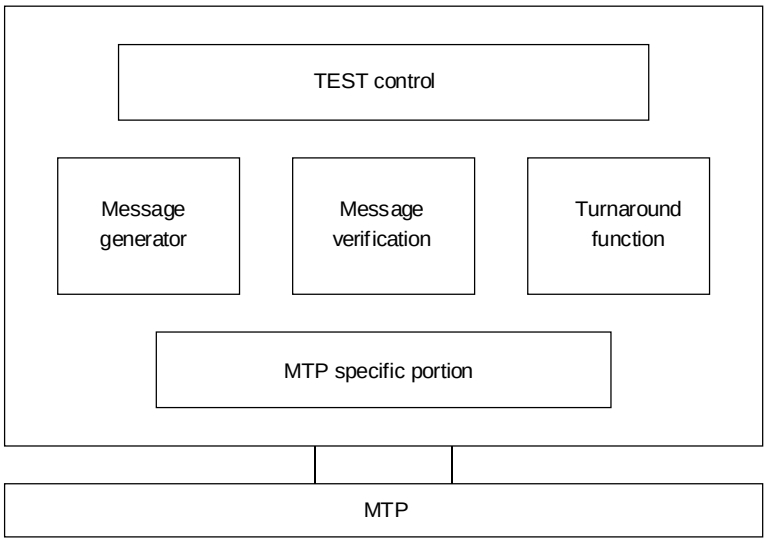


FIGURE 1/Q.755

SS No. 7 management and internal configuration of an SP



2.1.2 Main functions

The main function is the generation of bidirectional test traffic, giving the possibility at the receiving node of analysing the received test traffic (e.g. detection of missequencing, duplication or loss of messages, verification of transfer delays …). Errors may be introduced in the SS No. 7 network (by external means to the testers) during the transmission of test traffic.

2.1.3 Architectural model

The architectural model is as given in Figure 1.

All procedures are located in the Layer Management Entity (LME), all other functions are located within the Management Information Base (MIB) and the Management Process (MP).

2.1.4 Implementation

Only one implementation mode is to be described, and this will perform message generation, "turn around", verification and termination.

2.1.5 Traffic modes

There will be only one traffic mode, the "turn around" mode. However, the tester performing the "turn around" function will fulfil basic message verification such as sequence checking and message counting.

2.1.6 Functional blocks

Whilst keeping the single implementation mode, there are two functional roles which are identified during a test; the tester generating the traffic and the tester turning around the test messages. It is perfectly possible for a tester to be generating traffic towards one signalling point whilst performing the "turn around" role in another test to a different signalling point.

2.1.6.1 Generator

The Generator role uses the services of various blocks within the MT. The test control function will confirm that the remote end is ready and able to start a test, then control the duration and termination of the test. The message generation function will then generate the appropriate traffic messages at the rate requested in the test set-up. The generator will also control the message lengths. The message verification function receives the messages returning from the turn around end and checks them for corruption, loss, missequencing and duplication. The MTP specific portion deals with generating the MTP transfer primitives and handling the incoming MTP primitives. The OMAP interface handles test requests from TMN, test supervision and control and the presentation and interpretation of test results.

2.1.6.2 Turn around

The turn around role uses the test control function to control the acceptance and supervision of a test. Test traffic arriving from the generator is checked by the message verification block, before being returned to the generator via the turn around function. The MTP specific portion again deals with the sending and receiving of MTP primitives. The OMAP interface deals with test acceptance, test control and the presentation and interpretation of results.

2.1.7 Identification of test sequences

A particular test sequence is identified by the point codes and network indicators of the two testers involved. Thus it is only possible to have one test at a time running between two point codes. The GPC, the point code of the generating tester is included as an additional security feature.

2.1.8 Message rate considerations

To secure delivery in sequence via MTP all test traffic messages use the identical code within the SLS-field. Thus they will use only one link of every linkset passed. This should be considered when defining the actual message rate. Using the same SLS-code after turn-around may or may not define the same links in the backward direction as in the forward direction as the load-sharing key is implementation dependent.

2.2 Procedures

2.2.1 Test set-up

There are three possible phases during test set-up: test request, test acceptance and test refusal.

2.2.1.1 Test request

Once a test request has been received by the tester from OMAP a check will be made to ensure that no test already exists for the requested point code (turn around point code TPC). If a clash is detected an error is returned to OMAP with an appropriate reason, the test already in place will not be affected. If a valid request is received then the necessary counters are initialized, and a guard timer is started to control test set-up T1. A test request message is then sent to the TPC. The information provided by the OMAP will include an indication of the required response to the receipt of an MTP status with cause network congestion. The conditions applying to the setting of this indication are to be defined within Recommendation Q.751. The default action is to stop the test. It may be specifically requested by OMAP to report congestion indications, but continue the test. The indication is passed in the test request message and must be accepted by the turn around tester.

NOTE – This procedure should only be used with extreme caution.

2.2.1.2 Test acceptance

2.2.1.2.1 By the turn around tester

On reception of a test request message a check is performed to ensure that a test with the originating tester is not already in progress. If a test is found to be in progress then a test termination request message is sent, a report is made to OMAP and the original test is terminated.

If no test is found to be in progress then the turn around tester will request from OMAP to start a test from the respective point code. On receiving a negative response from OMAP (e.g. due to local conditions), a test refusal message is sent. A positive response will initiate the sending of a test acceptance message and the initialization of the necessary counters. OMAP also specifies criteria for test termination. See 2.2.2.1 apart from a).

2.2.1.2.2 By the generator

The reception of a test acceptance message by the generator will cause the termination of the set-up timer T1. The OMAP will be informed that a test is in progress, the generation of test traffic will begin.

2.2.1.3 Test refusal

If a test refusal message is received then the set-up timer T1 is terminated, any counters initialized will be cleared and a report is made to OMAP.

2.2.1.4 Timer T1 Expiry

If timer T1 expires then any counters initialized will be cleared and a report is made to OMAP. It is assumed that the test request was lost and any subsequent test acceptance or refusal messages will be dealt with as an unexpected message.

2.2.2 Test duration

2.2.2.1 At the generator

On receipt of a test acceptance message the test duration timer T2 is started, the messages are generated according to the rate information supplied by OMAP. As each message is sent, the Messages Sent count is incremented. The value of this count is given as the serial number field within the test traffic message. The need for a supervision timer for each message is implementation dependent. The generating tester may place further information (e.g. a time stamp) in the additional data field of the test traffic message, this is not looked at by the turn around tester, however the additional data field should contain sufficient filler octets (coded all zeros) to give an overall message length as requested during test set-up by OMAP.

When test traffic messages are received at the generator, the messages are checked by comparing the Generating Point Code field (GPC) with the tester's own point code. As messages are terminated at the MT the messages received counter is incremented, and the message serial number is checked as a means of sequence validation. Any further checking may be done using the information in the additional octets field.

2.2.2.2 At the turn around tester

Incoming messages are checked as in the generating tester. If the GPC is not the tester's own point code, and a current test to the relevant point code is in existence, then the messages are turned around. The messages received counter is incremented and the serial number checked for missequencing. The OPC and DPC of the MTP transfer indication are then swapped and the message formed into an MTP transfer request.

2.2.2.3 Response to missequencing

If on checking the message serial number an error in sequence is detected then a report is made to OMAP which includes the message serial number and any additional filler octets. However, to stop a message loss causing all remaining messages to be seen as missequenced the message counter must be reset to the serial number of the message detected as missequenced.

2.2.3 Termination

2.2.3.1 By the generator

The test ends by either:

a) expiry of T2 (where the value of T2 was specified during test set-up by OMAP); or

b) congestion indication if OMAP has not specifically instructed it to be ignored; or

c) specific request from OMAP.

The test termination procedure involves the sending of a test termination request message and the starting of a test termination timer T3.

On receipt of a test termination acknowledgment message the test results and reason for test end are sent to OMAP and the counters are cleared. If timer T3 expires then the local OMAP is informed.

If a test termination request message is received then a test termination acknowledgement message is sent, the test results and reason for end are sent to OMAP and the counters are cleared.

2.2.3.2 By the turn around tester

The procedure for terminating a test by the turn-around tester is the same as at the generator, except that T2 expiry is not possible. After sending a test termination request the turn-around tester continues its turn-around function until it either receives a test termination acknowledgement or T3 expires. If T3 expires, the local OMAP is informed.

2.2.3.3 Test termination acknowledgement

Upon receipt of a test termination request, the local test is stopped and a test termination acknowledgement is sent.

2.2.4 Reaction to MTP management primitives and MTP restart

2.2.4.1 MTP pause

If the affected point code is currently performing the generator function in one of the current tests then the test is paused, no more messages are generated and the timers and counts are held. If a local request to terminate the test whilst in this held state is received then a notification of the inability to terminate the test is returned to OMAP and the test termination procedure is started, however the test termination procedure will be held until the remote end becomes available (i.e. receipt of an MTP resume or an MT message from the unavailable tester).

If the MTP pause is received by a tester performing the turn-around function for the affected point code then no action is necessary, except where the local OMAP requests to terminate the test. In this case OMAP is again informed, the test termination procedure remains started but held until the remote end becomes available.

2.2.4.2 MTP resume

If a local test termination request has been received for the affected point code during the period the remote tester was unavailable, then an MTP resume will release the test termination procedure.

If there is a held test to the affected point code (i.e. the affected point code is the TPC) then the test will resume.

Otherwise the MTP resume is ignored.

2.2.4.3 MTP status

The MTP status primitive contains two parameters, the affected point code and a cause.

The cause may be:

- signalling network congestion (a national option allows a level to be included);
- remote user unavailable;
- remote user unequipped.

On receiving remote user unavailable or remote user unequipped for a point code currently in use by the tester, the MT will stop sending messages to the destination, and inform OMAP. The normal test termination procedure will not take place.

- Signalling network congestion indication.

If an MTP status is received with cause network congestion, for a point code currently involved in a test, then the congestion response indication provided by OMAP will determine the tester's response to this indication. The default action is to stop the test and report to OMAP. If the test request specified "report congestion indication but continue test", the tester will report congestion indication to OMAP, but continue the test.

2.2.4.4 MTP restart

If the tester detects a local MTP restart, then the test termination procedure is started for all current tests, but held until the restart is finished.

NOTE – Where the termination procedure is held the timer T3 is also held.

2.3 Formats and codes

2.3.1 SIO

The service information octet is made up of the service indicator and the sub-service field (see Figure 2).

DCBA	1000
Sub-service field	Service indicator

FIGURE 2/Q.755

The following codes are used in the field of the service information octet.

a) The service indicator is coded 1000.

b) Sub-service field:

bits BA Spare

bits DC

00 International network

01 Spare (for international use only)

10 National network

11 Reserved for national use

2.3.2 Label

The label has a length of 32 bits and is placed at the beginning of the signalling information field.

The label structure is shown in Figure 3

SLS	OPC	DPC
4	14	14

OPC Originating Point Code
DPC Destination Point Code
SLS Signalling Link Selection Field

FIGURE 3/Q.755

Label structure

2.3.3 Header codes

The first header code is the H0 header code; this is a four bit field that follows the label and identifies the message group. The H1 header code field occupies the next four bits and indicates the actual message within each group. The H0 field is coded as follows:

0000 Test control messages

0001 Test traffic messages

0010-1111 Spare

2.3.3.1 Test control

The H0 = 0000 group represents the test control messages. For this group the H1 codes are as follows:

0000	Test request message
0001	Test acceptance message
0010	Test refusal message
0011	Test termination request message
0100	Test termination acknowledge message
0101-1111	Spare

The test control messages are formatted as follows (see Figure 4).

BA		DCBA	0000	
Indicator	GPC	H1	H0	Label
2	14	4	4	32

GPC The point code of the tester initiating the test and generating the traffic

FIGURE 4/Q.755

Test control messages

The test request message additionally uses the indicator field; this is coded as follows:

BA	
00	Stop test on congestion indication
01	Report and then ignore congestion indications
10-11	Spare

2.3.3.2 Test traffic

The H0 = 0001 group represents the test traffic messages, for this group the H1 codes are as follows:

0000	Test traffic message
0001-1111	Spare

The test traffic messages are formatted as follows (see Figure 5).

		BA		0000	0001	
Filler Octets	Serial Number	Spare	GPC	H1	H0	Label
m * 8 0 ≤ m ≤ 261	32	2	14	4	4	32

GPC The point code of the tester initiating the test and generating the traffic
Serial number The serial number assigned to the message
Filler octets Additional octets of information i.e. a time stamp

FIGURE 5/Q.755

Test traffic messages

2.3.4 Timers

T1	3-5 sec	This timer controls the setting up of a test.
T2	10-500 000 sec (provisional)	This timer measures the duration of the test.
T3	5-10 sec	This timer governs the frequency at which test termination request messages are sent.

2.3.5 Interface requirements

The description of the interface between the MT and OMAP is outlined in Table 1.

There will be additional notifications from the tester to OMAP; these contain the appropriate information. Table 1 is only a guide as this interface is not for specification, (see Recommendation Q.751).

TABLE 1/Q.755

Test request	OMAP-MT	DPC, NI, SLS, message lengths, test duration. Message rate and congestion response
	MT-OMAP	OPC, NI, SLS, message lengths, test duration. Message rate and congestion response
Test acceptance	OMAP-MT	DPC, NI
	MT-OMAP	OPC, NI
Test refusal	OMAP-MT	DPC, NI
	MT-OMAP	OPC, NI
Test termination request	OMAP-MT	DPC, NI
Test termination acknowledge	MT-OMAP	OPC, NI, Test results and reason for end

3 SCCP tester (ST)

For further study.

4 References

CCITT Recommendation *ISDN protocol reference model*, Rec. I.320

CCITT Recommendation *B-ISDN protocol reference model and its application*, Rec. I.321