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SERIES Q: SWITCHING AND SIGNALLING

Specifications of Signalling System No. 7 – Signalling System No. 7 management

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MTP Protocol Tester

ITU-T Recommendation Q.755.1

(Previously CCITT Recommendation)

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For further details, please refer to ITU-T List of Recommendations.

ITU-T RECOMMENDATION Q.755.1

MTP PROTOCOL TESTER

Summary

This is a revised version of the MTP Protocol Tester, published in March 1993 as Recommendation Q.755.

The MTP Protocol Tester is used as an aid in testing between two implementations of the MTP of Signalling System No. 7. Its main use is as a tool for performing routing and bidirectionality tests for SS No. 7 in networks which are in service. In the international network, it would be the preferred message traffic generator. It is also a possible tool for validation testing when message traffic generation is needed whilst performing tests, and a possible message traffic generator for compatibility tests between different network operators. The tester is connected to the MTP as a user part, i.e. it is identified by a service indicator. It generates test traffic messages containing a serial number (and possibly additional information). On reception of these messages, the receiving tester checks that they have been delivered correctly (e.g. without loss, corruption, mis-sequencing or duplication).

There is only one message traffic stream in any test; this means that the tester is not suitable for all tests of Recommendation Q.782.

The tester would need extensions for message rate and length considerations for broadband MTP testing.

Source

ITU-T Recommendation Q.755.1 was prepared by ITU-T Study Group 11 (1997-2000) and was approved under the WTSC Resolution No. 1 procedure on the 15th of May 1998.

FOREWORD

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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.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

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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As of the date of approval of this Recommendation, the ITU had not received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementors are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database.

CONTENTS

Recommendation Q.755.1

MTP PROTOCOL TESTER

(Geneva, 1998)

1 Scope

This Recommendation defines the Message Transfer Part (MTP) Protocol Tester (MT), to be used as an aid when testing the MTP of ITU Signalling System No. 7.

The MTPs at nodes using the MT can be implemented according to any data of Recommendation Q.704[1] MTP Recommendations, as long as they provide the equivalent of the MTP primitives, and they support the MT Service Indicator (see [1]).

This Recommendation draws upon Recommendation Q.750 for architectural considerations of the relationship between the Tester and SS No. 7 management (OMAP) (see [5]).

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 Recommendations is regularly published.

[1] ITU-T Recommendation Q.704 (1996), *Signalling network functions and messages*.

[2] ITU-T Recommendation X.290 (1995), *OSI conformance testing methodology and framework for protocol Recommendations for ITU-T applications – General concepts*.

ISO/IEC 9646-1:1994, *Information technology – Open systems Interconnection – Conformance testing methodology and framework – Part 1: General concepts*.

[3] ITU-T Recommendation I.320 (1993), *ISDN protocol reference model*.

[4] CCITT Recommendation I.321 (1991), *B-ISDN protocol reference model and its application*.

[5] ITU-T Recommendation Q.750 (1997), *Overview of Signalling System No. 7 management*.

3 Symbols and abbreviations

This Recommendation uses the following abbreviations:

AE Application Entity

APDU Application Protocol Data Unit

ASE Application Service Element

ATS Abstract Test Suite

CF (MT) Control Function (of OMAP in the MIB)

DPC Destination Point Code

GPC Generator Point Code

[1] But not according to the High Speed Signalling Link Annex of Recommendation Q.703 (1996) nor to MTPs according to Recommendation Q.2210.

ISDN	Integrated Services Digital Network
ISUP	ISDN User Part
IUT	Implementation Under Test
LME	Level Management Entity
LT	Lower Tester
MAP	Mobile Application Part
MIB	Management Information Base
MSU	Message Signal Unit
MT	MTP Protocol Tester
MTP	(SS No. 7) Message Transfer Part
OMAP	Operations, Maintenance and Administration Part (SS No. 7 management)
OMASE	OMAP ASE
OPC	Originating Point Code
OSI	Open Systems Interconnection
PC	Point Code
PDU	Protocol Data Unit
SAP	Service Access Point
SAPi	SAP instance
SCCP	(SS No. 7) Signalling Connection Control Part
SLS	Signalling Link Selection (field)
SP	Signalling Point
SS No. 7	Signalling System No. 7
SUT	System Under Test
TC	Transaction Capabilities
TMP	Test Management Protocol
TPC	Turnaround Point Code
TT	TC Test Responder
TUP	Telephony User Part
UT	Upper Tester

4 Definitions

This Recommendation defines the following term:

4.1 MTP Service Access Point instance: The interface between an MTP user and the MTP, used to access a particular MTP network.

5 General

The MTP protocol tester may be used as an aid when testing the Message Transfer Part (MTP) of Signalling System No. 7 (SS No. 7) between two implementations. The tester's main function is simulation of an ordinary user part, as seen from the MTP, for the generation of test traffic messages.

Recommendations I.320 [3] and I.321 [4] specify the ISDN protocol reference model to be used. 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: Layer Management functions and Plane Management functions. 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 part of the M-plane contains Layer Management Entities. Each of these entities provides management functions relating to resources and parameters residing in its associated protocol layer. Layer Management handles the operation and maintenance information flows. The interfaces between adjacent layers within a plane and between the Layer Management Entity and its associated layer have to be defined in terms of service primitives. The interface between the Layer Management Entities and Plane Management does not need to be specified; it is implementation dependent.

For SS No. 7, the **Level Management Entity** is defined by analogy with the Layer Management Entity of Recommendations I.320 and I.321. This is to account for the different positions of the boundaries between SS No. 7 lower levels and those of OSI (e.g. the upper part of the MTP is level 3 in SS No. 7, the SCCP is level 4, but both would be within layer 3 if the OSI model strictly applied). For SS No. 7 management, the term LME is taken to mean "Level Management Entity".

Thus the MT is contained in the LME of the MTP (MTP LME).

In this Recommendation, the service primitives between the MTP LME and the MTP are described, as are the procedures, the messages and the MT substructure. It is necessary to define the information flow across the interface between Plane Management (MIB) and the MT [shown as the lowest Level Management Interface (LMI) in Figure 1], and so this is done in terms of signals which are required to control the concerned testing functions and to report results. See Figure 1 (which is a copy of Figure 5/Q.750) for the OMAP architectural model.

6 MTP Tester (MT)

The MT is connected to the MTP as a user part, i.e. it is identified by a service indicator. It generates test traffic messages (TEST TRAFFIC) containing a serial number (and possibly additional information) by using MTP-TRANSFER request primitives, and the MTP converts these into Message Signal Units (MSUs), with the TEST TRAFFIC in the Signalling Information Field (SIF). On reception of these messages, the MT checks that they have been delivered correctly (e.g. without loss, corruption, mis-sequencing or duplication).

6.1 Functions

6.1.1 Objectives and scope

The main use of the MT is:

– as a tool for performing routing and bidirectionality tests for SS No. 7 in networks which are in service. If such verification is required in the international network, the MT would be the preferred message traffic generator.

The MT is also:

– a possible tool for validation testing when message traffic generation is needed whilst performing tests. However, other traffic generators may be used if required when performing validation tests;

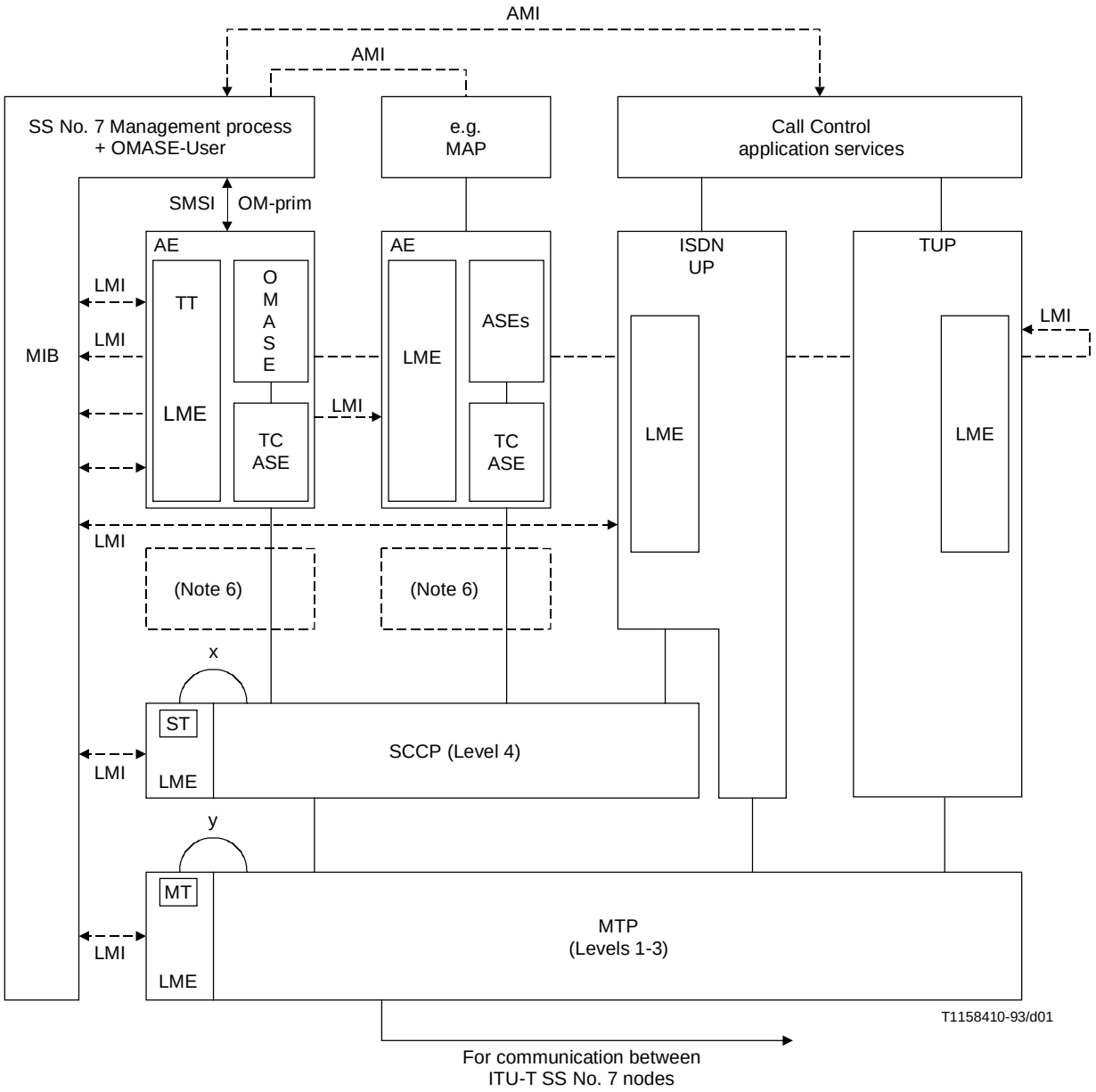
– the possible message traffic generator for compatibility tests between different network operators.

NOTE – Caution is necessary in the case of a request to generate message traffic that might cause an overload.

6.1.2 Main functions

The main function is the generation of bidirectional message test traffic, giving the possibility at the receiving node of analyzing the received test traffic (i.e. detection of mis-sequencing, duplication or loss of messages. Verification of transfer delays and detection of message corruption is only possible on the generating side.). Errors may be introduced in the SS No. 7 network (only by means external to the testers) during the transmission of test message traffic.

NOTE – Undefined or unexpected messages with SI = "MTP Tester" received during a test are discarded, optionally with a report. For the purposes of this Recommendation, an unexpected message is one that is not shown as input in a particular state in the SDL or the state transition matrix.



NOTE 1 – Dotted lines (but not boxes) denote direct management interfaces. Only the SMSI (see Note 5 below) is realized with primitives.

NOTE 2 – The LMI (Level Management Interface) is not a subject for standardization.

NOTE 3 – The AMI (Application Management Interface) is not a subject for standardization.

NOTE 4 – The items managed by OMAP can be regarded as conceptually resident in the MIB.

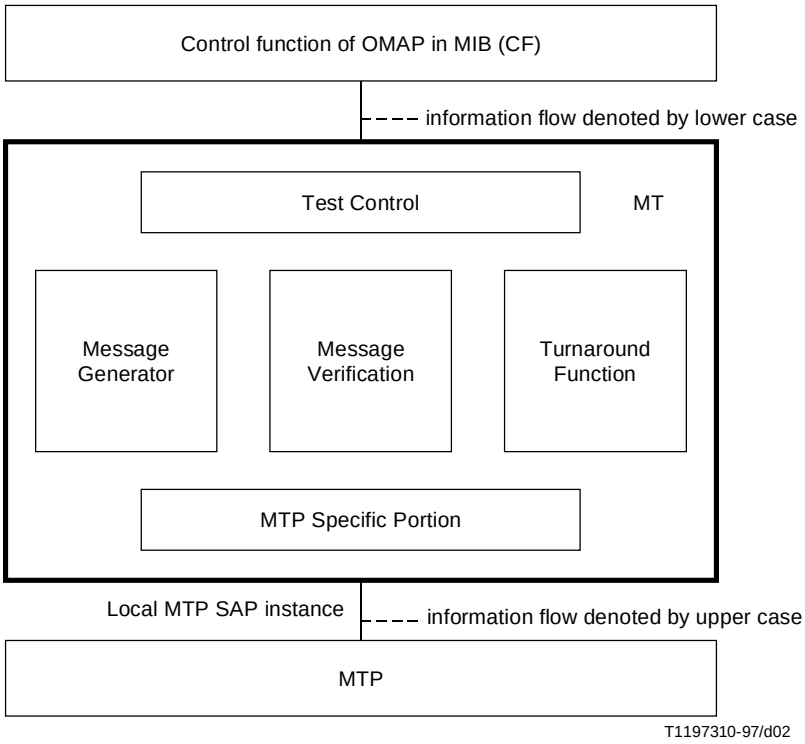
NOTE 5 – The SMSI is the systems management service interface; the OM primitives are defined for use over it for managed object functions defined in Recommendation Q.753.

NOTE 6 – OSI layers 4, 5 and 6 are null in SS No. 7. TC forms the bottom of OSI layer 7, SCCP the top of OSI layer 3 (but is in SS No. 7 level 4).

NOTE 7 – Interface x uses subsystem number to test the SCCP using the SCCP Tester (ST); interface y uses SIO to test the MTP using the MTP Tester (MT). The TC Test Responder (TT) has its own SSN; conceptually, it resides in the OMAP LME.

NOTE 8 – The LME (Level Management Entity) is defined for management of and within each level of SS No. 7. This is conceptually where each managed item resides as far as the level is concerned.

Figure 1/Q.755.1 – SS No. 7 management and internal configuration of an SP



NOTE 1 – This model is not intended to constrain implementation.

NOTE 2 – The Control Function of OMAP provides the management interface for the MT. It is used to define the test traffic message contents, to start and stop tests, to determine the action on congestion, and receive test results.

Figure 2/Q.755.1 – Architectural model of the MT

6.1.3 Architectural model

The OMAP architectural model is as given in Figure 1; the MT model is shown in Figure 2.

The MT functions are located in the MTP Level Management Entity (LME), control of the MT is located within the Management Information Base (MIB) (see Recommendation Q.750 [5] for the network management aspects).

6.1.4 Functional roles

There are two functional roles which are defined for the MTP Tester:

– the tester generating the test traffic messages; and

– the tester turning them around.

It is possible for a tester to be generating test traffic messages towards one signalling point whilst performing the turnaround role in another test to a different signalling point.

6.1.4.1 Generator role

When performing the generator role, a node uses the services of the various functional blocks within the MT (see Figure 2) in the following way. The Test Control function confirms that the remote end is ready and able to start a test, then controls the duration and termination of the test. The Message Generator function generates the appropriate TEST TRAFFIC messages at the rate requested in the test set-up procedure. It also controls the compatibility between message length and the message rate requested. The Message Verification function receives the TEST TRAFFIC messages returning from the turnaround node and checks them for loss, mis-sequencing and duplication. The generator role may also include a check for message corruption and other generator node dependent checks. The MTP Specific Portion generates the MTP transfer primitives and handles the incoming MTP primitives. The Control Function of OMAP in the MIB handles test requests from TMN, test supervision and control, and the presentation and interpretation of test results.

6.1.4.2 Turnaround role

When performing the turnaround role, a node uses the services of the various functional blocks within the MT (see Figure 2) in the following way. The Test Control function controls the acceptance and supervision of a test. TEST TRAFFIC messages arriving from the remote generator node are checked by the Message Verification function before being returned to the generator via the Turnaround Function. The MTP Specific Portion again deals with the sending and receiving of MTP primitives. The Control Function of OMAP in the MIB deals with the test acceptance, test control, and the presentation and interpretation of test results.

6.1.5 Identification of test sequences at a node

A particular test sequence is identified by the remote point code and local MTP Service Access Point (SAP) instance. Thus, it is only possible to have one test at a time running between two signalling points. The GPC, the point code corresponding to the MTP SAP instance of the generating tester, is included in the test messages as an additional security feature. Checks of the GPC are for further study.

6.1.6 Message rate considerations

To secure delivery in sequence via the MTP, all test traffic messages of the test sequence use the same code value for the SLS parameter. Thus, they will use only one link from each linkset utilized. This should be considered when defining the actual message rate. Although the same value for the SLS parameter is used by the Turnaround Function, it may or may not define the same link(s) or linkset(s) in the backward direction as in the forward direction, as the load-sharing key is implementation dependent.

6.2 Procedures

6.2.1 Test set-up

There are two phases during test setup:

– test request; and

– either test acceptance or test refusal.

6.2.1.1 Test request

Once a test request has been received by the tester from the OMAP Control Function, a check is made to ensure that no test already exists between the GPC and TPC in either direction. If a clash is detected, an error indication is returned to the Control Function with an appropriate reason, the test already in place is not affected. A local test request may also be refused due to local conditions (this is implementation dependent). If a valid request is received, then the necessary counters (*messages sent* counter and *messages received* counter) are initialized to zero, and a guard timer T1 is started to control the test setup. A TEST REQUEST message is then sent to the TPC. The information provided by the Control Function includes an indication of the required response to the receipt of an MTP-STATUS which has as its cause "network congestion". The required response may be to terminate the test. The Control Function might specifically request to report congestion indications, but continue the test. The indication is passed in the TEST REQUEST message.

NOTE 1 – The procedure to continue despite congestion should only be used with extreme caution.

NOTE 2 – In the event of a test request from the Control Function clashing with receipt of a TEST REQUEST message, the first request to be processed by the MT determines the action: if the test request from the Control Function is processed before the TEST REQUEST message, both requests are refused; if the TEST REQUEST message is processed first, the request from the Control Function is refused and the MT waits for the response to the TEST REQUEST message from the Control Function.

6.2.1.2 Test acceptance

6.2.1.2.1 By the turnaround 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 REFUSAL message is sent, the test termination procedure is activated for the test already running, and a report is made to the Control Function.

If no test is found to be in progress, then the turnaround tester requests the Control Function to start a test with the respective point code. If a negative response is received from the Control Function (e.g. due to local conditions), a TEST REFUSAL message is sent. A positive response causes the sending of a TEST ACCEPTANCE message, test duration timer T4 to be started and the *messages received* counter to be initialized to zero. The Control Function's response can additionally request to terminate the test on congestion, even though the TEST REQUEST message indicated to continue despite congestion.

6.2.1.2.2 By the generator

The reception of a TEST ACCEPTANCE message by the generator causes the termination of the set-up timer T1. The Control Function is informed that a test is in progress, the generation of test traffic begins and timer T2 is started. The action on congestion is to terminate the test if either the local OMAP Control Function so requested, or it was indicated in the TEST ACCEPTANCE message.

6.2.1.3 Test refusal

If a TEST REFUSAL message is received, then the set-up timer T1 is stopped, any resources initialized are released and a report is made to the Control Function.

6.2.1.4 Timer T1 expiry

If timer T1 expires, then any resources initialized are released and a report is made to the Control Function. It is assumed that the TEST REQUEST or TEST ACCEPTANCE or TEST REFUSAL were lost.

6.2.2 Procedures during the test

6.2.2.1 At the generator

On receipt of a TEST ACCEPTANCE message, the test duration timer T2 is started and TEST TRAFFIC messages are generated according to the rate information supplied by the Control Function. This is modelled by a timer Tt in the state transition matrix and in the SDL. Before each message is sent, the *messages sent* counter is incremented. The value of the count is given as the serial number field within the TEST TRAFFIC message. The generating tester may place further information (e.g. a time stamp) in the generator-dependent information of the TEST TRAFFIC message, which is padded to give the overall message length as requested during test set-up by the Control Function.

When TEST TRAFFIC messages are received at the generator, the messages can be checked by comparing the Generating Point Code (GPC) value 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 checked as a means of sequence validation (see also 6.2.2.2). Any further checking may be done using the generator-dependent information.

6.2.2.2 At the turnaround tester

A check is made to verify if a current test to the relevant Point Code is running for the incoming message's OPC and the local MTP SAP instance. The GPC can be examined. If these checks are successful, the message is turned around; otherwise, the message is discarded. The *messages received* counter is incremented and the serial number of the incoming message checked for mis-sequencing (e.g. against an expected sequence number variable, which is set to the last received sequence number + 1). The generator-dependent information is not modified.

The OPC and DPC of the MTP-TRANSFER indication primitive are then swapped, the SLS field and generator-dependent information are copied and the message formed into an MTP-TRANSFER request primitive (i.e. the corresponding TEST TRAFFIC message).

6.2.2.3 Response to mis-sequencing

If on checking the message serial number an error is detected, a report is made to the Control Function which includes the message serial number, the expected serial number, and its additional information (if any).

6.2.3 Test termination

The test termination procedure is activated at the generator or turnaround node by either:

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

b) a congestion indication, if the Control Function or the TEST REQUEST message or TEST ACCEPTANCE message have instructed it not to be ignored (see clause 6.2.1.2.2, last sentence); or

c) a specific request from the Control Function; or

d) the expiry of T4 (where the value of T4 was derived from T2 in the TEST REQUEST message).

The test termination procedure involves the sending of a TEST TERMINATION REQUEST message and the starting of a test termination timer T3.

If a TEST TERMINATION REQUEST message is received, then a TEST TERMINATION ACKNOWLEDGEMENT message is sent and the test results and reason for its ending are sent to the Control Function.

6.2.3.1 By the generator

On receipt of a TEST TERMINATION ACKNOWLEDGEMENT message, the test results and reason for the test ending are sent to the Control Function and the counters are cleared. If timer T3 expires, then the Control Function is informed and local resources are released.

6.2.3.2 By the turnaround tester

After sending a TEST TERMINATION REQUEST, the turnaround tester continues in its turnaround role until either it receives a TEST TERMINATION ACKNOWLEDGEMENT or T3 expires. If T3 expires, the local Control Function is informed and local resources are released.

6.2.3.3 TEST TERMINATION ACKNOWLEDGEMENT

Upon receipt of a TEST TERMINATION REQUEST, the local test is stopped and a TEST TERMINATION ACKNOWLEDGEMENT is sent.

6.2.4 Reaction to MTP management primitives and MTP restart

When the MTP restart procedure is terminated, the MTP indicates the end of MTP restart to all local MTP users showing each signalling point's accessibility or inaccessibility. The means of doing this is implementation dependent (see clause 9/Q.704 [1]). The end of MTP restart where the remote signalling point to which a test is running is accessible is modelled in this Recommendation by MTP-RESUME.indications at the appropriate MTP SAP instance.

6.2.4.1 MTP-PAUSE caused by unavailability of a destination

- At the generator side:

  If the generator receives an MTP-PAUSE and the affected point code denotes the turnaround tester in one of the current tests, then the test is paused, no more messages are generated and the Control Function is informed.

  The timers continue running and might expire. The counters are held.

  If a local request to terminate the test is received, or if T2 expires whilst in this held state, the generator releases local resources and stops the local test.

  If T1 is running when the MTP-PAUSE is received, T1 is stopped, local resources are released and the test is stopped.

  If T3 is running when the MTP-PAUSE is received, T3 is stopped, local resources are released and the test is stopped.

- At the turnaround side:

  If an MTP-PAUSE is received by a tester performing in the turnaround role for the affected point code (GPC), the local Control Function is informed, but no further action is necessary. If the local Control Function subsequently requests to terminate the test, the tester stops T4, releases local resources and stops the test.

6.2.4.2 MTP-RESUME

If there is a held test to the affected point code, then the test resumes. Otherwise, the MTP-RESUME is ignored.

6.2.4.3 MTP-STATUS

The MTP-STATUS primitive contains two parameters: the affected point code and a cause.

The cause may be one of:

– signalling network congestion (a national option allows a level to be included);

– remote user inaccessible;

– remote user unequipped;

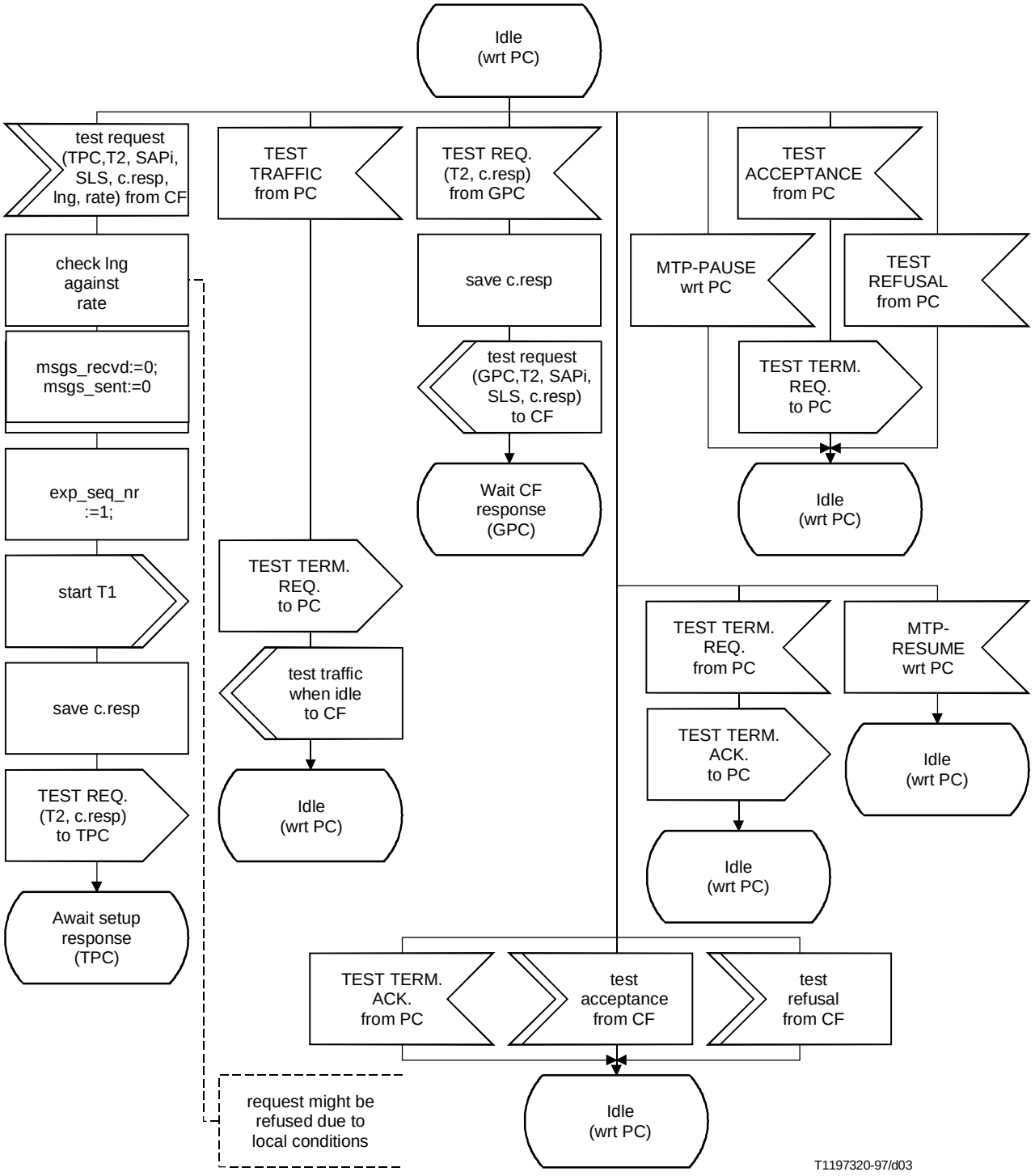
– remote user unknown.

On receiving remote user inaccessible, remote user unequipped or remote user unknown for a point code with which the tester is acting in a turnaround or generator role, the MT stops the test to the destination and informs the Control Function. The normal test termination procedure does not take place.

If an MTP-STATUS is received with cause network congestion, for a point code with which the tester is acting in a turnaround or generator role, then the action on congestion negotiated as in 6.2.1.2.1 and 6.2.1.2.2 determines the tester's action.

6.3 SDL Procedure

This SDL defines the MT procedure of Figure 2.



SAPi	MTP SAP instance
c.resp	reaction to congestion during test
exp_seq_nr	expected sequence number
wrt	with respect to

State(TPC) º State(GPC) º State(PC), "PC" should be replaced by the value

Figure 3/Q.755.1 (sheet 1 of 13) – Generator role

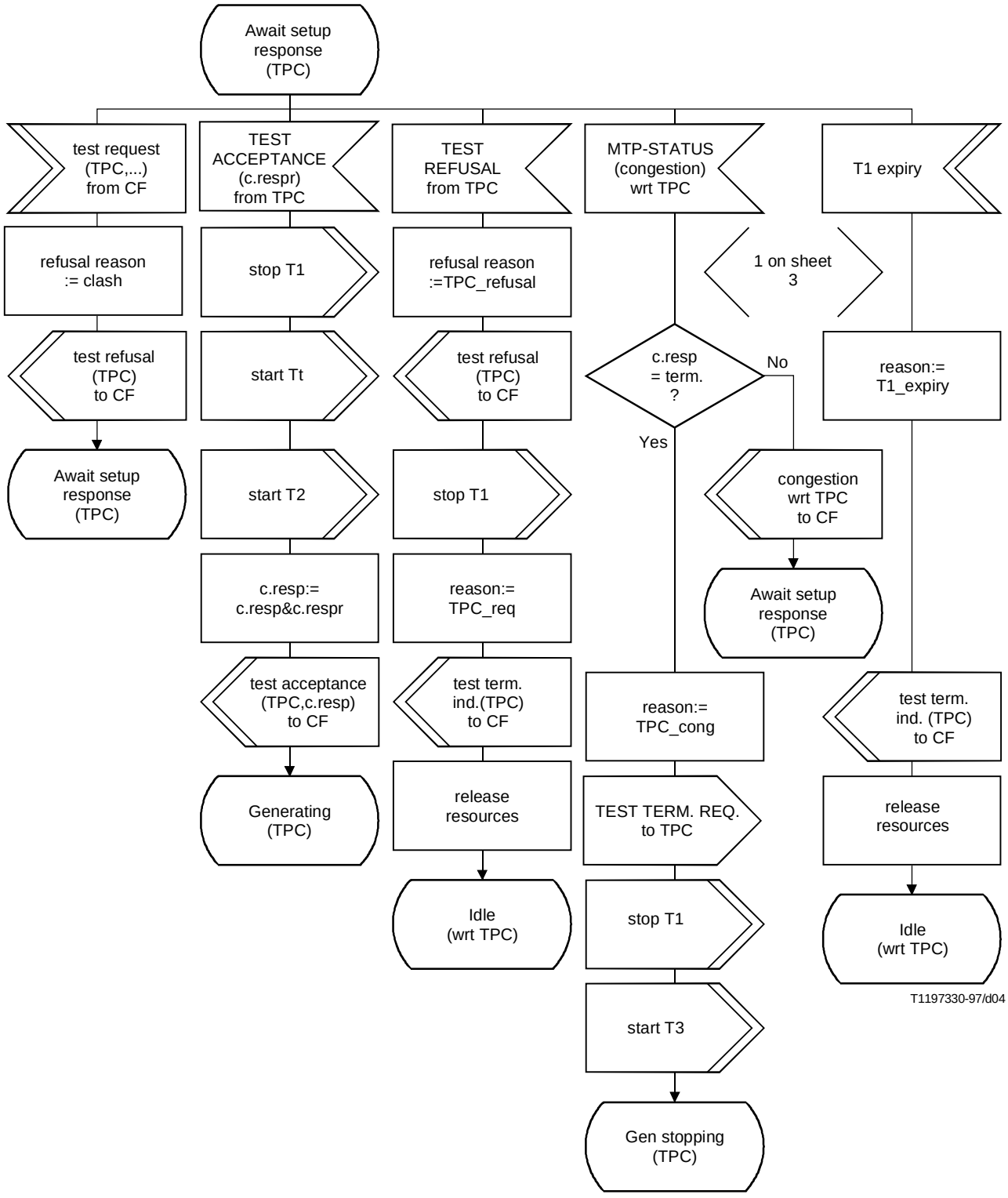


Figure 3/Q.755.1 (sheet 2 of 13) – Generator role

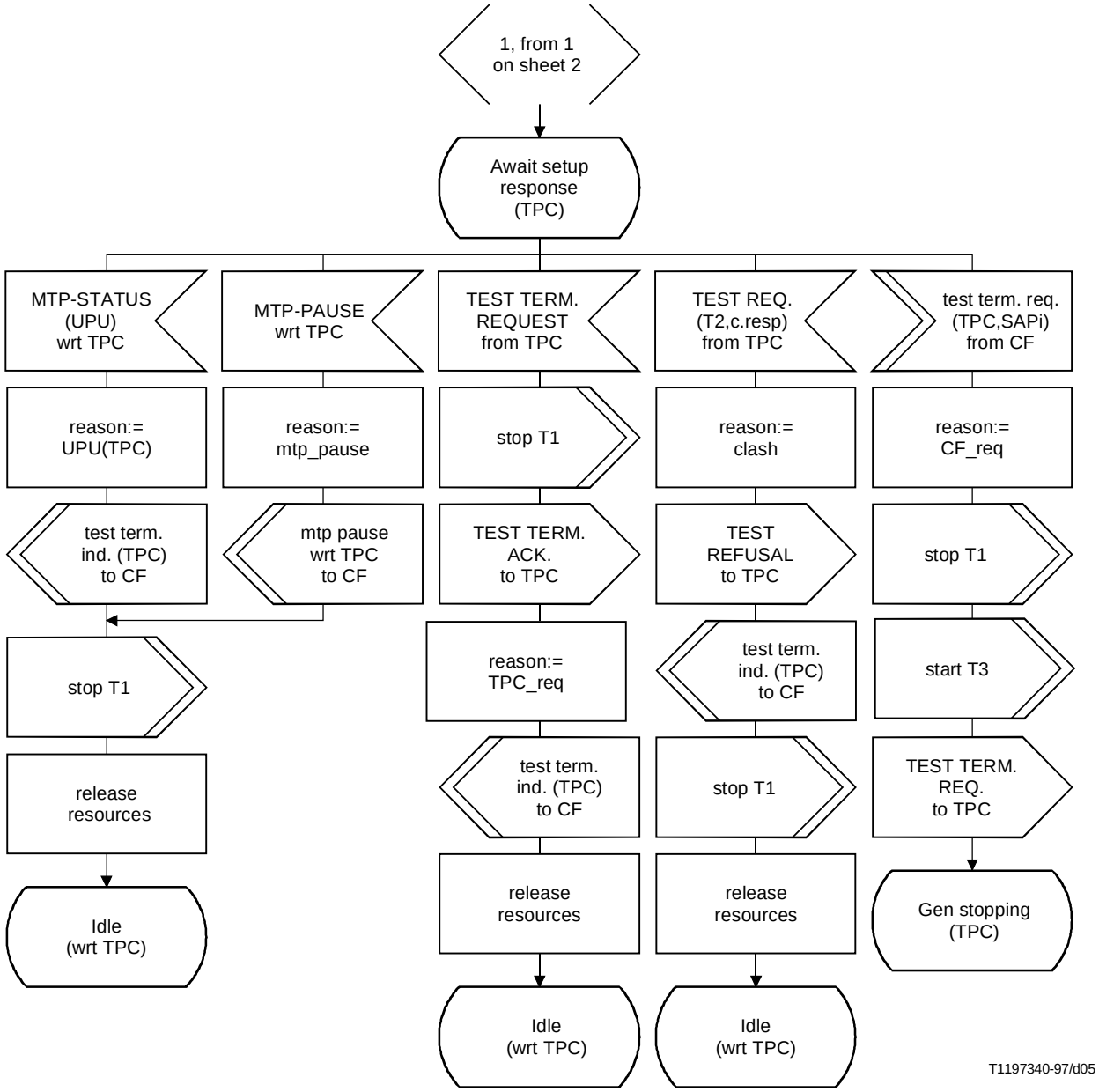


Figure 3/Q.755.1 (sheet 3 of 13) – Generator role

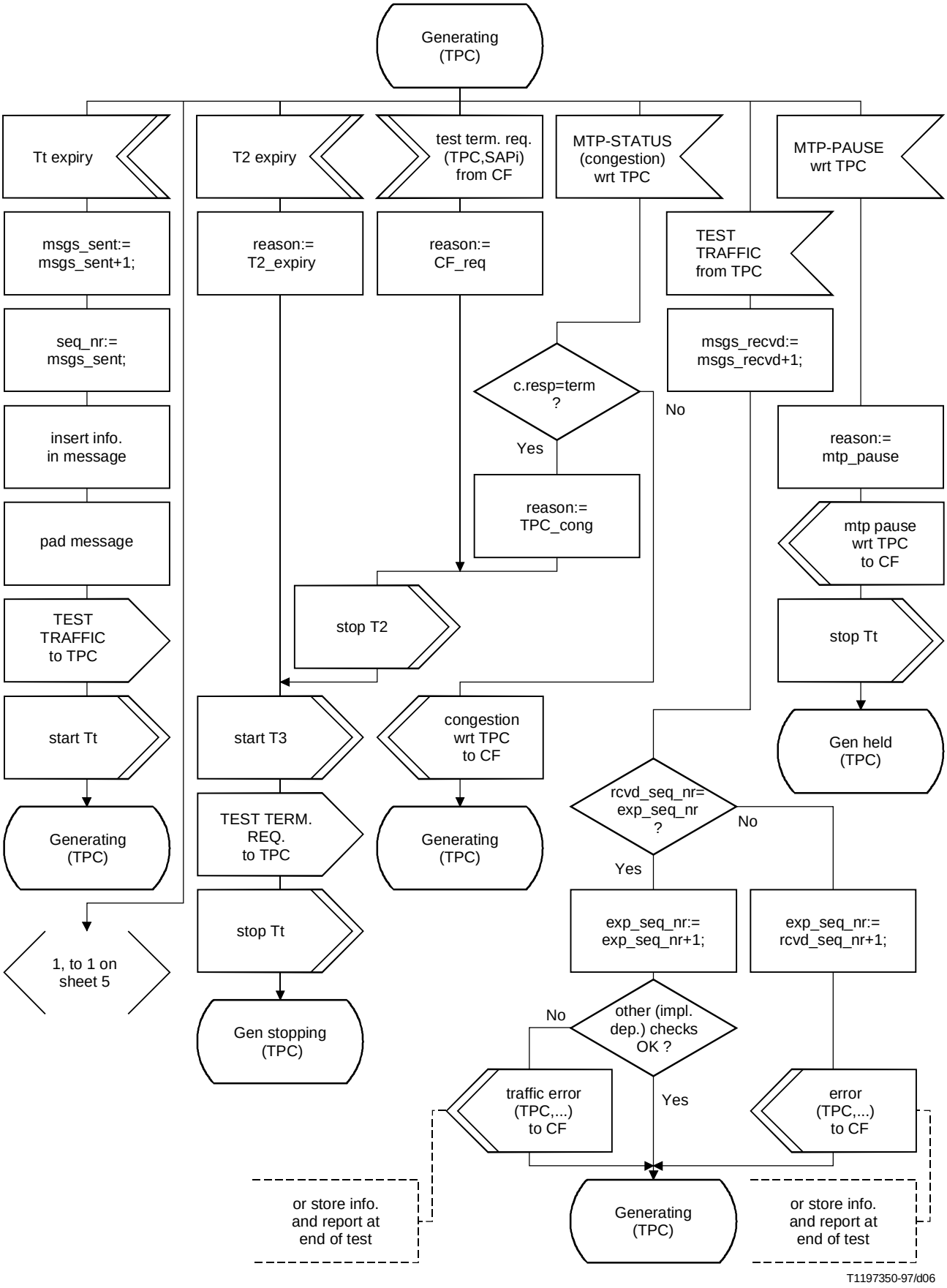


Figure 3/Q.755.1 (sheet 4 of 13) – Generator role

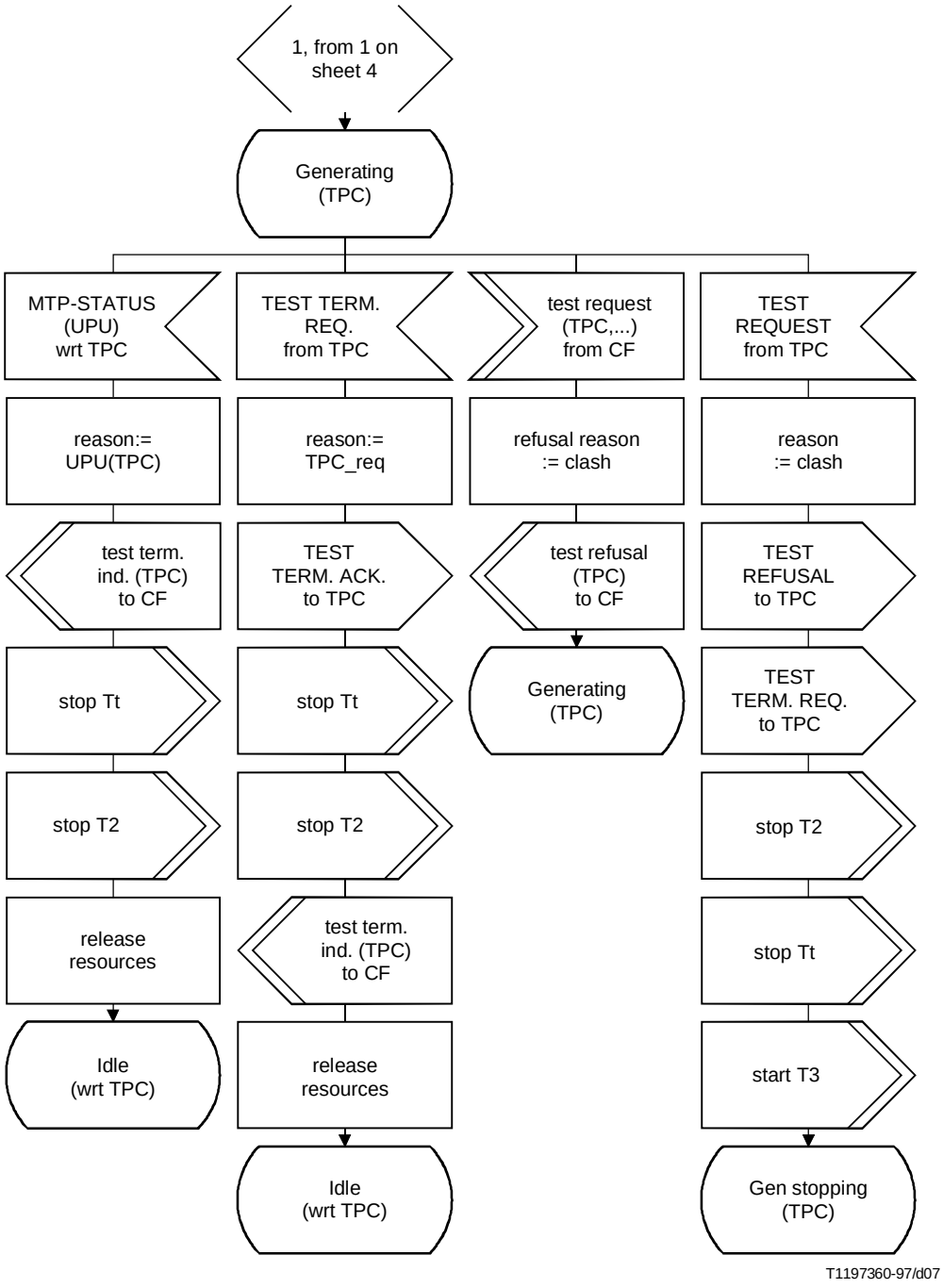


Figure 3/Q.755.1 (sheet 5 of 13) – Generator role

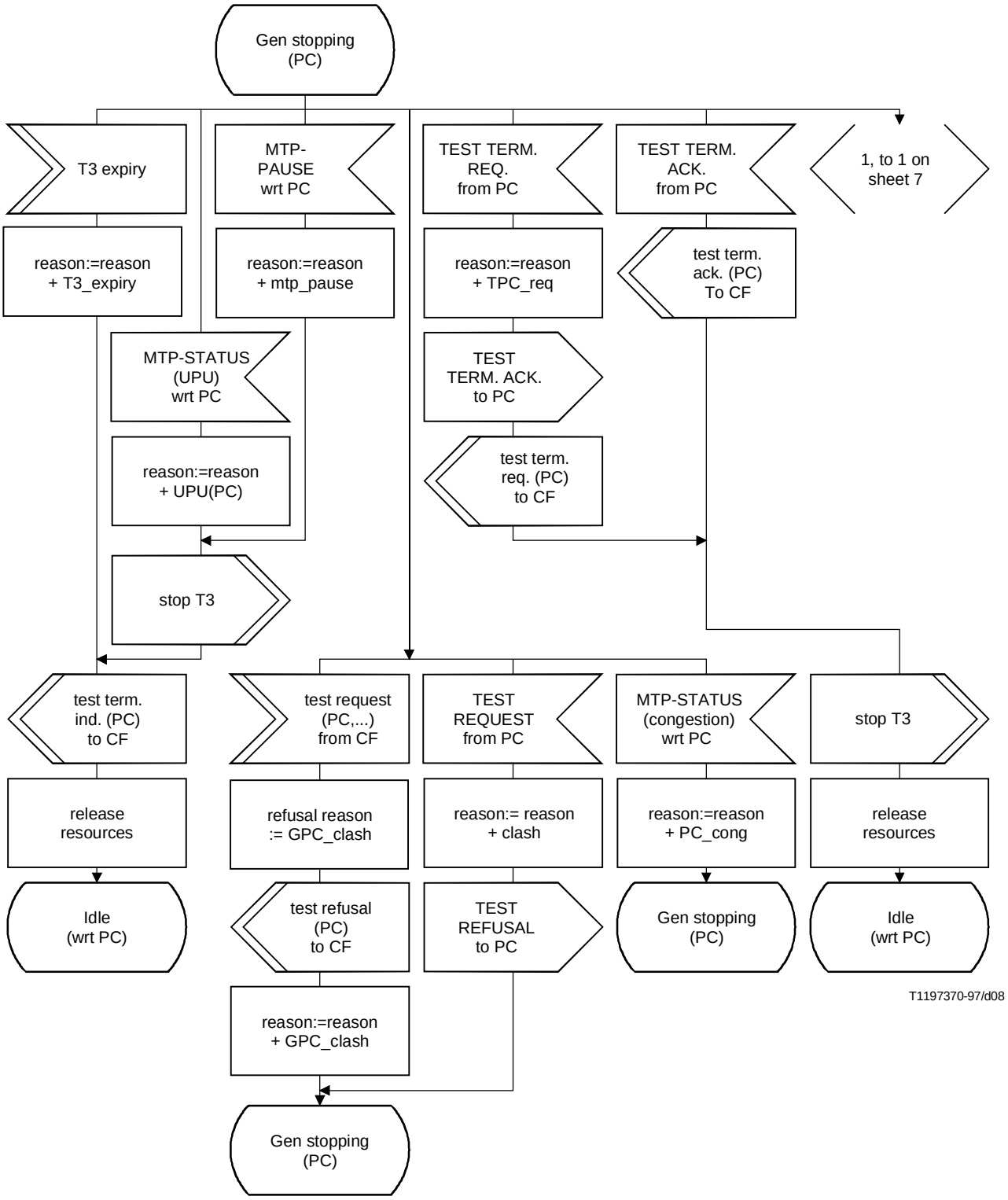


Figure 3/Q.755.1 (sheet 6 of 13) – Generator role

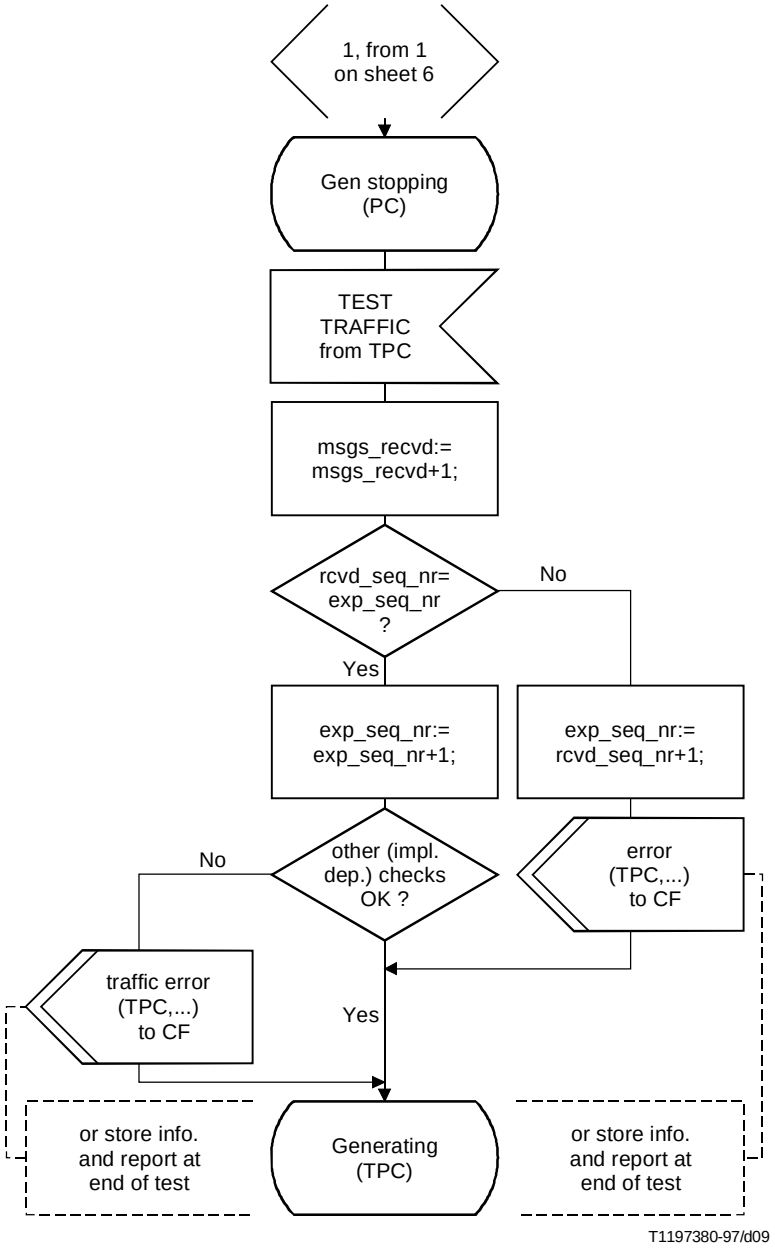


Figure 3/Q.755.1 (sheet 7 of 13) – Generator role

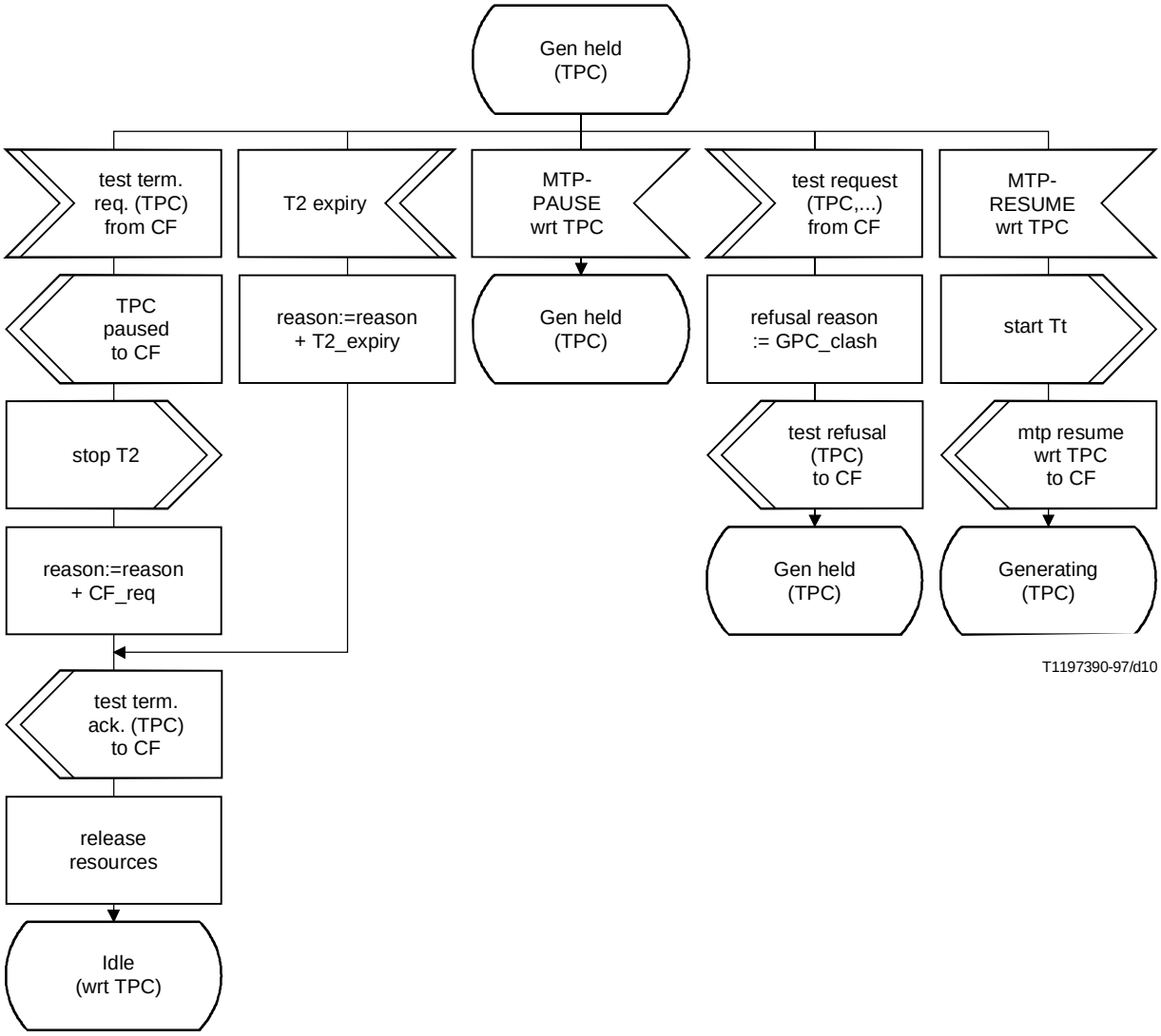


Figure 3/Q.755.1 (sheet 8 of 13) – Generator role

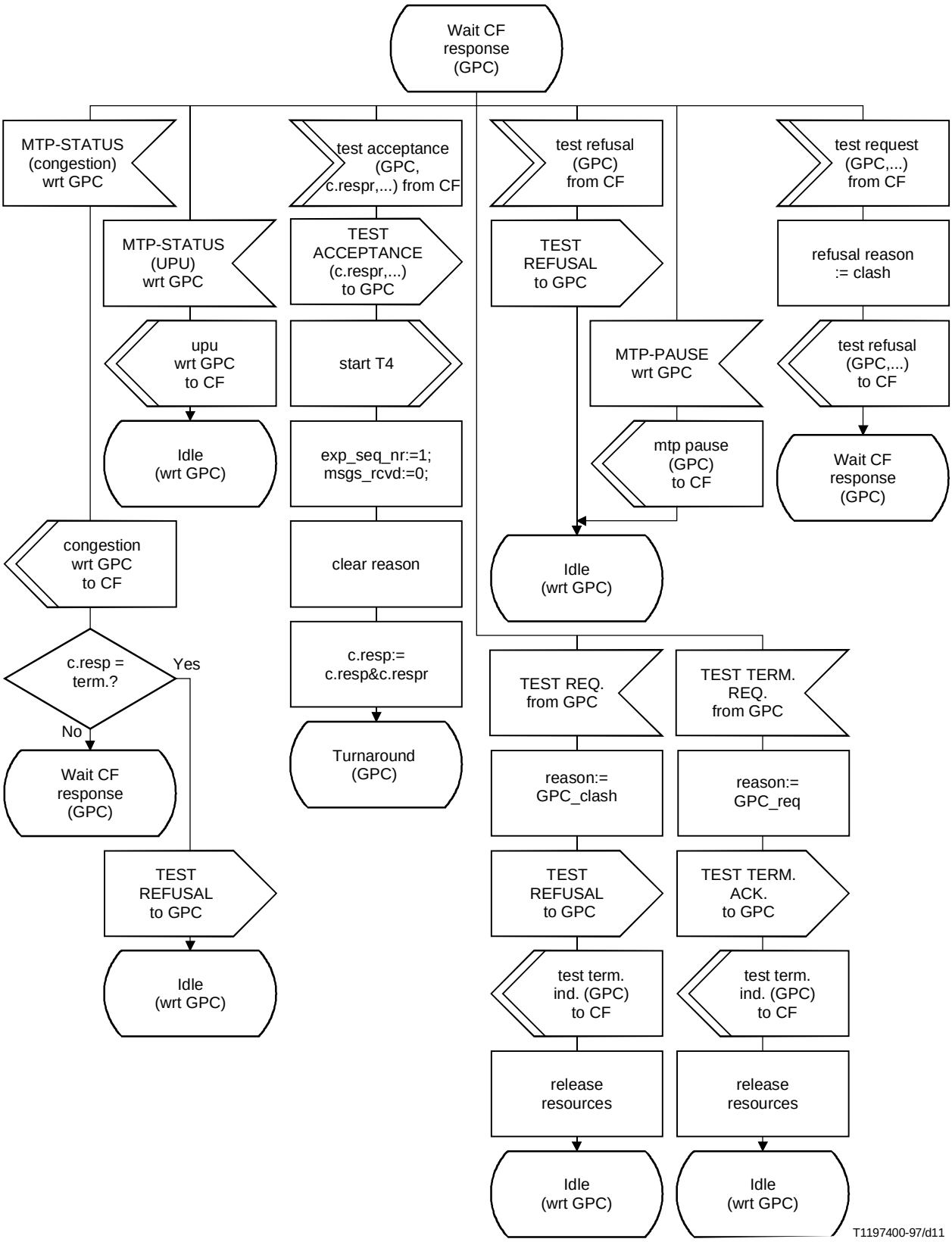


Figure 3/Q.755.1 (sheet 9 of 13) – Turnaround role

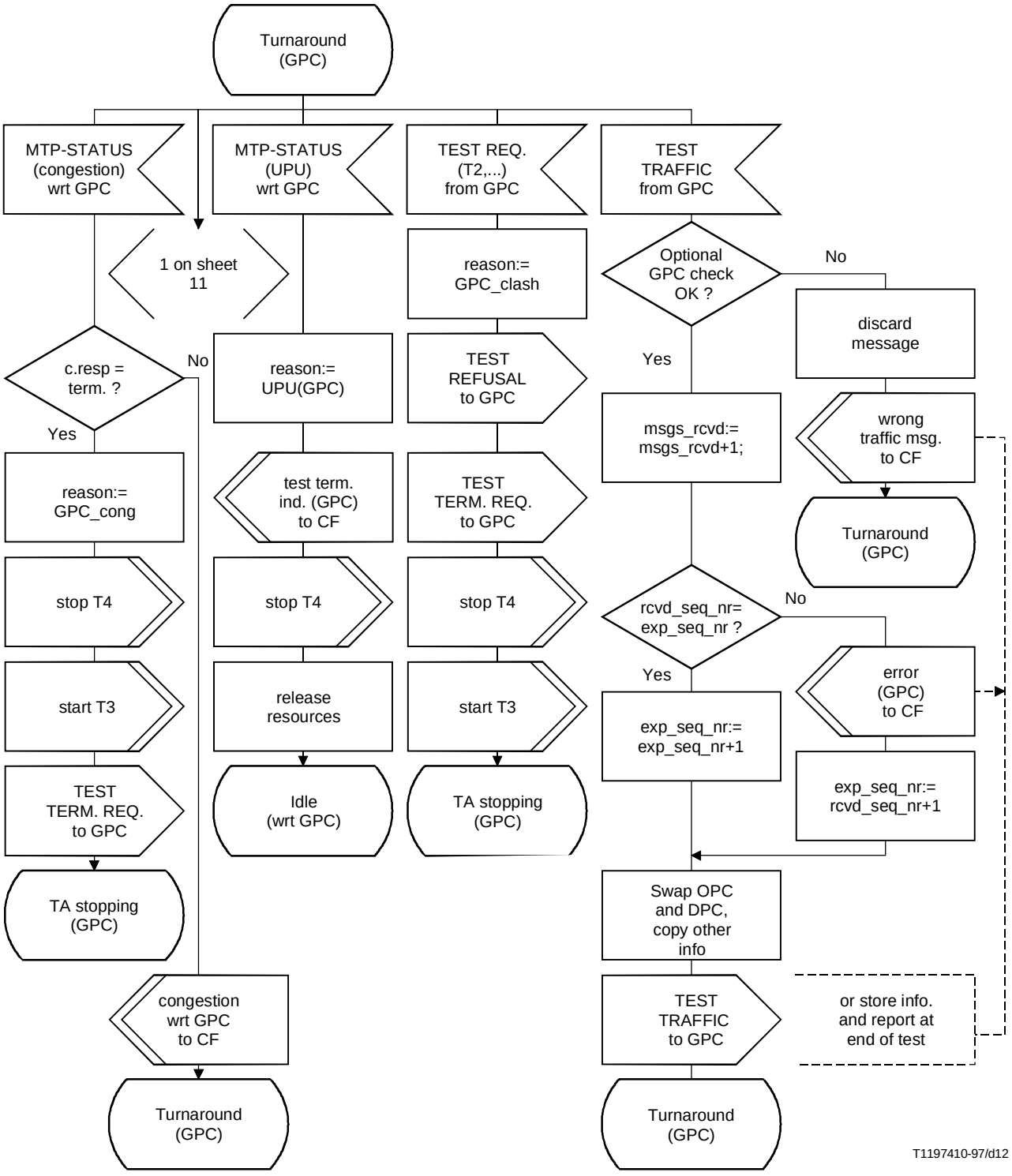


Figure 3/Q.755.1 (sheet 10 of 13) – Turnaround role

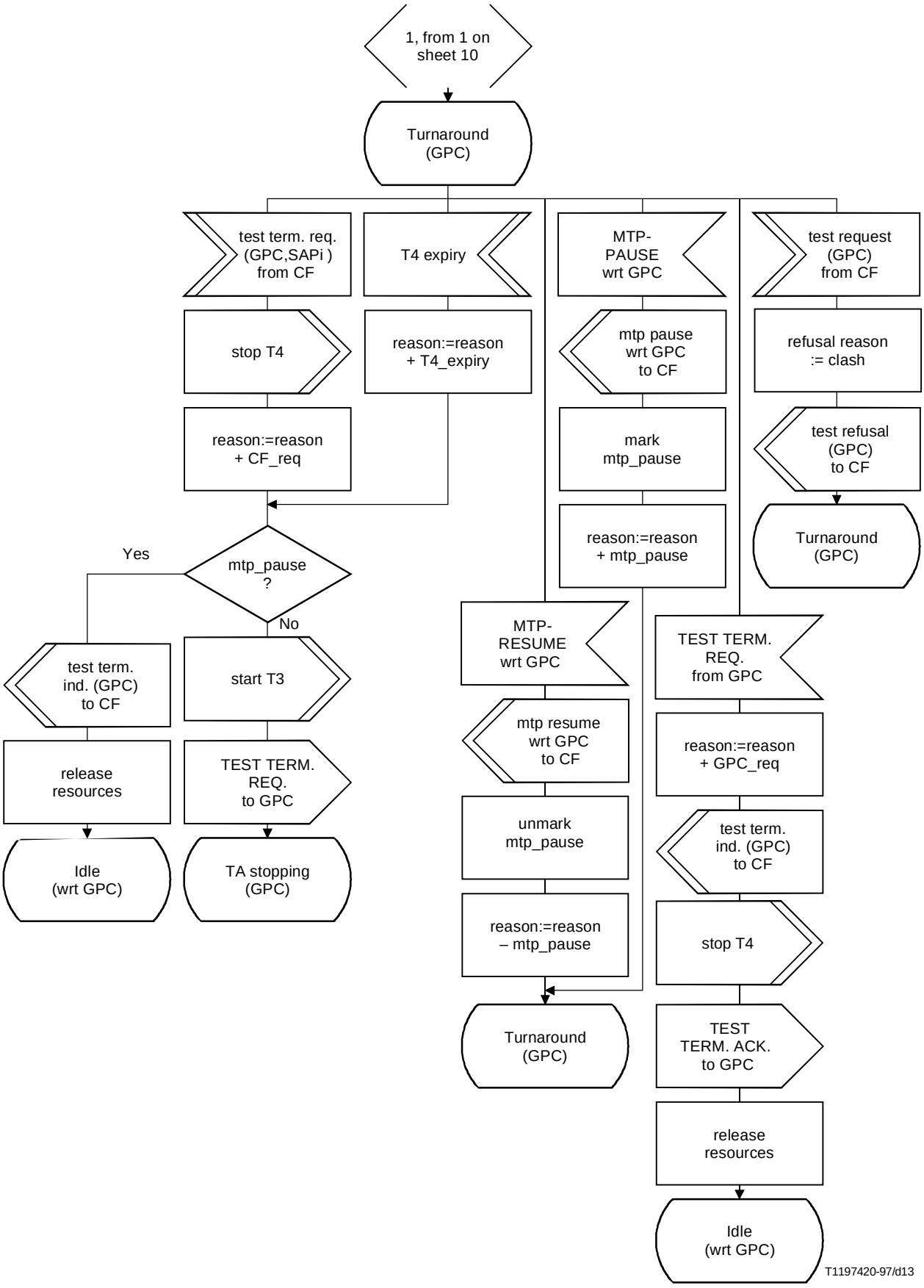


Figure 3/Q.755.1 (sheet 11 of 13) – Turnaround role

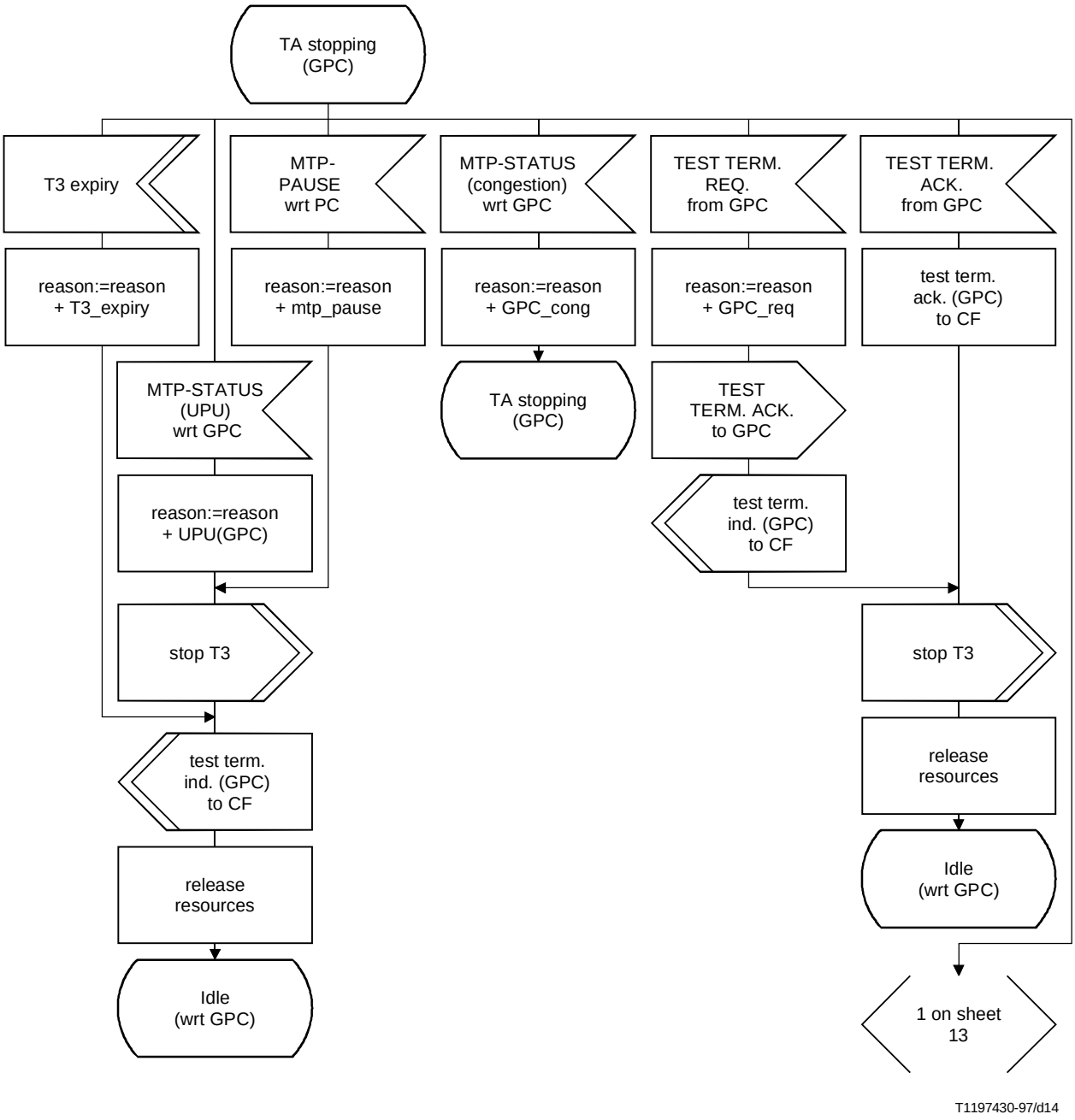


Figure 3/Q.755.1 (sheet 12 of 13) – Turnaround role

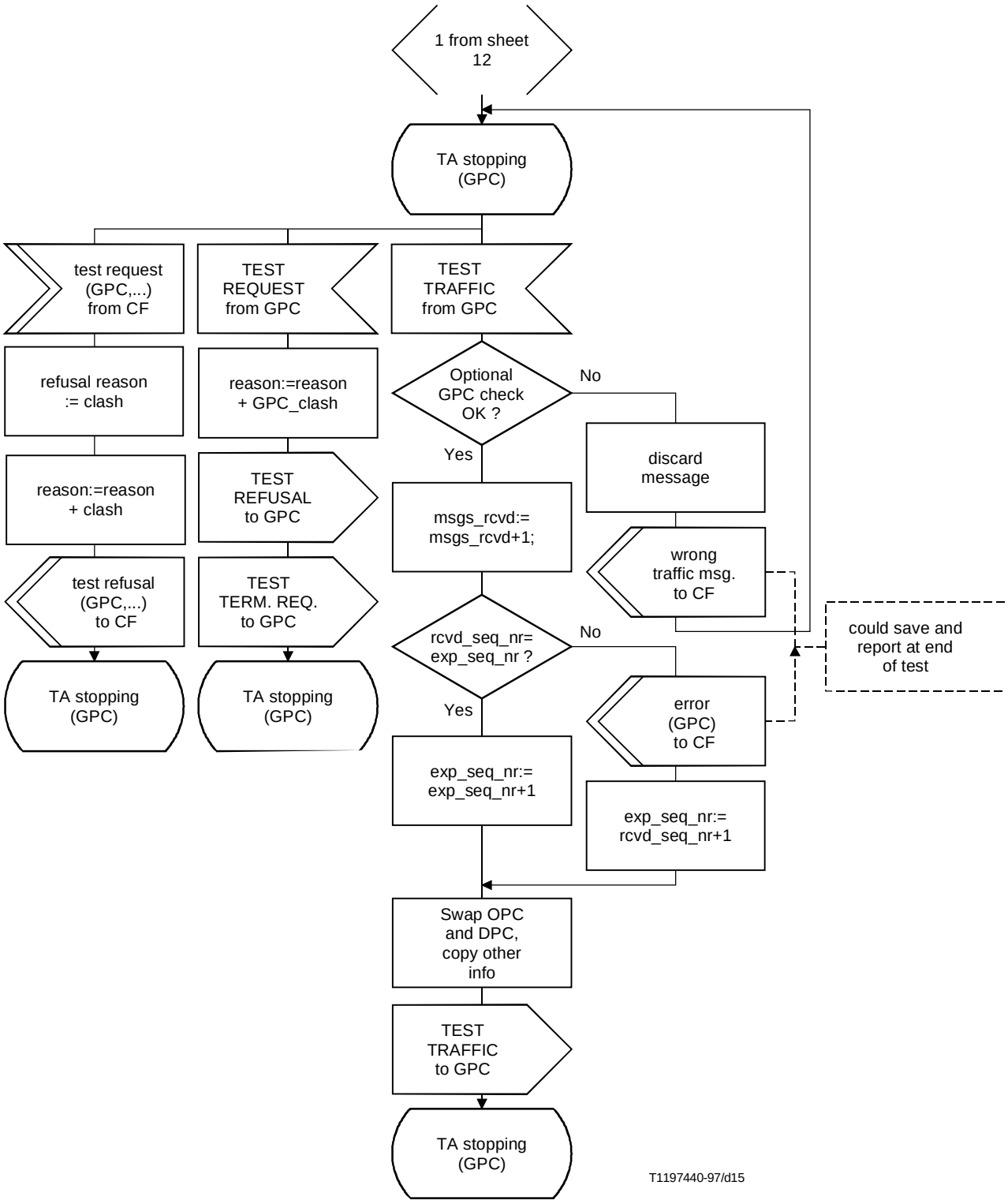


Figure 3/Q.755.1 (sheet 13 of 13) – Turnaround role

6.4 Formats and codes

In Figures 4 and 5, the fields are shown from right to left (the first field to be transmitted is at the right). Within each field the information is transmitted least significant bit first.

6.4.1 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	Reserved

6.4.1.1 Test control

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

DCBA	
0000	TEST REQUEST message
0001	TEST ACCEPTANCE message
0010	TEST REFUSAL message
0011	TEST TERMINATION REQUEST message
0100	TEST TERMINATION ACKNOWLEDGE message
0101-1111	Reserved

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

	BA		DCBA	0000	
T2	indicator	GPC	H1	H0	Label
24	2	14	4	4	32

Figure 4/Q.755.1 – Test control messages

GPC: The point code of the tester performing the generator role.

The indicator field is used only within TEST REQUEST and TEST ACCEPTANCE messages; it is coded as follows:

BA	
00	terminate test on congestion indication
01	report and then ignore congestion indications (i.e. continue test)
10-11	Reserved

For the TEST REFUSAL, TEST TERMINATION REQUEST and TEST TERMINATION ACKNOWLEDGE messages, bits BA are reserved and are coded 00 on generation, and are not examined on reception.

T2 is the value of test duration in seconds (present only in the TEST REQUEST message), encoded in binary.

6.4.1.2 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	Reserved

The TEST TRAFFIC messages are formatted as in Figure 5:

		BA		0000	0001	
generator-dependent info. octets	serial number	Reserved	GPC	H1	H0	Label
m * 8	32	2	14	4	4	32

$0 \leq m \leq 261$

Figure 5/Q.755.1 – Test traffic messages

Bits BA are coded 00 on generation, and are not examined on reception of TEST TRAFFIC messages.

GPC: The point code of the tester performing the generator role

serial number: The serial number assigned to the message, encoded in binary

generator-dependent info. octets: Additional octets of information, e.g. a time stamp

6.4.2 Timers

T1	3-5 sec	This timer controls the setting up of a test.
T2	10-500 sec	This timer defines the duration of the test at the generator.
T3	5-10 sec	This timer controls the test termination.
T4	T2 + Δ	Guard timer at the turnaround node. Δ is network dependent, but a provisional value could be 5 seconds.

6.4.3 Interface requirements

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

Table 1/Q.755.1

LMI control signals	Direction	Contents
test request	CF[a]-MT (request)	DPC, MTP Service Access Point (SAP) instance, SLS, message length, test duration message rate and congestion response
	MT-CF[b] (indication)	OPC, MTP SAP instance, SLS, test duration congestion response
test acceptance	CF-MT	DPC, MTP SAP instance, congestion response
	MT-CF	OPC, MTP SAP instance, congestion response
test refusal	CF-MT	DPC, MTP SAP instance, refusal reason
	MT-CF	OPC, MTP SAP instance, congestion response
test termination request	CF-MT	DPC, MTP SAP instance
test termination acknowledge, indication	MT-CF	OPC, MTP SAP instance + test result + reason for termination
error indication	MT-CF	OPC, MTP SAP instance, SLS, message contents including sequence number, number of messages received, expected sequence number
traffic error indication	MT-CF	OPC, MTP SAP instance, SLS, message contents, number of messages received

a) CF is short for the OMAP Control Function.

b) The Control Function decides at the turnaround node whether or not the request is acceptable.

The method of conveying additional notifications, e.g. MTP-STATUS, MTP-PAUSE, MTP-RESUME, test clash, from the tester to the Control Function, is implementation dependent.

6.5 State transition matrix

The state transition matrix following in Table 2 takes precedence over the SDL and text in case of discrepancies.

Table 2/Q.755.1 – State transition matrix – block (1,1)

Event \ State	Idle	Await setup response (TPC)	Generating (TPC)	Generating stopping (PC)
Timers running	**None**	**T1**	**T2**	**T3**
test request (PC,T2,SAPi,SLS, c.resp,lng,rate) from CF	check length against rate msgs_recvd := 0 msgs_sent := 0 exp_seq_nr := 1 start T1 save c.resp TEST REQUEST (T2,c.resp) to TPC GOTO: Await setup response (TPC)	refusal reason := clash test refusal (TPC) to CF GOTO: Await setup response (TPC)	refusal reason := clash test refusal (TPC) to CF GOTO: Generating (TPC)	refusal reason := GPC_clash test refusal (PC) to CF reason := reason + GPC_clash GOTO: Gen stopping (PC)
test acceptance (PC,c.respr) from CF	GOTO: Idle (wrt PC)	–	–	–
test refusal (PC) from CF	GOTO: Idle (wrt PC)	–	–	–
test termination request (PC,SAPi) from CF	–	reason := CF_req stop T1 start T3 TEST TERMINATION REQUEST to TPC GOTO: Gen stopping (TPC)	reason := CF_req stop T2 start T3 TEST TERMINATION REQUEST to TPC stop Tt GOTO: Gen stopping (TPC)	–

Table 2/Q.755.1 – State transition matrix – block (1,2)

Event \ State	Generating held (TPC)	Wait CF response (GPC)	Turnaround (GPC)	Turnaround stopping (GPC)
Timers running	**T2**	**None**	**T4**	**T3**
test request (PC,T2,SAPi,SLS,c.resp,lng,rate) from CF	refusal reason := GPC_clash test refusal (TPC) to CF GOTO: Gen held (TPC)	refusal reason := clash test refusal (GPC,...) to CF GOTO: Wait CF response (GPC)	refusal reason := clash test refusal (GPC) to CF GOTO: Turnaround (GPC)	refusal reason := clash reason := reason + clash test refusal (GPC,...) to CF GOTO: Turnaround stopping (GPC)
test acceptance (PC,c.respr) from CF	–	TEST ACCEPTANCE (c.respr,...) to GPC start T4 exp_seq_nr := 1 msgs_rcvd := 0 clear reason c.resp := c.resp & c.respr GOTO: Turnaround (GPC)	–	–
test refusal (PC) from CF	–	TEST REFUSAL to GPC GOTO: Idle (wrt GPC)	–	–

test termination request (PC,SAPi) from CF	reason := reason + CF_req
	TPC paused to CF
	stop T2
	test termination ack. (TPC) to CF
	release resources
	GOTO: Idle (wrt TPC)
		–	stop T4
			reason := reason + CF_req
			IF (mtp_pause) THEN
			test termination indication (GPC) to CF
			release resources
			GOTO: Idle (wrt GPC)
			ELSE
			start T3
			TEST TERMINATION REQUEST to GPC
			GOTO: Turnaround stopping (GPC)
			FI
				–

Table 2/Q.755.1 – State transition matrix – block (1,1) *(concluded)*

State / Event	Idle	Await setup response (TPC)	Generating (TPC)	Generating stopping (PC)
Timers running	**None**	**T1**	**T2**	**T3**
TEST TERMINATION ACKNOWLEDGEMENT from PC	GOTO: Idle (wrt PC)	–	–	test termination ack. (PC) to CF stop T3 release resources GOTO: Idle (wrt PC)
TEST REQUEST (T2,c.resp) from PC	save c.resp test request (GPC,T2,SAPi,SLS, c.resp) to CF GOTO: Wait CF response (GPC)	reason := clash TEST REFUSAL to TPC test termination indication (TPC) to CF stop T1 release resources GOTO: Idle (wrt TPC)	reason := clash TEST REFUSAL to TPC TEST TERMINATION REQUEST to TPC stop T2 stop Tt start T3 GOTO: Gen stopping (TPC)	reason := reason + clash TEST REFUSAL to PC GOTO: Gen stopping (PC)

Table 2/Q.755.1 – State transition matrix – block (1,2) *(concluded)*

Event \ State	Generating held (TPC)	Wait CF response (GPC)	Turnaround (GPC)	Turn around stopping (GPC)
Timers running	**T2**	**None**	**T4**	**T3**
TEST TERMINATION ACKNOWLEDGEMENT from PC	–	–	–	test termination ack. (GPC) to CF stop T3 release resources GOTO: Idle (wrt GPC)
TEST REQUEST (T2,c.resp) from PC	–	reason := GPC_clash TEST REFUSAL to GPC test termination indication (GPC) to CF release resources GOTO: Idle (wrt GPC)	reason := GPC_clash TEST REFUSAL to GPC TEST TERMINATION REQUEST to GPC stop T4 start T3 GOTO: Turnaround stopping (GPC)	reason := reason + GPC_clash TEST REFUSAL to GPC TEST TERMINATION REQUEST to GPC GOTO: Turnaround stopping (GPC)

Table 2/Q.755.1 – State transition matrix – block (2,1)

State / Event	Idle	Await setup response (TPC)	Generating (TPC)	Generating stopping (PC)
Timers running	**None**	**T1**	**T2, Tt**	**T3**
TEST ACCEPTANCE (c.respr) from PC	TEST TERMINATION REQUEST to PC GOTO: Idle (wrt PC)	stop T1 start Tt start T2 c.resp := c.resp & c.respr test acceptance (TPC,c.resp) to CF GOTO: Generating (TPC)	–	–
TEST REFUSAL from PC	GOTO: Idle (wrt PC)	refusal reason := TPC_refusal test refusal (TPC) to CF stop T1 reason := TPC_req test termination indication (TPC) to CF release resources GOTO: Idle (wrt TPC)	–	–
TEST TERMINATION REQUEST from PC	TEST TERMINATION ACK. to PC GOTO: Idle (wrt PC)	TEST TERMINATION ACK. to TPC stop T1 reason := TPC_req test termination indication (TPC) to CF release resources GOTO: Idle (wrt TPC)	reason := TPC_req TEST TERMINATION ACK. to TPC stop Tt stop T2 test termination indication (TPC) to CF release resources GOTO: Idle (wrt TPC)	reason := reason + TPC_req TEST TERMINATION ACK. to PC test termination request (PC) to CF stop T3 release resources GOTO: Idle (wrt PC)

Table 2/Q.755.1 – State transition matrix – block (2,2)

Event \ State	Generating held (TPC)	Wait CF response (GPC)	Turnaround (GPC)	Turnaround stopping (GPC)
Timers running	**T2**	**None**	**T4**	**T3**
TEST ACCEPTANCE (c.respr) from PC	–	–	–	–
TEST REFUSAL from PC	–	–	–	–
TEST TERMINATION REQUEST from PC	–	reason := GPC_req TEST TERMINATION ACK. to GPC test termination indication (GPC) to CF release resources GOTO: Idle (wrt GPC)	reason := reason + GPC_req test termination indication (GPC) to CF stop T4 TEST TERMINATION ACK. to GPC release resources GOTO: Idle (wrt GPC)	reason := reason + GPC_req TEST TERMINATION ACK. to GPC test termination indication (GPC) to CF stop T3 release resources GOTO: Idle (wrt GPC)

Table 2/Q.755.1 – State transition matrix – block (2,1) *(concluded)*

Event \ State	Idle	Await setup response (TPC)	Generating (TPC)	Generating stopping (PC)
Timers running	**None**	**T1**	**T2, Tt**	**T3**

TEST TRAFFIC from PC	TEST TERMINATION REQUEST to PC
	test traffic when idle to CF
	GOTO: Idle (wrt PC)
		–	msgs_recvd := msgs_recvd + 1
			IF (rcvd_seq_nr = exp_seq_nr)
			THEN
			exp_seq_nr := exp_seq_nr + 1
			IF NOT (other impl. dep. checks OK)
			THEN
			traffic error (TPC,...) to CF FI
			ELSE
			exp_seq_nr := rcvd_seq_nr + 1
			error (TPC,...) to CF
			FI
			GOTO: Generating (TPC)
				msgs_recvd := msgs_recvd + 1
				IF (rcvd_seq_nr = exp_seq_nr)
				THEN
				exp_seq_nr := exp_seq_nr + 1
				IF NOT (other impl. dep. checks OK)
				THEN
				traffic error (TPC,...) to CF FI
				ELSE
				exp_seq_nr := rcvd_seq_nr + 1
				error (TPC,...) to CF
				FI
				GOTO: Gen stopping (PC)

MTP-PAUSE (wrt PC)	GOTO: Idle (wrt PC)	reason := mtp_pause mtp_pause wrt TPC to CF stop T1 release resources GOTO: Idle (wrt TPC)	reason := mtp_pause mtp_pause wrt TPC to CF stop Tt GOTO: Gen held (TPC)	reason := reason + mtp_pause stop T3 test termination indication (PC) to CF release resources GOTO: Idle (wrt PC)
MTP-RESUME (wrt PC)	GOTO: Idle (wrt PC)	–	–	–

Table 2/Q.755.1 – State transition matrix – block (2,2) *(concluded)*

Event \ State	Generating held (TPC)	Wait CF response (GPC)	Turnaround (GPC)	Turnaround stopping (GPC)
Timers running	**T2**	**None**	**T4**	**T3**

TEST TRAFFIC from PC	–	–	IF NOT (Optional GPC check OK)
			THEN
			discard message
			wrong traffic msg to CF
			ELSE
			msgs_rcvd := msgs_rcvd +1
			IF (rcvd_seq_nr = exp_seq_nr)
			THEN
			exp_seq_nr := exp_seq_nr + 1
			ELSE
			error(GPC) to CF
			exp_seq_nr := rcvd_seq_nr + 1 FI
			swap OPC,DPC, copy other info
			TEST TRAFFIC to GPC FI
			GOTO: Turnaround (GPC)
				IF NOT (Optional GPC check OK)
				THEN
				discard message
				wrong traffic msg to CF
				ELSE
				msgs_rcvd := msgs_rcvd + 1
				IF (rcvd_seq_nr = exp_seq_nr)
				THEN
				exp_seq_nr := exp_seq_nr + 1
				ELSE
				error(GPC) to CF
				exp_seq_nr := rcvd_seq_nr + 1 FI
				swap OPC,DPC, copy other info
				TEST TRAFFIC to GPC FI
				GOTO: Turnaround stopping (GPC)

MTP-PAUSE (wrt PC)	GOTO: Gen held (TPC)	mtp_pause (GPC) to CF GOTO: Idle (wrt GPC)	mtp_pause wrt GPC to CF mark mtp_pause reason := reason + mtp_pause GOTO: Turnaround (GPC)	reason := reason + mtp_pause stop T3 test termination indication (GPC) to CF release resources GOTO: Idle (wrt GPC)
MTP-RESUME (wrt PC)	start Tt mtp_resume wrt TPC to CF GOTO: Generating (TPC)	–	mtp_resume wrt GPC to CF unmark mtp_pause reason := reason – mtp_pause GOTO: Turnaround (GPC)	–

Table 2/Q.755.1 – State transition matrix – block (3,1)

State / Event	Idle	Await setup response (TPC)	Generating (TPC)	Generating stopping (PC)
Timers running	**None**	**T1**	**T2, Tt**	**T3**

MTP-STATUS (congestion) wrt PC	–	IF (c.resp = term.) THEN
		reason := TPC_cong
		TEST TERMINATION REQUEST to TPC
		stop T1
		stop T3
		GOTO: Gen stopping (TPC)
		ELSE
		congestion wrt TPC to CF
		GOTO: Await setup response (TPC)
		FI
			IF (c.resp = term.) THEN
			reason := TPC_cong
			stop T2
			stop T3
			TEST TERMINATION REQUEST to TPC
			stop Tt
			GOTO: Gen stopping (TPC)
			ELSE
			congestion wrt TPC to CF
			GOTO: Generating (TPC)
			FI
				reason := reason + PC_cong
				GOTO: Gen stopping (PC)

MTP-STATUS (UPU) wrt PC	–	reason := UPU(TPC) test termination indication (TPC) to CF stop T1 release resources GOTO: Idle (wrt TPC)	reason := UPU(TPC) test termination indication (TPC) to CF stop Tt stop T2 release resources GOTO: Idle (wrt TPC)	reason := reason + UPU(PC) stop T3 test termination indication (PC) to CF release resources GOTO: Idle (wrt PC)
T1 expiry	–	reason := T1_expiry test termination indication (TPC) to CF release resources GOTO: Idle (wrt TPC)	–	–
T2 expiry	–	–	reason := T2_expiry start T3 TEST TERMINATION REQUEST to TPC stop Tt GOTO: Gen stopping (TPC)	–
T3 expiry	–	–	–	reason := reason + T3_expiry test termination indication (PC) to CF release resources GOTO: Idle (wrt PC)

Table 2/Q.755.1 – State transition – block (3,2)

Event \ State	Generating held (TPC)	Wait CF response (GPC)	Turnaround (GPC)	Turnaround stopping (GPC)
Timers running	**T2**	**None**	**T4**	**T3**

MTP-STATUS (congestion) wrt PC	–	congestion wrt GPC to CF
		IF (c.resp = term.) THEN
		TEST REFUSAL to GPC
		GOTO: Idle (wrt GPC)
		ELSE
		GOTO: Wait CF response (GPC)
		FI
			IF (c.resp = term.) THEN
			reason := GPC_cong
			stop T4
			stop T3
			TEST TERMINATION REQUEST to GPC
			GOTO: Turnaround stopping
			ELSE
			congestion wrt GPC to CF
			GOTO: Turnaround (GPC)
			FI
				reason := reason + GPC_cong
				GOTO: Turnaround stopping (GPC)

MTP-STATUS (UPU) wrt PC	–	upu wrt GPC to CF GOTO: Idle (wrt GPC)	reason := UPU(GPC) test termination indication (GPC) to CF stop T4 release resources GOTO: Idle (wrt GPC)	reason := reason + UPU(GPC) stop T3 test termination indication (GPC) to CF release resources GOTO: Idle (wrt GPC)
T1 expiry	–	–	–	–
T2 expiry	reason := reason + T2_expiry test termination ack. (TPC) to CF release resources GOTO: Idle (wrt TPC)	–	–	–
T3 expiry	–	–	–	reason := reason + T3_expiry test termination indication (GPC) to CF release resources GOTO: Idle (wrt GPC)

Table 2/Q.755.1 – State transition matrix – block (4,1)

Event \ State	Idle	Await setup response (TPC)	Generating (TPC)	Gen stopping (PC)
Timers running	**None**	**T1**	**T2, Tt**	**T3**
T4 expiry	–	–	–	–
Tt expiry	–	–	msgs_sent := msgs_sent + 1 seq_nr := msgs_sent insert info in message pad message TEST TRAFFIC to TPC start Tt GOTO: Generating (TPC)	–

Table 2/Q.755.1 – State transition matrix – block (4,2)

Event \ State	Generating held (TPC)	Wait CF response (GPC)	Turnaround (GPC)	Turnaround stopping (GPC)
Timers running	**T2**	**None**	**T4**	**T3**

T4 expiry	–	–	reason := reason + T4_expiry
			IF (mtp_pause)
			THEN
			test termination indication (GPC) to CF
			release resources
			GOTO: Idle (wrt GPC)
			ELSE
			start T3
			TEST TERMINATION REQUEST to GPC
			GOTO: Turnaround stopping (GPC)
			FI
				–

Tt expiry	–	–	–	–

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