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THE INTERNATIONAL
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BLUE BOOK

VOLUME VI – FASCICLE VI.9

SPECIFICATIONS OF SIGNALLING SYSTEM No. 7

RECOMMENDATIONS Q.771-Q.795

IXTH PLENARY ASSEMBLY
MELBOURNE, 14-25 NOVEMBER 1988

Geneva 1989

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ISBN 92-61-03531-0

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APPLICABLE AFTER THE NINTH PLENARY ASSEMBLY (1988)

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Specifications of Signalling System No. 7

PRELIMINARY NOTES

1 The Questions entrusted to each Study Group for the Study Period 1989-1992 can be found in Contribution No. 1 to that Study Group.

2 In this Volume, the expression "Administration" is used for shortness to indicate both a telecommunication Administration and a recognized private operating agency.

3 The strict observance of the specifications for standardized international signalling and switching equipment is of the utmost importance in the manufacture and operation of the equipment. Hence these specifications are obligatory except where it is explicitly stipulated to the contrary.

The values given in Fascicles VI.1 to VI.14 are imperative and must be met under normal service conditions.

FASCICLE VI.9

Recommendations Q.771 to Q.795

SPECIFICATIONS OF
SIGNALLING SYSTEM No. 7

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SECTION 1

TRANSACTION CAPABILITIES APPLICATION PART (TCAP)

Recommendation Q.771

FUNCTIONAL DESCRIPTION OF TRANSACTION CAPABILITIES

1 Introduction

1.1 *General*

Transaction Capabilities (TC) provide functions and protocols to a large variety of applications distributed over exchanges and specialized centres in telecommunication networks.

The support of TC by terminal equipments is for further study.

The term "Transaction Capabilities" refers to Application layer services and protocols, called Transaction Capabilities Application Part, or TCAP, plus any supporting Presentation, Session and Transport layers services and protocols, called the Intermediate Service Part, or ISP.

To date, only Signalling System No. 7 MTP plus SCCP have been considered as network layer service providers. However, any standard OSI Network Layer might be used in place of the MTP plus SCCP, provided that the requirements of the applications supported by TC (e.g. service and performance requirements) can be met. This area requires further study.

Figure 1/Q.771 shows the general structure of TC. It shows that the Transaction Capabilities Application Part (TCAP) forms a part of layer 7 of the OSI Reference Model. The remainder of layer 7 is referred to as a TC-user. The Intermediate Service Part (ISP) covers layers 4 to 6.

Figure 2/Q.771 illustrates the situation of TC in the No. 7 Signalling System.

1.2 *Contents of the Recommendations Series Q.771-Q.775*

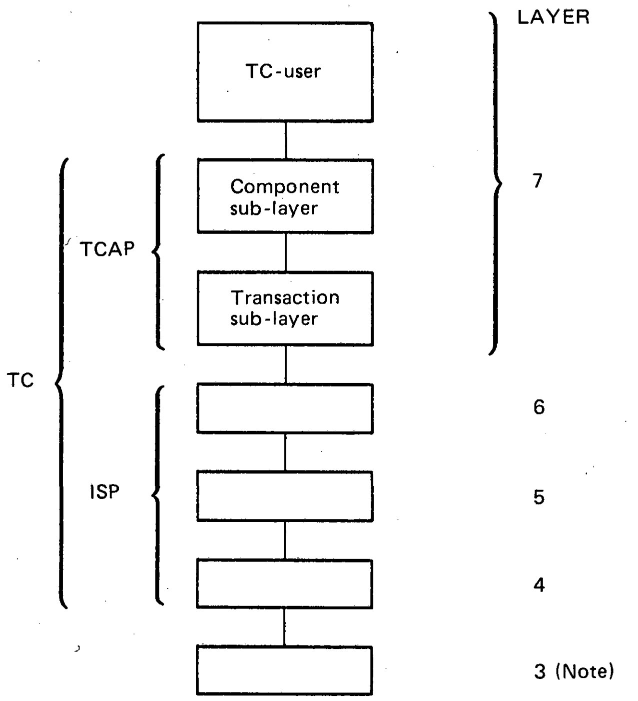
Recommendation Q.771 contains a general description of the services provided by the Transaction Capabilities, and the service expected from the SCCP.

Recommendation Q.772 defines the Transaction Capabilities Information Elements, and their functions.

Recommendation Q.773 defines the formats and encoding used for the Transaction Capabilities Messages. Annex A specifies the protocol data units using the ASN.1 formal notation (Recommendations X.208/X.209).

Recommendation Q.774 specifies the Transaction Capabilities procedures. Annex A to this Recommendation contains SDL diagrams for TC.

Recommendation Q.775 contains guidelines and examples on how to define applications and their use of TC.



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Note — TC will be supported by No. 7 Network. Portability of TC will also permit support by other networks providing standard network services, connection oriented (X.213) or connectionless.

FIGURE 1/Q.771

Structure of TC

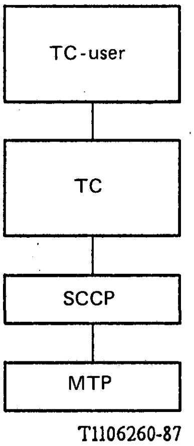

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FIGURE 2/Q.771

Situation of TC in the No. 7 Signalling System

The present Recommendation contains both introductory information (chapters 1 and 2), and a detailed description (chapters 3 and 4), using primitives, of the services provided by TC. The reader interested in the first aspect only may read the first two chapters only; chapters 3 and on contain more detailed information.

1.3 *Objectives*

1.3.1 *Definition of Transaction Capabilities*

The overall objective of Transaction Capabilities is to provide the means for the transfer of information between nodes, and to provide generic services to applications, while being independent of any of these.

1.3.2 *Scope of Transaction Capabilities*

Transaction Capabilities in a Signalling System No. 7 network should be considered for use between:

1) exchanges
2) an exchange and a network service centre (e.g. data base, specialized facility unit, OA&M Centre).
3) network service centres.

The following applications have been recognized as TC-users:

– mobile service application (e.g. location of roamers)
– registration, activation and invocation of supplementary services involving specialized facility units (e.g. freephone service credit card service)
– non circuit control-related exchange of signalling information (e.g. closed user group, look-ahead procedure)
– operation and maintenance applications (e.g. query/response, bulk data transfer).

This list is not exhaustive.

These applications can be classified into two broad categories:

– real-time sensitive, with small amounts of data to be transferred
– less real-time sensitive, with possibly large amounts of data to be transferred.

A more precise definition of the boundary between these two categories requires further study. A given application is not compelled to belong to only one of these categories.

TC services offered to applications in the first category are based on a connectionless network service. They are introduced in § 2.3, and further described in chapter 3 of this Recommendation.

TC services offered to applications in the second category are based on a connection-oriented network service. They are introduced in § 2.4, and further described in chapter 4 of this Recommendation.

The mechanism for selecting a category is for further study.

2 Overview

2.1 *Terminology*

The following terms are used throughout the Q.77x Series of Recommendations and are defined in the Signalling System No. 7 glossary: class of operation; component correlation; component portion; dialogue; information element; Intermediate Service Part; linked operation; operation; reply; result; tag; transaction; Transaction Capabilities; Transaction Capabilities Application Part; transaction portion.

2.2 *Structure of TC*

2.2.1 *Architectural concepts*

The OSI protocol reference model (Recommendation X.200) is used to model TC.

From an end-user point of view, Transaction Capabilities for initially planned services lie within the Network layer of the OSI model. Provision of network layer services to end-users requires communication between TC-users at various network nodes; these intra-network communications may in turn be modelled using the 7-layer reference model of OSI.

TCAP is structured in two sub-layers:

– the component sub-layer, which deals with individual actions or data, called components

– the transaction sub-layer, which deals with the exchange of messages cotaining components between two TC-users.

This is illustrated by Figure 3/Q.771.

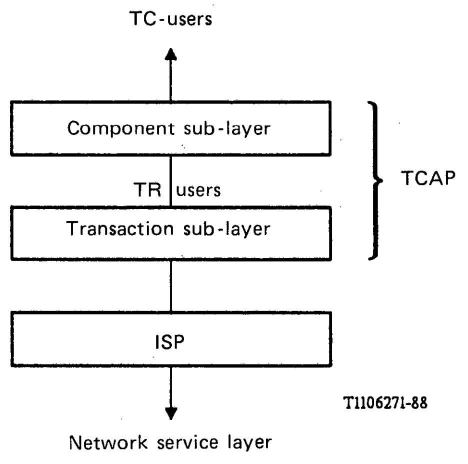


FIGURE 3/Q.771

Structure of TC

2.2.2 *Addressing issues*

When TC uses the Signalling System No. 7 network service, the addressing options supported by the SCCP are used.

When other network layer service providers are used, the addressing options supported by these providers will be used; further study on this area is required.

2.2.3 *Management aspects*

For further study.

2.2.4 *Alignment of TCAP with X.219 and X.229 (ROSE)*

The Component sub-layer of TCAP is in partial alignment with the capabilities of the Remote Operation Service Element (ROSE). The current status of TCAP and ROSE alignment is on the basis of protocol alignment, namely the X.229 protocol is contained within the TCAP component protocol. In addition, the Component sub-layer includes some extensions to ROSE. Service alignment on the primitive interface to TC/ROSE users is for further study.

The X.219 Remote Operation Service provides five classes of operations. Class 1 is synchronous, reporting both success and failure. Classes 2 to 5 are asynchronous and correspond to the TCAP operation classes 1 to 4. TCAP has not adopted ROSE class 1 (synchronous), because the full-duplex mode of operation is used in TCAP. TC-users may use the TCAP operation class 1 in a synchronous mode if appropriate. Further details are given in Recommendation Q.775.

2.3 *TC Based on a Connectionless Network Service*

2.3.1 *Architecture*

This chapter defines a class of TC services based on a connectionless network service, in this case, no functionality is provided by the ISP, and TCAP interfaces directly with the SCCP, as represented on Figure 4/Q.771.

The class of TC services is selected by the TC-user on the basis of a Quality of Service parameter.

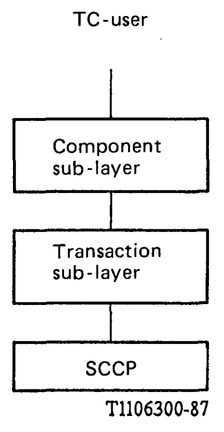


FIGURE 4/Q.771

Structure of TC based on a connectionless network service

2.3.2 *Service Provided by the Component Sub-layer*

2.3.2.1 *Component*

A component consists of a request to perform an **operation**, or a **reply**.

An operation is an action to be performed by the remote end. It may have associated parameters. An invocation of an operation is identified by a component ID; this allows several invocations of the same or different operations to be active simultaneously.

One or more replies may be sent to an operation.

The ability for TC-users to exchange components which are neither operation invocations, nor replies, is for further study.

Components are passed individually between a TC-user and the Component sub-layer. The originating TC-user may send several components to the Component sub-layer before these are transmitted (in a single message) to the remote end. Whenever several components are received in a single message, each one is delivered individually to the destination TC-user.

Components in a message are delivered to the remote TC-user in the same order as they are provided at the originating interface. The importance of the order is by prior agreement between the TC-users involved.

2.3.2.2 *Dialogue*

Successive components exchanged between two TC-users in order to perform an application constitute a dialogue. The Component sub-layer provides dialogue facilities, allowing several dialogues to run concurrently between two given TC-users.

Two kinds of facilities are provided: unstructured and structured.

2.3.2.2.1 *Unstructured dialogue*

TC-users send components that do not expect replies without forming an explicit association between themselves. This is referred to as the unstructured dialogue case. The implicit association always exists between the communicating TC-users. When one TC-user sends a unidirectional message to its peer, this indicates use of the unstructured dialogue facility. A TC-user may have any number of operations active at any given time, the maximum number is dependent on the unique invoke IDs available to it at any time.

When a TC-user is a receiver of a unidirectional message, if a protocol error is to be reported, it is also returned in a unidirectional message.

2.3.2.2.2 *Structured dialogue*

Alternatively, TC-users indicate the beginning, or the formation of an association, the continuation, and the end of a dialogue; this is referred to as a structured dialogue. Using a structured dialogue allows two TC-users to run several dialogues concurrently, each being identified by a particular dialogue ID. Each dialogue ID has a separate invoke ID name space, thus allowing duplication of invoke IDs in different dialogues. In sequence delivery of messages may be provided by means of application protocols, or by use of the appropriate class of service.

When using the structured dialogue service, the TC-user has to indicate one of the following three possibilities when sending a component to its peer entity:

i) a dialogue begins;

ii) a dialogue continues: full-duplex exchange of components is possible;

iii) a dialogue ends: the sending side will not send more components, nor will it accept any more components from the remote end.

2.3.2.3 *Component Correlation*

The Component sub-layer provides the following facilities:

a) association of operations and replies

   The value of the invoke ID, which identifies an operation invocation without ambiguity, is returned in a reply to that invocation.

   Four classes of operations are considered:

   - class 1: both success and failure are reported
   - class 2: only failure is reported
   - class 3: only success is reported
   - class 4: neither success, nor failure is reported.

   The replies to an operation consist of one or more components. Where necessary, the TC-user provides segmentation of a successful result. In addition, any number of linked operations may be sent prior to the last component of the reply.

   Any kind of component, except a reject component, may be rejected. Rejection of a result causes termination of the corresponding operation; rejection of a linked operation does not affect the linked-to operation.

   A TC-user may cancel an operation which it has previously invoked. No reply for this invocation will be accepted afterwards.

   The last component may be:

   - a return result indicating success
   - a return error indicating operation failure
   - a reject indicating a syntax error.

b) abnormal situations handling

   The Component sub-layer covers a number of abnormal situations in relation with a component:

   - component reject: when the Component sub-layer receives a malformed component, or a component which violates the rules of exchange of operations and replies, it informs the TC-user(s)
   - operation expiry: when the Component sub-layer detects that a class 1, 2 or 3 operation has not received a final reply after some amount of time (which depends on the operation), it releases the corresponding invoke ID and informs the TC-user. Note that this situation is abnormal only in the case of a class 1 operation. Application of this to class 4 operations is a local matter.

2.3.2.4 *Error handling*

When the Component sub-layer is informed of a situation which prevents it from providing the service expected by the TC-users, it will notify the TC-user, and may terminate the peding operations.

A TC-user may also decide to abort a dialogue, which puts an end to any pending operation.

2.3.3 *Service provided by the Transaction Sub-layer*

The Transaction sub-layer provides the capability for the exchange of components between TR-users. The transaction sub-layer also provides the capability to send transaction messages between peer TR-layer entities by means of the services provided by the lower layer network services. The only foreseen TS-user for the moment is the component sub-layer. Two types of service are provided:

2.3.3.1 *Unstructured dialogue*

There is no explicit initiation, or termination associated with an unstructured dialogue. The only facility provided to the TC-user is the capability to send one, or several components that do not expect replies (invocation of class 4 operations) grouped in a unidirectional message to the remote TR-user.

At the originating side, the TC-user indicates the components to be sent in a unidirectional message by means of primitives of the request type containing a unique dialogue ID. When the TC-user issues a TC-UNI request primitive with the same dialogue ID, all the components with the same dialogue ID are sent as user data to the transaction sub-layer by means of the TR-UNI primitive by the component sub-layer. At the transaction sub-layer message level, the unidirectional message does not contain any transaction ID thereby providing no association between messages of this type. The dialogue ID is used to send a group of components in a UNI message to a particular destination address.

2.3.3.2 *Structured dialogue*

The structured dialogue facility allows a TC-user to start a dialogue, exchange components within this dialogue, terminate it, or abort it.

Each TR-user identifies a transaction by a separate transaction ID. The following facilities are provided:

- transaction begin: the beginning of a transaction between two TR-users causes a transaction ID to be allocated to this transaction, and permits sending TR-user information to the destination TR-user. In response to transaction begin, the destination TR-user may continue the transaction, or end it.
- transaction continuation: allows full-duplex exchange of messages between TR-users inside a transaction.
- transaction end: release the associated transaction ID, and puts an end to the exchange of messages inside this transaction. Either of the TR-users may decide to end a transaction. There are three ways for the TR-user to terminate a transaction:
    1) prearranged end: a convention exists between the TR-users; each of them may decide to terminate the transaction without having to inform the peer TR-user, which will take a similar decision on its own
    2) basic end: it informs the peer TR-user, possibly sending TR-user information to it.
    3) transaction abort: causes the abandonment of any message of the transaction for which transmission or delivery is pending, and ends the transaction. The reason for aborting the transaction is indicated to the remote TR-user.
- if, for some reason, no response of any kind is received to transaction begin, the Transaction sub-layer will eventually abort this transaction and inform the TR-user. This is a local option.
- transaction abort by TCAP: whenever one of a list of abnormal situations is detected, the Transaction sub-layer decides to abort the corresponding transaction and informs the TR-users.

– exception reporting: the Transaction sub-layer may report to TR-users abnormal situations of which it is notified by the underlying layer.

When the TR-user is the Component sub-layer:

a) there is a one-to-one mapping between a dialogue and a transaction,

b) a message may contain zero, one or more components, within the limits of the message size supported by the underlying layer.

2.4 *TC Based on a connection-oriented network service*

For further study.

3 Service provided by TC based on a connectionless network service

3.1 *Component Sub-layer*

3.1.1 *Overview of Component Sub-layer primitives*

Tables 1/Q.771 and 2/Q.771 give an overview of the primitives to/from the TC-users, and contain references to the sections of this Recommendation where these primitives are described in detail.

Table 1/Q.771 shows the TC-primitives relating to dialogue handling. The purpose of these primitives is to request or indicate facilities of the underlying (sub)-layer, in relation with message transmission or dialogue handling. When the Transaction Sub-layer is used to support the dialogue, these primitives map onto TR-primitives with the same generic name, as there is a one to one relationship between a dialogue and a transaction.

TABLE 1/Q.771

Primitives for dialogue handling

Name	Type	Section
TC-UNI	Request Indication	3.1.2.2.1
TC-BEGIN	Request Indication	3.1.2.2.2.1
TC-CONTINUE	Request Indication	3.1.2.2.2.2
TC-END	Request Indication	3.1.2.2.2.3
TC-U-ABORT	Request Indication	3.1.2.2.2.3
TC-P-ABORT	Indication	3.1.4.2

– TC-UNI: requests/indicates an unstructured dialogue.

– TC-BEGIN: begins a dialogue.

– TC-CONTINUE: continues a dialogue.

– TC-END: ends a dialogue.

Each of the previous primitives causes any component(s) previously passed on the interface for the referenced dialogue to be delivered to the remote end (except TC-END with prearranged end).

- TC-U-ABORT: allows a TC-user to terminate a dialogue abruptly, without transmitting any pending components.
- TC-P-ABORT: informs the TC-user that the dialogue has been terminated by the service provider (i.e. TC Transaction sub-layer) in reaction to a transaction abort by the Transaction sub-layer. Any pending components are not transmitted.

Table 2/Q.771 shows the TC-primitives for component handling. The main purpose of these primitives is to handle operations and replies; these primitives do not as such require facilities from the underlying (sub)-layer.

TABLE 2/Q.771

Primitives for component handling

Name	Type	Section
TC-INVOKE	Request Indication	3.1.3.2
TC-RESULT-L	Request Indication	3.1.3.3
TC-RESULT-NL	Request Indication	3.1.3.3
TC-U-ERROR	Request Indication	3.1.3.4
TC-L-CANCEL	Indication	3.1.3.6
TC-U-CANCEL	Request	3.1.3.6
TC-L-REJECT	Indication	3.1.4.1
TC-R-REJECT	Indication	3.1.4.1
TC-U-REJECT	Request Indication	3.1.3.5

- TC-INVOKE: invocation of an operation, which may be linked to another operation invocation
- TC-RESULT-L: only result or last part of the segmented result of a successfully executed operation
- TC-RESULT-NL: non-final part of the segmented result of a successfully executed operation
- TC-U-ERROR: reply to a previously invoked operation, indicating that the operation execution failed
- TC-L-CANCEL: informs the TC-user locally that an operation invocation is terminated due to a timeout condition
- TC-U-CANCEL: causes local termination of an operation invocation, as a consequence of a TC-user decision

- TC-L-REJECT: (local reject) informs the local TC-user that a Component sub-layer detected invalid component was received
- TC-R-REJECT: (remote reject) indicates that TCAP detected an invalid component
- TC-U-REJECT: rejection of a component by the TC-user, indicating a malformation which prevents the operation from being executed, or the reply from being understood

The various primitives associated with component and dialogue handling are described with their parameters. The following notation is used:

(M) indicates a mandatory parameter

(O) indicates an optional parameter

FS indicates that further study is required

A blank indicates that the parameter is not applicable

(=) indicates that the parameter must have the same value in a request primitive and in the corresponding indication primitive.

This notation applies throughout this Recommendation.

3.1.2 *Dialogue Handling*

Dialogue handling provides facilities for the exchange of components within a dialogue.

3.1.2.1 *Definition of Parameters*

This section defines the parameters used with the primitives associated with dialogue handling.

Address parameters: two address parameters are used: the "Destination Address" and the "Originating Address" parameters. These parameters identify respectively the destination and originating TC-user.

"Components Present": indicates whether any components will be received; when no component is being transmitted, it indicates that the list is empty, other wise it indicates a sequence (see § 3.1.3.8) of components which are associated with the dialogue handling primitive. The "Components Present" parameter is used in primitives of the indication type only.

"Dialogue ID": this parameter also appears in the component handling primitives, and is used to associate components with a dialogue. The same dialogue ID must be used within the same dialogue, or a unidirectional primitive. In a unidirectional primitive the same dialogue ID assures all components with the identical dialogue ID are blocked together in the same unidirectional message destined for the same destination address. For structured dialogues, the dialogue ID is used to identify all the components belonging to the same dialogue from the beginning of the dialogue to its end. The dialogue ID maps onto the IDs exchanged in the messages between a pair of nodes.

"P-ABORT": contains information indicating the cause for which TCAP decides to abort a dialogue.

"Parameters": contains the parameter(s) to be sent to the remote TC-user in association with an operation invocation, a reply, or a dialogue abort. This information is not analysed by TCAP.

"Quality of Service": the TC-user indicates the acceptable quality of service. The default value of this parameter corresponds to the underlying service defined in § 3.4. Other Quality of service is for further study.

"Termination": indicates which scenario is chosen by the TC-user for the end of the dialogue (prearranged or basic).

"User Abort Information": the TC-user may include information related to a TC-user-initiated abort.

3.1.2.2 *Dialogue facilities*

The dialogue facilities allow a TC-user to exchange components with a peer TC-user to perform a distributed application. The unidirectional message facility may be used to send class 4 operation invocations and reports of protocol errors in these invocations from either TC-user using an unstructured dialogue. The structured dialogue facilities provide the capability to explicitly initiate a transaction, exchange components within the dialogue, terminate it, or abort it.

3.1.2.2.1 *Unstructured dialogue*

There is no initiation or termination associated with an unstructured dialogue; the only facility provided is the request for transmission of one, or several components invoking class 4 operations or reporting protocol errors in these invocations, grouped in a message to the remote TC-user.

Components to be transmitted have been previously passed to the component sub-layer by means of component handling primitives of the "request" type.

The use of the unstructured dialogue facility is indicated by issuing a TC-UNI primitive, as described in Table 3/Q.771.

At the originating side, a TC-UNI request primitive is issued to request transmission to the remote TC-user of all the components which have been passed to the component sub-layer with the same dialogue ID.

At the receiving side, the destination TC-user is informed that one or more component(s) have been received by means of a TC-UNI indication primitive. The parameters in this primitive apply to all the components being received; these components will actually be delivered by means of component handling primitives of the indication type.

TABLE 3/Q.771

TC-UNI Primitives

Parameter	Primitive: TC-UNI	
	Request	Indication
Quality of service	FS	
Destination address	M	M [a]
Originating address	M [a]	M (=)
Dialogue ID	M [b]	
Components present	M	M (=)

[a] This parameter may be implicitly associated with the access point at which the primitive is issued.

[b] This parameter has only local significance.

3.1.2.2.2 *Structured dialogue*

The structured dialogue facility allows a TC-user to start a dialogue, exchange components within this dialogue, terminate it, or abort it. It provides for Transaction IDs in the transaction messages that provide a unique association among the related transaction messages.

3.1.2.2.2.1 *Beginning of a dialogue*

A TC-user begins a new dialogue by issuing a TC-BEGIN request primitive. The purpose of this primitive is:

– to indicate to the Component sub-layer that a new dialogue starts, identified by the Dialogue ID parameter of the primitive;
– to request transmission of any component(s) previously passed to the Component sub-layer by means of component handling primitives of the "request" type with the same Dialogue ID.

A TC-BEGIN request primitive may be issued prior to passing any component to the Component sub-layer.

At the receiving side, the destination TC-user is informed that a new dialogue starts by means of a TC-BEGIN indication primitive. The presence of component(s) is indicated by the Components Present.

Table 4/Q.771 describes the TC-BEGIN primitives.

TABLE 4/Q.771

TC-BEGIN Primitives

Parameter	Primitive: TC-BEGIN	
	Request	Indication
Quality of service	FS	FS
Destination address	M	M [a]
Originating address	M [a]	M (=)
Dialogue ID	M	M
Components present		M

[a] This parameter may be implicitly associated with the access point at which the primitive is issued.

3.1.2.2.2.2 *Dialogue continuation*

A TC-user indicates that it wants to continue a dialogue by issuing a TC-CONTINUE request primitive. This primitive requests transmission of any component(s) that have been passed to the Component sub-layer for this dialogue, since the last TC-BEGIN or TC-CONTINUE request primitive was issued for this dialogue.

At the receiving side, the TC-CONTINUE indication primitive indicates:

– that the dialogue may continue

– that components are being delivered (if the Components Present parameter does not indicate "empty").

Table 5/Q.771 describes the TC-CONTINUE primitives.

TABLE 5/Q.771

TC-CONTINUE Primitives

Parameter	Primitive: TC-CONTINUE	
	Request	Indication
Dialogue ID	M	M
Components present		M

3.1.2.2.2.3 *End of a dialogue*

Three scenarios are provided to TC-users to end a dialogue:

- prearranged end
- basic end
- abort by the TC-user.

Dialogue ending uses the TC-END request and indication primitives described in Table 6/Q.771. The TC-END request primitive indicates which scenario is being used for the dialogue.

TABLE 6/Q.771

TC-END Primitives

Parameter	Primitive: TC-END	
	Request	Indication
Dialogue ID	M	M
Components present		M
Termination	M	

a) prearranged end

In this scenario, TC-users have decided by prior arrangement when to end the dialogue: the effect of the TC-END primitive is purely local; no TC-END indication is used.

No component can be sent or received for the dialogue once the TC-END request primitive has been issued.

b) basic end

In this scenario, the ending causes transmission of any pending components at the side which initiates it. Note, however, that any components for which transmission would be pending in the reverse direction will not be delivered.

The basic scenario uses the TC-END primitives for two purposes:

- delivery of any component(s) that has been passed to the Transaction sub-layer, and for which transmission is pending
- indication that no more components will be exchanged for this dialogue in either direction.

c) abort of a dialogue by a TC-user

The TC-user has the ability to request immediate ending of a dialogue without taking into account any pending operation invocation (abort). When doing so, the TC-user may provide end to end information indicating the cause of the abort and diagnostic information; this information is transported by TCAP without analysis.

The TC-U-ABORT request and indication primitives are used to indicate abort by the TC-user; Table 7/Q.771 describes these primitives.

TABLE 7/Q.771

TC-U-ABORT Primitives

Parameter	Primitive: TC-U-ABORT	
	Request	Indication
Dialogue ID	M	M
User abort information	O	O (=)

3.1.3 *Component Handling*

3.1.3.1 *Definition of Parameters*

This section defines the parameters used with the primitives associated with component handling.

"Class": see § 2.3.2.3.

"Dialogue ID": relates components to a specific dialogue.

"Invoke ID": identifies an operation invocation.

"Linked ID": links an operation invocation to a previous operation invocation.

"Error": contains information provided by the TC-user when an operation returns failure. This information is not analysed by TCAP.

"Last Component": is used in primitives of the "indication" type only, to designate the last component of a message. Note that indication of the last part of the result of an operation is via the name of the primitive.

"Operation": identifies the action to be executed by a TC-user on request of another TC-user.

"Parameters": contains any parameters accompanying an operation, or provided in reply to an operation.

"Problem Code": identifies the cause for rejecting a component.

"Timeout": indicates the maximum lifetime of a component ID. It is used to handle cases where operations do not receive any expected reply.

3.1.3.2 *Operation Invocation*

An operation invocation is requested to the Component sub-layer by means of a TC-INVOKE request primitive. When this invocation is linked to a previous operation, the Linked ID parameter is used.

A corresponding TC-INVOKE indication primitive is used to indicate operation activation to the destination TC-user.

Table 8/Q.771 shows the primitives associated with operation invocation.

TABLE 8/Q.771

Operation invocation primitives

Parameter	Primitive: TC-INVOKE	
	Request	Indication
Dialogue ID	M	M [a]
Class	M	
Invoke ID	M	M (=)
Linked ID	O	O (=)
Operation	M	M (=)
Parameters	O	O (=)
Last component		M
Timeout	M	

[a] Mandatory except for invocation of class 4 operation received in a unidirectional message.

3.1.3.3 *Report of success*

Success is reported to indicate that an operation (of class 1 or 3) has been executed by the remote TC-user. The operation is identified in the Invoke ID parameter. Several replies may be used to report success. The following primitives are used:

- TC-RESULT-L indicates the only or last segment of a result
- TC-RESULT-NL indicates a segment of a result (with more segments to follow)

There is no limitation on the number of segments.

The TC-RESULT-L and TC-RESULT-NL primitives are described in Table 9/Q.771. A primitive of the "request" type is used to pass a result from the TC-user to the Component sub-layer; a primitive of the "indication" type is used to deliver this result to the TC-user.

TABLE 9/Q.771

Report of success primitives

Parameter	Primitive	
	TC-RESULT-L TC-RESULT-NL Request	TC-RESULT-L TC-RESULT-NL Indication
Dialogue ID	M	M
Invoke ID	M	M (=)
Parameters	O	O (=)
Last component		M

3.1.3.4 *Report of failure*

A TC-user receiving a (class 1 or 2) operation which it cannot execute, though it "understands" it, will issue a TC-U-ERROR request primitive, indicating the reason of the failure (Error parameter). The corresponding operation is identified by the Invoke ID parameter.

The TC-user which invoked this operation is informed by a TC-U-ERROR indication primitive.

Table 10/Q.771 describes the TC-U-ERROR primitives.

TABLE 10/Q.771

Report of failure primitives

Parameter	Primitive: TC-U-ERROR	
	Request	Indication
Dialogue ID	M	M
Invoke ID	M	M (=)
Error	M	M (=)
Parameters	O	O (=)
Last component		M

Note – Report of failure is a final reply.

3.1.3.5 *Reject by the TC-User*

A TC-user may reject any component (except a reject component) generated by its peer entity, which it considers incorrect. The cause for the rejection is indicated in the Problem Code parameter; separate parameters are available for the rejection of individual component types.

Any rejection of an invocation or a result terminates the operation. When a linked operation is rejected, the linked-to operation is not affected.

A TC-user rejects a component by means of the TC-U-REJECT request primitive, and is informed of rejection by the remote TC-user by means of the TC-U-REJECT indication primitive. These primitives are described by Table 11/Q.771.

TABLEAU 11/Q.771

User rejection primitives

Parameter	Primitive: TC-U-REJECT	
	Request	Indication
Dialogue ID	M	M [a)]
Invoke ID	M	M (=)
Problem code	M	M (=)
Last component		M

[a)] Mandatory except for rejection of invocation of class 4 operation received in a unidirectional message.

3.1.3.6 *Cancel of an Operation*

The cancel facility terminates the corresponding operation invocation. It can be requested either by the TC-user, or by the Component sub-layer. In both cases, it has only local effect: no notification is sent to the remote end.

The Component sub-layer uses the cancel facility to inform the TC-user that the timer associated with a class 1, 2 or 3 operation has expired; the TC-L-CANCEL indication primitive is used for this purpose. The timer is run for all classes, but the reporting for class 4 operations is a local matter.

The TC-user uses the TC-U-CANCEL request primitive to inform the local Component sub-layer of a cancel decision. No component is sent.

Table 12/Q.771 describes the TC-CANCEL primitives.

TABLE 12/Q.771

TC-CANCEL Primitives

Parameter	Primitive	
	TC-L-CANCEL indication	TC-U-CANCEL request
Dialogue ID	M	M
Invoke ID	M	M

3.1.3.7 *Grouping of Components inside a Message*

A sequence of components is obtained by passing one or several components with a given Dialogue ID to the Component Sub-layer between two successive requests for transmission (TC-BEGIN, TC-CONTINUE or TC-END request primitives), or before the first one (TC-BEGIN request), using the same Dialogue ID, or the only request for transmission (i.e. TC – UNI).

At the originating side, a list of components is delimited by TC-UNI, TC-BEGIN, TC-CONTINUE or TC-END request primitives.

At the destination side, a sequence of components starts with a primitive indicating transmission; its end is indicated by the "Last Component" parameter of the primitives which deliver components to a TC-user. The "Components Present" parameter in the transmission primitive indicates whether the sequence is empty, or not.

Note – Components grouped inside a message are delivered to the remote end in the same order as they are provided by the TC-user at the originating end.

3.1.4 *Abnormal situations*

3.1.4.1 *Reject of a Component by the Component sub-layer*

When detecting that a received component is invalid, the Component sub-layer notifies the local TC-user by means of the TC-L-REJECT indication primitive. This primitive indicates the cause of the reject (Problem Code parameter) with sufficient information to make the retention of the failed component superfluous: whenever possible the Component Type and Component ID are indicated; otherwise a "general problem" cause is indicated. This information is passed to the TC-user, and also retained in the Component sub-layer which uses it to form a reject component.

Any type of component can be rejected. When the component to be rejected is itself identified as a reject component, rejection is purely local; when the rejected component is identified as an invoke or a result, the whole corresponding operation is considered as terminated; when it is a linked operation, this linked operation is terminated, but the linked-to operation is not affected.

When informed of a Component sub-layer reject, the local TC-user may decide to continue the exchange of components. If so, the remote TC-user is informed through the reject component sent when the local TC-user issues the next dialogue handling primitive.

If the Component sub-layer generated reject combined with accumulated components from the TC-user exceeds the message length limitations, then the TC-user, being aware of the reject component, must initiate two dialogue handling primitives. The Component sub-layer, also being aware of the length problem, will send all the components, except the reject, with the first primitive. The reject will be sent with the next dialogue handling primitive together with any further components provided by the TC-user.

Table 13/Q.771 describes the primitives used in relation with TCAP component rejection.

TABLE 13/Q.771

Component sub-layer rejection primitive

Parameter	Primitive	
	TC-L-REJECT indication	TC-R-REJECT indication
Dialogue ID	M	M [a]
Invoke ID	O	O
Problem code	M	M
Last component		M

[a] Mandatory except for rejection of invocation of a class 4 operation received in a unidirectional message.

3.1.4.2 *Dialogue abort*

Due to an abnormal situation, an underlying (sub-)layer may decide to abort the association between users; the dialogue has then to be aborted. All associated operations are terminated, and the TC-users are notified by means of TC-P-ABORT indication primitives. The P-abort parameter contains the cause for which it was decided to abort the dialogue.

The Component sub-layer does not decide on dialogue abort.

Table 14/Q.771 describes the TC-P-ABORT primitive.

TABLE 14/Q.771

Primitive for TCAP Abort

Parameter	Primitive
	TC-P-ABORT indication
Dialogue ID	M
P-abort	M

3.1.5 *Component states and state transition diagrams*

For a given component ID, component correlation takes place only at the side which originates the operation; for this ID, component states and state transition diagrams are defined at this side only. The other side just reflects the value of the component ID in an Invoke or a Linked ID.

The following states are defined:

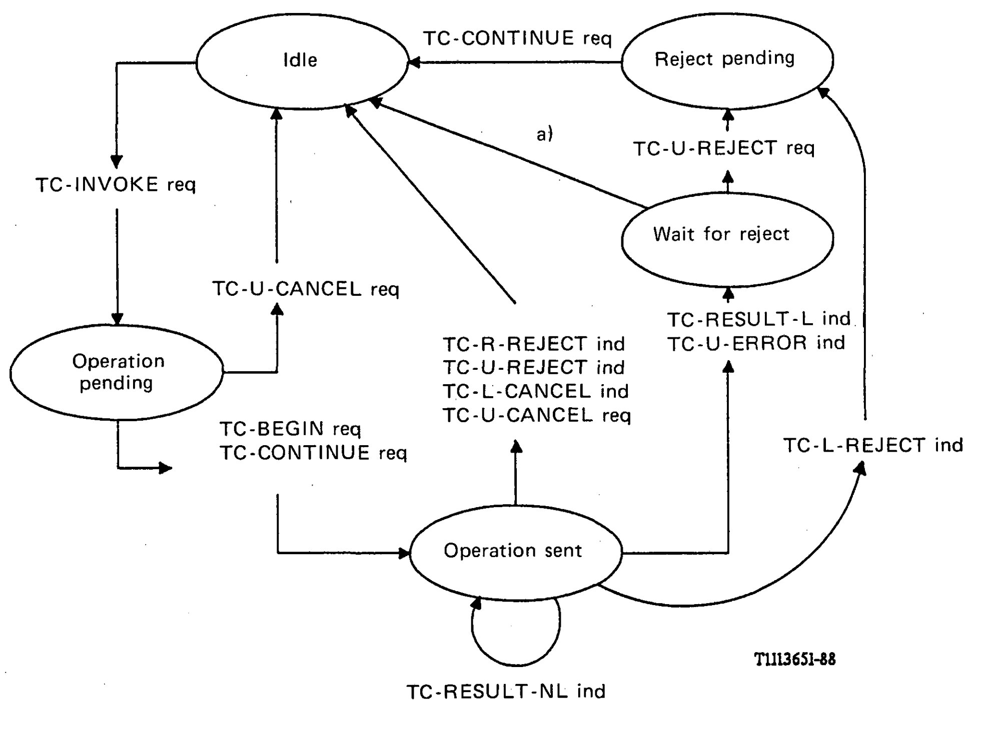
- Idle: no activity associated with the component ID
- Operation Pending: an operation has been passed to the Component sub-layer, but no request for transmission has been issued
- Operation Sent: an operation has been transmitted to the remote end, but no result has been received
- Wait for Reject: the result has been received; TCAP is waiting for its possible rejection by the TC-user
- Reject pending: reject of the result has been requested by the TC-user, but no request for transmission has been issued.

State transition diagrams are defined for the four classes of operations.

Note 1 – Each of these diagrams corresponds to one component ID: the one indicated in the Invoke ID parameter; linked operations do not alter the state machine of the linked-to operation.

Note 2 – TC-END request or indication primitives, TC-U-ABORT request or indication primitives, or the TC-P-ABORT indication primitive cause return to the "Idle" state of any component ID associated with the dialogue. Corresponding transitions are not represented on the diagrams.

Class 1 operations (both success and failure reported)

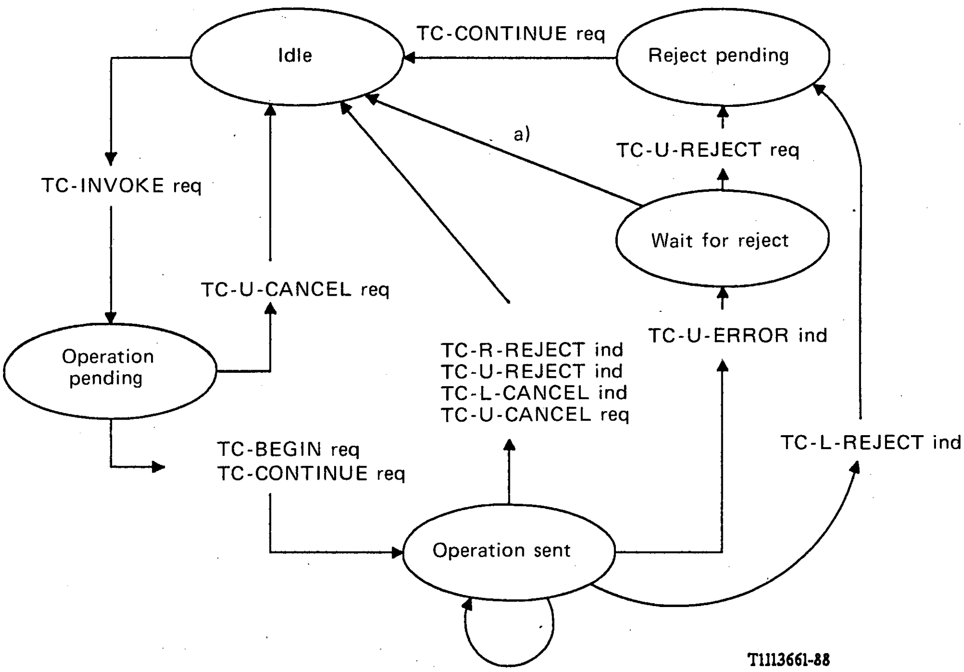


a) This transition is based on an implementation-dependent mechanism. The TC-user is not formed in this case.

FIGURE 5/Q.771

State transition diagram for Class 1 operations

Class 2 operations (only failure reported)

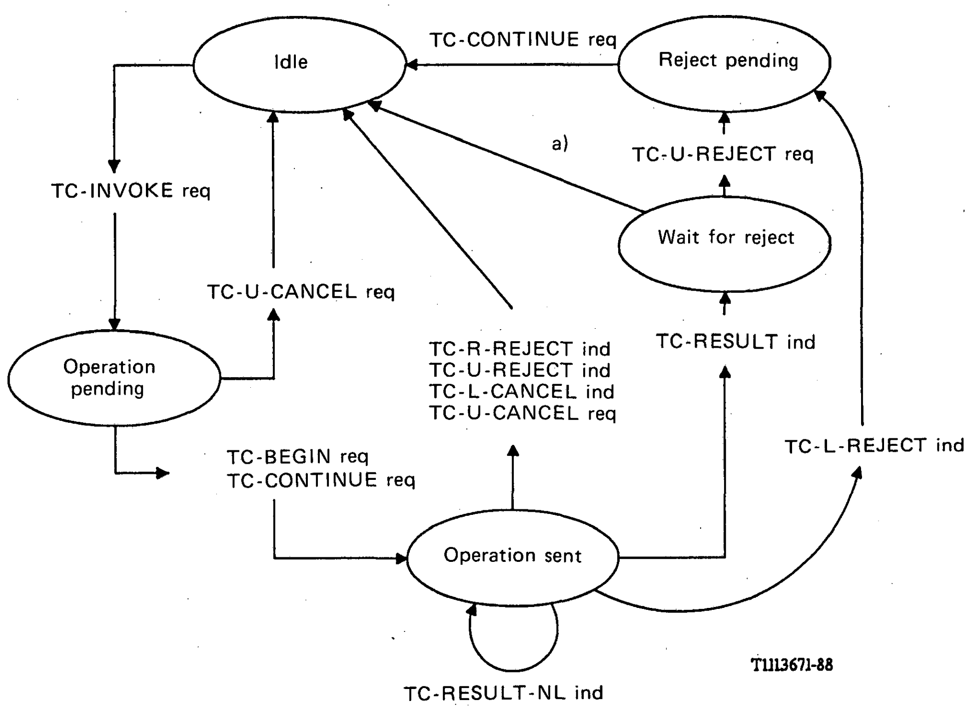


a) This transition is based on an implementation-dependent mechanism. The TC-user is not informed in this case.

FIGURE 6/Q.771

State transition diagram for Class 2 operations

Class 3 operations (only success reported)

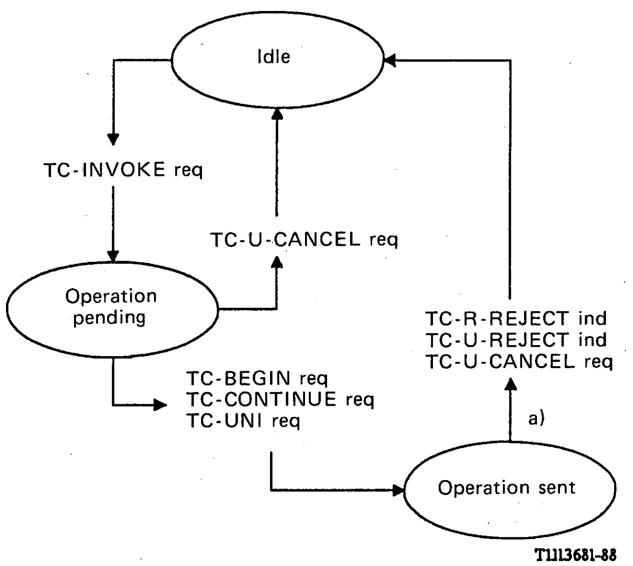


a) This transition is based on an implementation-dependent mechanism. The TC-user is not informed in this case.

FIGURE 7/Q.771

State transition diagram for Class 3 operations

Class 4 operations (neither success nor failure reported)



a) This transition can occur as a result of operation timeout expiry. Notification to the TC-user is a local matter.

FIGURE 8/Q.771

State transition diagram for Class 4 operations

3.1.6 *Mapping of Component sub-layer onto Transaction sub-layer*

When mapping the Component sub-layer onto the Transaction sub-layer, a one to one mapping exists between a dialogue and a transaction explicity in the case of a structured dialogue, or implicitly in the case of an unstructured dialogue. It follows that there is a one to one relationship between dialogue handling primitives of the Component sub-layer and transaction handling primitives in the Transaction sub-layer; similar generic names have been chosen for the primitives to reflect this. The component handling primitives of the Component sub-layer have no counterpart in the Transaction sub-layer.

The correspondence between the two sub-layers is further described in Recommendation Q.774.

3.2 *Transaction Sub-layer*

3.2.1 *Overview of Transaction Sub-layer primitives*

Table 15/Q.771 gives an overview of the primitives between the TR users and the Transaction sub-layer. A detailed description of these primitives and their parameters is given in the next sections. For each primitive, Table 15/Q.771 indicates the relevant section.

TABLE 15/Q.771

Primitives for the transaction sub-layer

Name	Type	Section
TR-UNI	Request indication	3.2.2
TR-BEGIN	Request indication	3.2.3
TR-CONTINUE	Request indication	3.2.4
TR-END	Request indication	3.2.5
TR-U-ABORT	Request indication	3.2.5.3
TR-P-ABORT	Indication	3.2.6.1

Definition of the parameters:

"Quality of Service": the TR-user indicates the preferred quality of service. This is for further study.

"Destination Address": identifies the destination TR-user.

"Originating Address": identifies the originating TR-user.

"P-abort": indicates the cause of the abort of a transaction by TCAP.

"Reason": indicates the nature of an abnormal situation.

"Transaction ID": a transaction is identified by a separate transaction ID at each end.

"Termination": identifies the termination scenario chosen for the transaction (prearranged or basic).

"User Abort Information": information related to a TR-user abort.

"User Data": contains the information to be passed between TR-users.

3.2.2 *Information Transfer In Unstructured Dialogue*

Information may be sent from one TR – user to another TR-user without establishing an explicit association. In this case, the transaction sub-layer considers that there is no relationship among messages transmitted by this means.

The corresponding primitives are the TR-UNI request and indication primitives, described in Table 16/Q.771.

TABLE 16/Q.771

TR-UNI Primitives

Parameter	Primitive: TR-UNI	
	Request	Indication
Quality of service	FS	–
Destination address	M	M [a)]
Originating address	M [a)]	M (=)
User data	M	M (=)

[a)] This parameter may be implicitly associated with the access point at which the primitive is issued.

3.2.3 *Transaction begin*

The transaction begin facility starts a transaction between two TR-users. This may be accompanied by the transfer of TR-user information (called user data in the following).

In order to begin a transaction, a TR-user issues the TR-BEGIN request primitive.

At the destination side, the TR-BEGIN indication primitive is used to inform the destination TR-user of the beginning of a transaction, and to deliver any accompanying user data.

Table 17/Q.771 describes the transaction begin primitives.

TABLE 17/Q.771

Primitives for transaction begin

Parameter	Primitive: TR-BEGIN	
	Request	Indication
Quality of service	FS	FS
Destination address	M	M [a)]
Originating address	M [a)]	M (=)
Transaction ID	M	M
User data	O	O (=)

[a)] This parameter may be implicitly associated with the access point at which the primitive is issued.

Figure 9/Q.771 shows the transaction state transitions during transaction begin. The following states are introduced:

- Idle (I): the transaction does not exist
- Init Sent (IS): the transaction just started at the originating side
- Init Received (IR): the transaction just started at the destination side.

```
        TR-BEGIN req                                        TR-BEGIN ind

IS <-----------------              I              -----------------> IR
```

FIGURE 9/Q.771

State transitions for transaction begin

3.2.4 *Transaction continuation*

Transaction continuation allows two TR-users to exchange messages in both directions inside a transaction. The TR-CONTINUE primitives are used for this purpose. They are described by Table 18/Q.771.

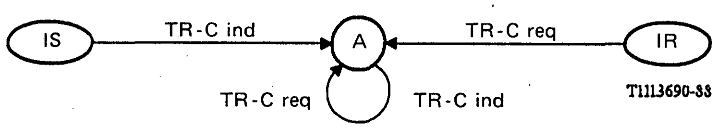
The Transaction sub-layer does not provide segmentation/reassembly or flow control.

State transitions associated with the continuation of a transaction are represented on Figure 10/Q.771, where state A (Active) indicates that the transaction was accepted by the remote end, and the transaction can be used to exchange messages in both directions.

TABLE 18/Q.771

Transaction Continuation Primitives

Parameter	Primitive: TR-CONTINUE	
	Request	Indication
Transaction ID	M	M
User Data	O	O (=)



Note – TR-C stands for TR-CONTINUE.

FIGURE 10/Q.771

State transitions for transaction continuation

3.2.5 *Transaction End*

Three facilities are provided to a TR-user to end a transaction:

– prearranged end

– basic end

– abort.

The first two facilities use the TR-END primitives; the Termination parameter indicates which option is selected. The TR-END primitives are described by Table 19/Q.771.

The last facility uses the TR-U-ABORT primitives described by Table 20/Q.771.

TABLE 19/Q.771

TR-END primitives

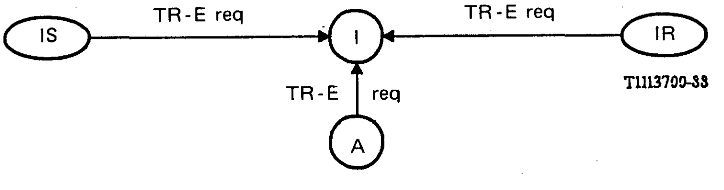
Parameter	Primitive: TR-END	
	Request	Indication
Transaction ID	M	M
Termination	M	
User data	O	O (=)

3.2.5.1 *Prearranged end*

When prearranged end has been selected, the procedure is purely local. Each TR-user may decide to end the transaction at any point in time, regardless of the current transaction state. The TR-END request primitive only is used: the remote TR-user is not informed, and should request transaction end on its own.

The User Data parameter should not be present in this case.

Figure 11/Q.771 shows the transaction state transitions for prearranged end of a transaction. The states are those defined in 3.2.3 and 3.2.4 above.



Note – TR-E stands for TR-END.

FIGURE 11/Q.771

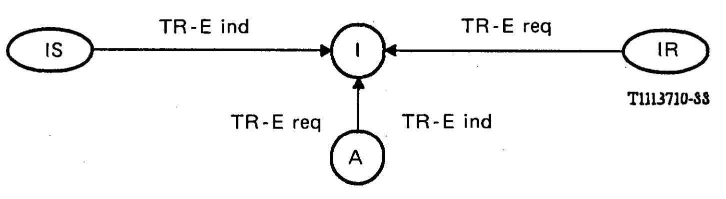
State transitions for the prearranged end of a transaction

3.2.5.2 *Basic end*

When basic termination has been selected, the TR-user requests the end of the transaction by issuing the TR-END request primitive indicating this option; the primitive may then contain User Data which is sent to the peer entity.

At the destination side, the TR-END indication primitive is used to inform the TR-user of the end of the transaction, and deliver any accompanying User Data.

Figure 12/Q.771 shows the transaction state transitions for the basic end of transaction. The states are those defined in §§ 3.2.3 and 3.2.4 above.



Note – TR-E stands for TR-END.

FIGURE 12/Q.771

State transitions for the basic end of a transaction

3.2.5.3 *Transaction Abort by the TR-user*

A TR-user may request the abort of a transaction at any moment; it uses for this purpose the TR-U-ABORT request primitive, which may optionally contain the cause of the abort, and/or additional end to end information. This information is contained in the User Abort Information parameter: it is transmitted without analysis to the peer entity. Any messages of the transaction for which transmission is pending are discarded.

A TR-user is informed of the decision of its peer entity to abort the transaction by means of the TR-U-ABORT indication primitive.

TR-U-ABORT primitives are described by Table 20/Q.771.

TABLE 20/Q.771

TR-U-ABORT Primitives

Parameter	Primitive: TR-U-ABORT	
	Request	Indication
Transaction ID	M	M
User Abort Information	O	O (=)

3.2.6 *Abnormal situations*

3.2.6.1 *Abort by the Transaction Sub-layer*

The abort facility may be invoked by the Transaction sub-layer in reaction to abnormal situations. The possible reasons for such a decision are indicated in Recommendation Q.774.

Transaction abort causes the abandonment of any message of the transaction for which transmission is pending.

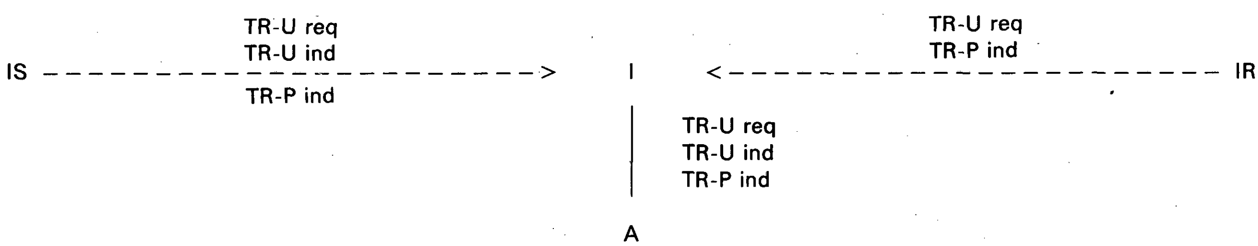
Transaction abort is made by means of the TR-P-ABORT indication primitive described by Table 21/Q.771.

TABLE 21/Q.771

Transaction sub-layer abort primitive

Parameter	Primitive
	TR-P-ABORT indication
Transaction ID	M
P-abort	M

Figure 13/Q.771 shows the state transitions for transaction abort. The states are those defined in §§ 3.2.3 and 3.2.4 above.



Note – TR-P stands for TR-P-ABORT, TR-U for TR-U-ABORT.

FIGURE 13/Q.771

State transitions for transaction abort

3.3 *Services provided by the ISP*

No additional service is provided by the ISP when the TC-service is based on a connectionless network service.

3.4 *Services assumed from the connectionless network layer*

In the Signalling System No. 7 environment, the services assumed from the SCCP are those defined in Recommendation Q.711, § 2.2 (SCCP Connectionless Services, class 0 or class 1).

Relations of TC with the SCCP management require further study.

4 Service provided by TC based on a connection-oriented network service

For further study.

TRANSACTION CAPABILITIES INFORMATION ELEMENT DEFINITIONS

1 General

This Recommendation describes the individual information elements and parameters used within Transaction Capabilities messages. The encoding and formatting of these elements are shown in Recommendation Q.773.

The meaning of each information element is described in general terms.

For TC based upon a connectionless network service, the current TC is equivalent to the Transaction Capabilities Application Part (TCAP).

The TCAP message format consists of two parts, namely the transaction portion and the component portion. Information in the component portion concerns individual operations and their replies. The transaction portion contains protocol control information for the transaction sub-layer.

For a more detailed analysis of the architecture, see Figure 3/Q.771, and associated text.

2 Transaction portion

The transaction portion of a TC message may contain the following information elements, viz:

2.1 *Message type*

Five types of messages are defined for the transaction portion as follows:

2.1.1 *Unidirectional*

This message is used when there is no need to establish a transaction with another peer TR-User.

2.1.2 *Begin*

This message is used to initiate a transaction with another peer TR-User.

2.1.3 *End*

This message is used to terminate a transaction with another peer TR-User.

2.1.4 *Continue*

This message is used to complete the establishment of a transaction and to continue an established transaction.

2.1.5 *Abort*

This message is used to terminate a transaction following an abnormal situation detected by the transaction sub-layer (the service provider), or to abort a transaction by the TR-User (the service user).

2.2 *Transaction IDs*

Transaction IDs are independently assigned by each of the two nodes communicating via a transaction, enabling each node to uniquely identify the transaction and associate the entire contents of the message with that particular transaction. There are two types of Transaction IDs, viz:

2.2.1 *Originating Transaction ID*

The Originating Transaction ID is assigned by the node sending a message, and is used to identify the transaction at that end.

2.2.2 *Destination Transaction ID*

The Destination Transaction ID identifies the transaction at the receiving end. The first Originating Transaction ID value received is reflected as the Destination Transaction ID value.

2.3 *P-Abort Cause*

This is used when the transaction sub-layer aborts a transaction.

P-Abort cause definitions are as follows:

2.3.1 *Unrecognized Message Type*

The message type is not one of those defined in §§ 2.1.1 to 2.1.5 above.

2.3.2 *Unrecognized transaction ID*

A transaction ID has been received for which a transaction does not exist at the receiving node.

2.3.3 *Badly formatted transaction portion*

The transaction portion of the received message does not conform to the X.209 encoding rules as outlined in Recommendation Q.773, § 3.

2.3.4 *Incorrect transaction portion*

The elemental structure within the transaction portion of the received message, does not conform to the rules for the transaction portion defined in Recommendation Q.773 § 5.

2.3.5 *Resource limitation*

Sufficient resources are not available.

2.4 *User abort information*

This is used to pass User Specified Information by the TR-User when it aborts a transaction.

2.5 *Component portion*

This contains the component portion. When the component portion is empty this information element is not present.

3 **Component Portion**

The Component Portion contains the following types of information elements. They are delivered to the user at the receiving end in the same order in which they were received from the user at the originating end.

3.1 *Component type*

There are five types of component that may be present in the Component Portion of a TC message. The four Protocol Data Units (PDUs) defined inRecommendation X.229 are used, viz:

TCAP component	X.229 PDU
Invoke	ROIV
Return result (last)	RORS
Return error	ROER
Reject	RORJ

The remaining component type - Return Result (Not Last) - is defined by TCAP.

These component types are defined as follows:

3.1.1 *Invoke*

The invoke component requests that an operation be performed. It may be linked to another operation invocation previously sent by the other end.

3.1.2 *Return result (Not Last)*

When TC uses a connectionless Network Service, it may be necessary for the TC-User to segment the result of an operation. In this case this component is used to convey each segment of the result except the last, which is conveyed in a Return Result (Last) component.

3.1.3 *Return result (Last)*

The Return Result (Last) component reports successful completion of an operation. It may contain the last/only segment of a result.

3.1.4 *Return error*

The Return Error component reports that an operation has not been successfully completed.

3.1.5 *Reject*

The Reject component reports the receipt and rejection of an incorrect component, other than a Reject component. The possible causes for rejecting a component are defined by the Problem Code element in § 3.8.

3.2 *Invoke ID*

An Invoke ID is used as a reference number to identify uniquely a request for an operation. It is present in any reply to an Invoke component (Return Result, Return Error or Reject), enabling the reply to be correlated with the invoke.

3.3 *Linked ID*

A Linked ID is included in an invoke component by a node when it responds to an operation invocation with a linked operation invocation. The node receiving the Linked ID uses it for correlation purposes, in the same way that it uses the invoke ID in Return Result, Return Error and Reject components.

3.4 *Operation code*

The Operation Code element indicates the precise operation to be invoked, and is present in an invoke component type. The operation may be a local operation or a global operation. A local operation can be used in one ASE only. The same global operation can be used in several different ASEs.

The actual operation codes, the definition of the operations and their associated parameters, are defined in relevant ASE specifications. The component sub-layer does not set or examine the operation code value, nor which parameters are present, nor the parameter values.

3.5 *Set (of parameters)*

The Set element is used to contain a set of parameters accompanying a component. It is required in the case of more than one parameter being included in a component. The parameters themselves are defined in relevant ASE specifications.

3.6 *Sequence (of parameters)*

The Sequence element is used similarly to the Set element, except that a specific sequence of parameters is included in the component.

3.7 *Error code*

The Error Code element contains the reason why an operation cannot be completed successfully. It is present only in a Return Error component. As with operations, errors may be local or global.

These errors and associated parameters are defined in relevant ASE specifications.

3.8 *Problem code*

The Problem code element contains the reason for the rejection of a component, and one such element is present in a Reject component. Four problem code elements are defined, viz:

3.8.1 *General problem*

This element contains one of the problem codes which apply to the component sub-layer in general, and which do not relate to any specific component type. All of these are generated by the component sub-layer. They are:

3.8.1.1 *Unrecognized component*

The component type is not recognized as being one of those defined in § 3.1.

3.8.1.2 *Mistyped component*

The elemental structure of a component does not conform to the structure of that component as defined in Recommendation Q.773 § 6.

3.8.1.3 *Badly structured component*

The contents of the component do not conform to the encoding rules defined in Recommendation Q.773 § 3.

3.8.2 *Invoke problem*

This element contains one of the problem codes which relate only to the invoke component type. They are:

3.8.2.1 *Duplicate invoke ID*

The invoke ID is already in use by a previously invoked operation. This code is generated by the TC-User.

3.8.2.2 *Unrecognized operation*

The operation code value is not one of those used by the ASE. This code is generated only by the TC-User.

3.8.2.3 *Mistyped parameter*

A parameter tag is not one of those associated with the operation invoked. This code is generated only by the TC-User.

3.8.2.4 *Resource limitation*

Sufficient resources are not available to perform the operation requested. This code is generated by the TC-User.

3.8.2.5 *Initiating release*

The operation requested cannot be invoked as the dialogue is about to be released. This code is generated only by the TC-User.

3.8.2.6 *Unrecognized linked ID*

The linked ID does not correspond to a previously invoked operation. This code is generated only by the component sub-layer.

3.8.2.7 *Linked response unexpected*

The operation referred to by the linked ID is not an operation for which linked invokes are allowed. This code is generated only by the TC-User.

3.8.2.8 *Unexpected linked operation*

The linked operation is not one of those that the operation referred to by the linked ID allows. This code is generated only by the TC-User.

3.8.3 *Return result problem*

This element contains one of the problem codes which relate only to the return result component type. They are:

3.8.3.1 *Unrecognized invoke ID*

No operation with the specified invoke ID is in progress. This code is generated by the component sub-layer.

3.8.3.2 *Return result unexpected*

The invoked operation does not report success. This code is generated by the component sub-layer.

3.8.3.3 *Mistyped parameter*

A parameter tag is not one of those associated with the outcome of the operation. This code is generated only by the TC-User.

3.8.4 *Return error problem*

This element contains one of the problem codes which relate only to the return error component type. They are:

3.8.4.1 *Unrecognized invoke ID*

No operation with the specified invoke ID is in progress. This code is generated by the component sub-layer.

3.8.4.2 *Return error unexpected*

The invoked operation does not report failure. This code is generated by the component sub-layer.

3.8.4.3 *Unrecognized error*

The reported error is not one of those defined for the ASE. This code is generated by the TC-User.

3.8.4.4 *Unexpected error*

The received error is not one of those which the invoked operation may report. This code is generated by the TC-User.

3.8.4.5 *Mistyped parameter*

A parameter tag is not one of those associated with the outcome of the operation. This code is generated only by the TC-User.

TRANSACTION CAPABILITIES FORMATS AND ENCODING

1 Introduction

This Recommendation provides the format and encoding of Transaction Capabilities Application Part (TCAP) messages. Formats and Encoding for the Intermediate Service Part (ISP) are for further study. This Recommendation is based on the encoding rules provided in CCITT Recommendation X.209 and is consistent with that Recommendation.

2 Description conventions

This Recommendation does not use Recommendation X.209 formal description language. This Recommendation uses the description method of other Q.700 series Recommendations. Annex A uses the formal decription language to supplement this Recommendation.

3 Standard representation

3.1 *General message structure*

Each information element within TCAP message has the same structure. An information element consists of three fields, which always appear in the following order. The Tag distinguishes one type from another and governs the interpretation of the Contents. The Length specifies the length of the Contents. The Contents is the substance of the element, containing the primary information the element is intended to convey. Figure 1/Q.733 shows an overview of a TCAP message and an information element.

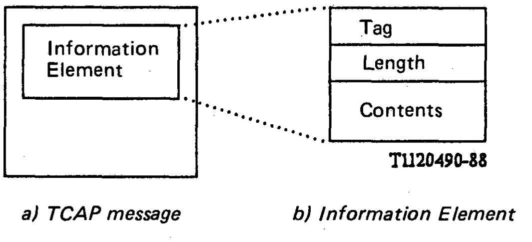


FIGURE 1/Q.773

Structure of TCAP message and information element

Each field is coded using one or more octets. Octets are labelled as shown in Figure 2/Q.773. The first octet is the first transmitted. Bits in an octet are labelled as shown in Figure 3/Q.773, with bit A the least significant and the first transmitted.

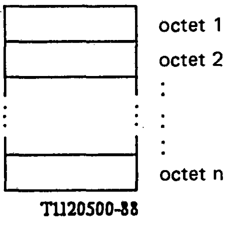


FIGURE 2/Q.773

Octet labelling scheme

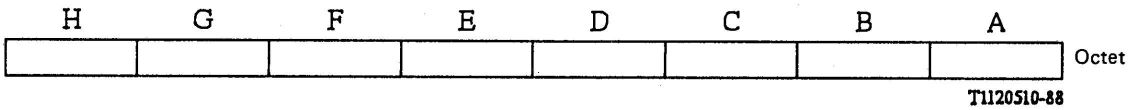


FIGURE 3/Q.773

Bit labelling scheme

The contents of each element is either one value (Primitive) or one or more information elements (Constructor), as shown in Figure 4/Q.773.

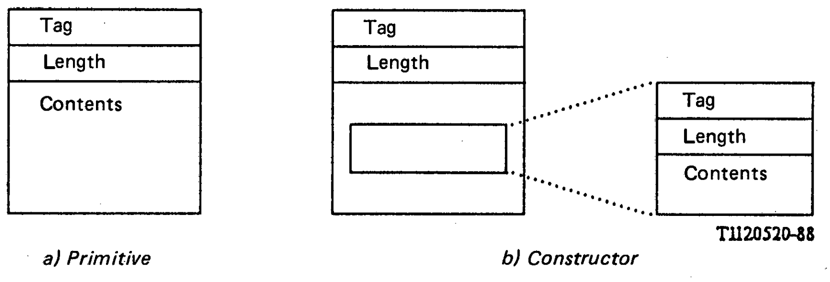
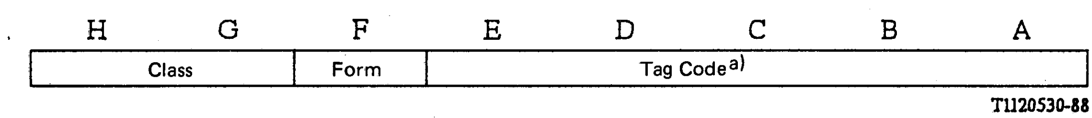


FIGURE 4/Q.773

Types of contents

3.2 *Tag*

An information element is first interpreted according to its position within the syntax of the message. The Tag distinguishes one information element from another and governs the interpretation of the Contents. It is one or more octets in length. The Tag is composed of "Class", "Form" and "Tag code", as shown in Figure 5/Q.773.



a) The Tag code may be extended to the following octet(s) as discussed in § 3.2.

FIGURE 5/Q.773

Format of tag

3.2.1 *Tag class*

All Tags use the two most significant bits (H and G) to indicate the Tag Class. These bits are coded as shown in Table 1/Q.773.

TABLE 1/Q.773

Coding of tag class

Class	Coding (HG)
Universal	00
Application-wide	01
Context-specific	10
Private use	11

The universal class is used for Tags that are exclusively standardized in CCITT Recommendation X.209 and are application independent types. Universal Tags may be used anywhere a universal information element type is used. The universal class applies across all CCITT Recommendations, i.e. across CCITT No. 7 ASEs, X.400 MHS, etc.

The Application-wide class is used for information elements that are standardized across all applications (ASEs) using CCITT No. 7 TC, i.e. TC-Users.

The Context-specific class is used for information elements that are specified within the context of the next higher construction and take into account the sequence of other data elements within the same construction. This class may be used for tags in a construction, and the tags may be re-used in any other construction.

The Private Use class is reserved for information elements specific to a nation, a network or a private user. Such information elements are beyond the scope of the TC Recommendations.

The Tag codes of the Application-wide class not assigned in this Recommendation are reserved for future use.

3.2.2 *Form of the element*

Bit F is used to indicate whether the element is "Primitive" or "Constructor", as is shown in Table 2/Q.773. A primitive element is one whose structure is atomic (i.e. one value only). A constructor element is one whose content is one or more information elements which may themselves be constructor elements.

Both forms of elements are shown in Figure 4/Q.773.

TABLE 2/Q.773

Coding element form

Element form	Coding (F)
Primitive	0
Constructor	1

3.2.3 *Tag code*

Bits A to E of the first octet of the Tag plus any extension octets represent a Tag code that distinguishes one element type from another of the same class. Tag codes in the range 00000 to 11110 (0 to 30 decimal) are provided in one octet.

The extension mechanism is to code bits A to E of the first octet as 11111. Bit H of the following octet serves as an extension indication. If bit H of the extension octet is set to 0, then no further octets for this tag are used. If bit H is set to 1, the following octet is also used for extension of the Tag code. The resultant Tag consists of bits A to G of each extension octet, with bit G of the first extension octet being most significant and bit A of the last extension octet being least significant. Tag code 31 is encoded as 0011111 in bits G to A of a single extension octet. Higher tag codes continue from this point using the minimum possible number of extension octets.

Figure 6/Q.773 shows the detailed format of the Tag code.

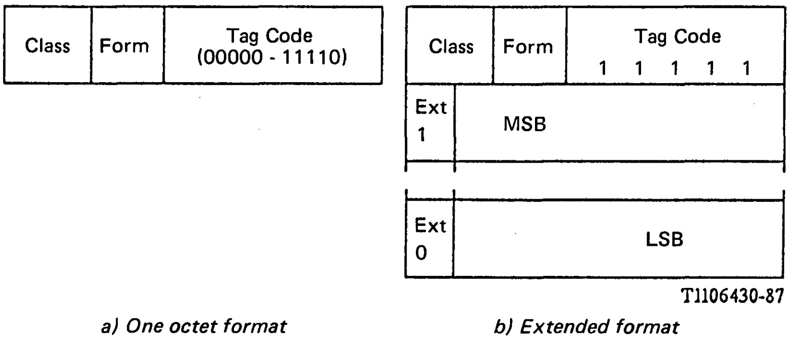


FIGURE 6/Q.773

Format of the tag code

3.3 *Length of the Contents*

The Length of the Contents is coded to indicate the number of octets in the Contents. The length does not include the Tag nor the Length of the Contents octets.

The Length of the Contents uses the short, long or indefinite form. If the length is less than 128 octets, the short form is used. In the short form, bit H is coded 0, and the length is encoded as a binary number using bits A to G.

If the Length of the contents is greater than 127 octets, then the long form of the Length of the Contents is used. The long form Length is from 2 to 127 octets long. Bit H of the first octet is coded 1, and bits A to G of the first octet encode a number one less than the size of the Length in octets as an unsigned binary number whose MSB and LSB are bits G and A, respectively. The length itself is encoded as an unsigned binary number whose MSB and LSB are bit H of the second octet and bit A of the last octet, respectively. This binary number should be encoded in the fewest possible octets, with no leading octets having the value 0.

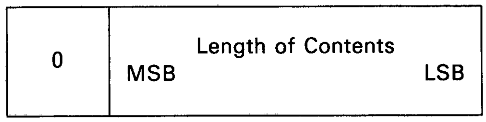
The indefinite form is one octet long and may (but need not) be used in place of the short or long form, whenever the element is a constructor. It has the value 10000000. When this form is employed, a special end-of-contents (EOC) indicator terminates the Contents.

There is no notation for the end-of-contents indicator. Although considered part of the Contents syntactically, the end-of-contents indicator has no semantic significance.

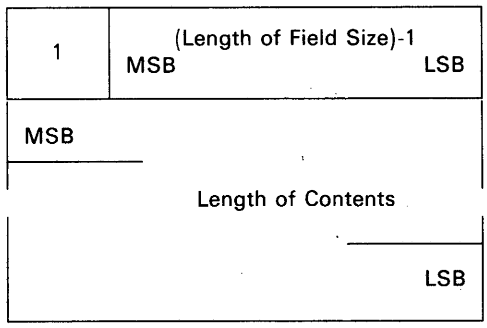
The representation for the end-of-contents indicator is an element whose class is universal, whose form is primitive, whose ID Code has the value 0, and whose Contents is unused and absent:

EOC	Length	Contents
00(hex)	00(hex)	Absent

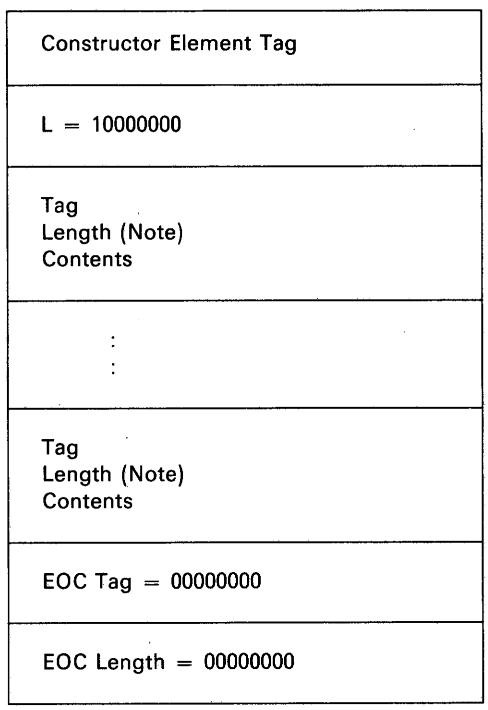
Figure 7/Q.773 shows the formats of the Length field described above. The maximum value that may be encoded is constrained by the network message size limitations in the connectionless case. Limitations in the connection-oriented case are for further study.



a) Short form



b) Long form



c) Indefinite form

Note – The Length may take any of three forms: short, long, and indefinite.

FIGURE 7/Q.773

Format of length field

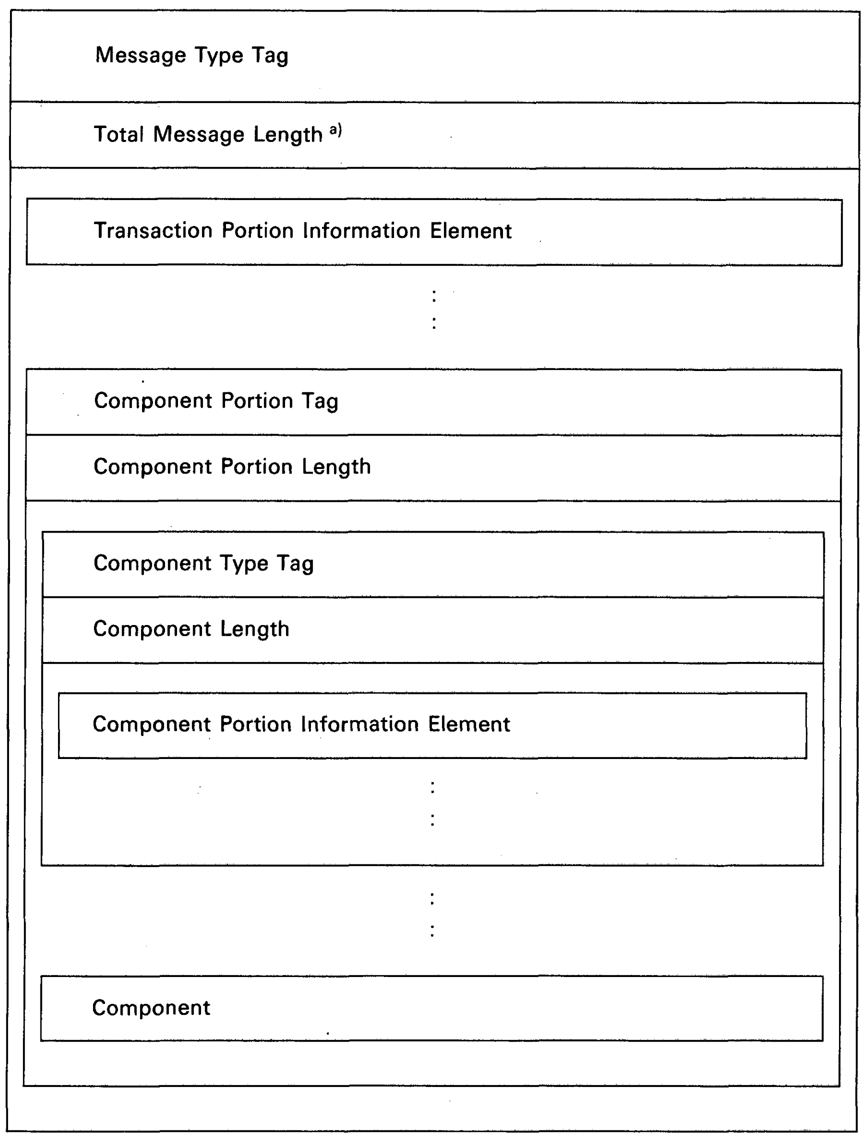
3.4 *Contents*

The contents is the substance of the element and contains the information the element is intended to convey. Its length is variable, but always an integral number of octets. The contents is interpreted in a type-dependent manner, i.e. according to the tag value.

4 TCAP message structure

A TCAP message is structured as a single constructor information element. It consists of a Transaction Portion which contains information elements used by the Transaction sub-layer, and a Component Portion which contains information elements used by the Component sub-layer. One of the Transaction Portion elements is called the Component Portion, and it contains the Component sub-layer information elements. Each Component is a constructor information element.

Figure 8/Q.773 shows the detailed TCAP message structure described above.



[a)] The user should be aware of total message length limitations when using TCAP in the SS No. 7 connectionless environment.

FIGURE 8/Q.773

Detailed TCAP message structure

5 Transaction Portion

Transaction Portion information elements use the Application Wide class as defined in § 3.2.1.

5.1 *Structure of the Transaction Portion*

The Transaction Portion fields for various message types are shown in Tables 3/Q.773 to 8/Q.773.

TABLE 3/Q.773

Transaction Portion fields
Unidirectional message type

Element Form	Fields of Transaction Portion	Mandatory Indication
Constructor	Message Type tag Total message length [a]	Mandatory
Constructor	Component Portion tag Component Portion length	Mandatory
Constructor	One or more Components (Not a part of Transaction Portion) (Described in § 6)	Mandatory

[a] See Note [a] to Figure 8/Q.773.

TABLE 4/Q.773

Transaction portion fields
Begin message type

Element Form	Fields of Transaction Portion	Mandatory Indication
Constructor	Message type tag Total message length [a]	Mandatory
Primitive	Originating Transaction ID tag Transaction ID length Transaction ID	Mandatory
Constructor	Component Portion tag Component Portion length	Mandatory [b]
Constructor	One or more Components (Not a part of Transaction Portion) (Described in § 6)	Optional

[a] See Note [a] to Figure 8/Q.773.

[b] The Component Portion tag is not required if there are no Components being sent in the message.

TABLE 5/Q.773

Transaction Portion fields
End message type

Element Form	Fields of Transaction Portion	Mandatory Indication
Constructor	Message type tag Total message length [a)]	Mandatory
Primitive	Destination Transaction ID tag Transaction ID length Transaction ID	Mandatory
Constructor	Component Portion tag Component Portion length	Mandatory [b)]
Constructor	One or more Components (Not a part of Transaction Portion) (Described in § 6)	Optional

[a)] See Note [a)] to Figure 8/Q.773.

[b)] See Note [b)] to Table 4/Q.773.

TABLE 6/Q.773

Transaction Portion fields
Continue message type

Element Form	Fields of Transaction Portion	Mandatory Indication
Constructor	Message type tag Total message length [a)]	Mandatory
Primitive	Originating Transaction ID tag Transaction ID length Transaction ID	Mandatory
Primitive	Destination Transaction ID tag Transaction ID length Transaction ID	Mandatory
Constructor	Component Portion tag Component Portion length	Mandatory [b)]
Constructor	One or more Components (Not a part of Transaction Portion) (Described in § 6)	Optional

[a)] See Note [a)] to Figure 8/Q.773.

[b)] See Note [b)] to Table 4/Q.773.

TABLE 7/Q.773

Transaction Portion fields
Abort message type (P-Abort)

Element Form	Fields of Transaction Portion	Mandatory Indication
Constructor	Message type tag Total message length [a]	Mandatory
Primitive	Destination Transaction ID tag Transaction ID length Transaction ID	Mandatory
Primitive	P-Abort Cause tag P-Abort Cause length P-Abort Cause	Mandatory [b]

[a] See Note [a] to Figure 8/Q.773.

[b] P-Abort Cause is only present when the Abort is generated by the Transaction sub-layer.

TABLE 8/Q.773

Transaction Portion fields
Abort message type (U-Abort)

Element Form	Fields of Transaction Portion	Mandatory Indication
Constructor	Message type tag Total message length [a]	Mandatory
Primitive	Destination Transaction ID tag Transaction ID length Transaction ID	Mandatory
Constructor	User Abort Information tag User Abort Information length User Abort Information	Optional [b]

[a] See Note [a] to Figure 8/Q.773.

[b] The User Abort Information is optional, and may only be present when the Abort is generated by the TC-User.

5.2 *Message Type Tag*

This field consists of one octet and is mandatory for all TCAP messages. Message Type tags are coded as shown in Table 9/Q.773.

TABLE 9/Q.773

Coding of message type tag

Message type	H	G	F	E	D	C	B	A
Unidirectional	0	1	1	0	0	0	0	1
Begin	0	1	1	0	0	0	1	0
(reserved)	0	1	1	0	0	0	1	1
End	0	1	1	0	0	1	0	0
Continue	0	1	1	0	0	1	0	1
(reserved)	0	1	1	0	0	1	1	0
Abort	0	1	1	0	0	1	1	1

5.3 *Transaction ID tags*

Two types of Transaction IDs, i.e. Originating Transaction ID and Destination Transaction ID, may be used. Zero, one or two ID information elements are required depending upon the Message type used. Table 10/Q.773 depicts this relationship.

TABLE 10/Q.773

Transaction ID(s) in each message type

Message type	Originating ID	Destination ID
Begin	Yes	No
End	No	Yes
Continue	Yes	Yes
Abort	No	Yes

The Originating and Destinastion Transaction ID Tags are coded as shown in Table 11/Q.773.

TABLE 11/Q.773

Coding of Transaction ID tags

	H	G	F	E	D	C	B	A
Originating Transaction ID Tag	0	1	0	0	1	0	0	0
Destination Transaction ID Tag	0	1	0	0	1	0	0	1

The length of a Transaction ID is 1 to 4 octets.

5.4 *P-Abort Cause tag*

The P-Abort Cause tag is coded as shown in Table 12/Q.773.

TABLE 12/Q.773

Coding of P-Abort Cause tag

	H	G	F	E	D	C	B	A
P-Abort Cause Tag	0	1	0	0	1	0	1	0

The P-Abort cause values are coded as shown in Table 13/Q.773.

TABLE 13/Q.773

Coding of P-Abort Cause values

P-Abort Cause	H	G	F	E	D	C	B	A
Unrecognized Message Type	0	0	0	0	0	0	0	0
Unrecognized Transaction ID	0	0	0	0	0	0	0	1
Badly Formatted Transaction Portion	0	0	0	0	0	0	1	0
Incorrect Transaction Portion	0	0	0	0	0	0	1	1
Resource Limitation	0	0	0	0	0	1	0	0

5.5 *User Abort Information tag*

The User Abort Information element Tag is coded as shown in Table 14/Q.773.

TABLE 14/Q.773

Coding of User Abor Information tag

	H	G	F	E	D	C	B	A
User Abort Information tag	0	1	1	0	1	0	1	1

The TC-User may provide any information element desired as the contents of the User Abort Information element.

5.6 *Component Portion tag*

The Component Portion Tag is coded as shown in Table 15/Q.773.

TABLE 15/Q.773

Coding of Component Portion tag

	H	G	F	E	D	C	B	A
Component Portion Tag	0	1	1	0	1	1	0	0

6 Component Portion

The Component Portion, when present, consists of one or more Components. The Components are based on, and extended from, the Remote Operations Service Element (ROSE) Application Protocol Data Units (APDUs) of Recommendation X.229 as indicated in Section 3/Q.772.

6.1 *Component type tag*

Each Component is a sequence of information elements. The Component types, as defined for TCAP, have the structure indicated in the following tables.

The information elements for the various Components shown in Tables 16/Q.773 to 19/Q.773 are all mandatory except the Linked ID and the parameters. The parameter may be one of the following:

- A Sequence of parameters
- A Set of parameters
- A specific parameter with its own tag (i.e. not part of a sequence or set)
- Nothing at all (i.e. absent)

Section 6.4 and Table 24/Q.773 define the Sequence and Set tags.

TABLE 16/Q.773

Invoke component

Invoke component	Mandatory Indication
Component type tag Component length	M
Invoke ID tag Invoke ID length Invoke ID	M
Linked ID tag Linked ID length Linked ID	O
Operation Code tag Operation Code length Operation Code	M
Parameters	O

TABLE 17/Q.773

Return Result (Last) and Return Result (Not Last) components

Return Result (Last) and Return Result (Not Last) components	Mandatory Indication
Component type tag Component length	M
Invoke ID tag Invoke ID length Invoke ID	M
Sequence tag Sequence length	O [b]
Operation Code tag Operation Code length Operation Code	O [b]
Parameters	O [b]

[a] ROSE has only one APDU called Return Result. See § 3.1.2/Q.772.

[b] Omitted when no information elements are included in the parameters.

TABLE 18/Q.773

Return Error Component

Return Error component	Mandatory Indication
Component type tag Component length	M
Invoke ID tag Invoke ID length Invoke ID	M
Error Code tag Error Code length Error Code	M
Parameters	O

TABLE 19/Q.773

Reject component

Reject component	Mandatory Indication
Component type tag Component length	M
Invoke ID tag [a] Invoke ID length Invoke ID	M
Problem Code tag Problem Code length Problem Code	M
Parameters	O

[a] If the Invoke ID is not available, Universal Null (Table 22/Q.773) with length = 0 should be used.

The Component Type Tag is coded context-specific, constructor as indicated in Table 20/Q.773.

TABLE 20/Q.773

Component type tag

Component type tag	H	G	F	E	D	C	B	A
Invoke	1	0	1	0	0	0	0	1
Return Result (Last)	1	0	1	0	0	0	1	0
Return Error	1	0	1	0	0	0	1	1
Reject	1	0	1	0	0	1	0	0
(reserved)	1	0	1	0	0	1	0	1
(reserved)	1	0	1	0	0	1	1	0
Return Result (Not Last)	1	0	1	0	0	1	1	1

The format of a Return Result (Not Last) is identical to that of a Return Result (Last).

6.2 *Component ID tag*

The term Component ID refers to the Invoke ID or the Lined ID. The Component ID tag is coded as shown in Table 21/Q.773.

TABLE 21/Q.773

Coding of Component ID Tag

	H	G	F	E	D	C	B	A
Invoke ID	0	0	0	0	0	0	1	0
Linked ID [a]	1	0	0	0	0	0	0	0

[a] This tag differs from the Invoke ID, which is coded as a universal INTEGER, in order to distinguish it from the following tag (Operation Code) which is also coded as a universal INTEGER.

The length of a Component ID is 1 octet.

An Invoke Component has one or two Component IDs: an Invoke ID, and if it is desired to associate the Invoke with a previous Invoke, then the Linked ID is provided in addition to the Invoke ID.

Return Result and Return Error Components have one Component ID, called an Invoke ID which is the reflection of the Invoke ID of the Invoke Component to which they are responding.

The Reject Component uses as its Invoke ID, the Invoke ID in the Component being rejected. If this ID is unavailable (e.g. due to mutilation of the message undetected by lower layers), then the Invoke ID tag is replaced with a universal NULL tag (which always has length = 0) as shown in Table 22/Q.773.

TABLE 22/Q.773

Coding of NULL tag

	H	G	F	E	D	C	B	A
NULL tag	0	0	0	0	0	1	0	1

If an Invoke containing both Invoke and Linked IDs is being rejected, only the Invoke ID is used in the Reject Component.

6.3 *Operation Code tag*

Each operation is assigned a value to identify it. Operations can be classified as local or global operations. A local operation code follows an Operation Code Tag and Operation Code length. The Operation Code Tag is coded as shown in Table 23/Q.773.

TABLE 23/Q.773

Coding of Operation Code tag

	H	G	F	E	D	C	B	A
Local Operation Code tag	0	0	0	0	0	0	1	0
Global Operation Code tag	0	0	0	0	0	1	1	0

The Global Operation Code is coded as described in Recommendation X.209.

6.4 *Sequence and Set tags*

When there is more than one parameter in a Component (applicable to all Component types), they follow the Sequence or Set Tag, which are coded universal, constructor, as shown in Table 24/Q.773. The choice of Sequence or Set is at the discretion of the Application Service Element using TCAP.

TABLE 24/Q.773

Coding of Sequence and Set tags

	H	G	F	E	D	C	B	A
Sequence Tag	0	0	1	1	0	0	0	0
Set Tag	0	0	1	1	0	0	0	1

6.5 *Error Code tag*

Each error is assigned a value to identify it. Errors can be classified as local or global errors. A local error code follows the Error Code Tag and Error Code Length. The Error Code Tag is coded as shown in Table 25/Q.773.

TABLE 25/Q.773

Coding of Error Code tag

	H	G	F	E	D	C	B	A
Local Error Code Tag	0	0	0	0	0	0	1	0
Global Error Code Tag	0	0	0	0	0	1	1	0

The Global Error Code is coded as described in Recommendation X.209.

6.6 *Problem Code*

The Problem Code consists of one of the four elements General Problem, Invoke Problem, Return Result Problem or Return Error Problem. The tags for these elements are coded as shown in Table 26/Q.773. Their values are shown in Tables 27/Q.773 to 30/Q.773.

TABLE 26/Q.773

Coding of Problem Type tags

Problem Type	H	G	F	E	D	C	B	A
General Problem	1	0	0	0	0	0	0	0
Invoke	1	0	0	0	0	0	0	1
Return Result	1	0	0	0	0	0	1	0
Return Error	1	0	0	0	0	0	1	1

TABLE 27/Q.773

Coding of General Problem

	H	G	F	E	D	C	B	A
Unrecognized Component [a)]	0	0	0	0	0	0	0	0
Mistyped Component [a)]	0	0	0	0	0	0	0	1
Badly Structured Component [a)]	0	0	0	0	0	0	1	0

[a)] TCAP Components are equivalent to ROSE APDUs.

TABLE 28/Q.773

Coding of Invoke Problem

	H	G	F	E	D	C	B	A
Duplicate Invoke ID	0	0	0	0	0	0	0	0
Unrecognized Operation	0	0	0	0	0	0	0	1
Mistyped Parameter [a)]	0	0	0	0	0	0	1	0
Resource Limitation	0	0	0	0	0	0	1	1
Initiating Release [b)]	0	0	0	0	0	1	0	0
Unrecognized Linked ID	0	0	0	0	0	1	0	1
Linked Response Unexpected	0	0	0	0	0	1	1	0
Unexpected Linked [c)] Operation	0	0	0	0	0	1	1	1

[a)] TCAP Invoke parameter is equivalent to ROSE Invoke argument.

[b)] ROSE uses "Initiator releasing" as only the initiator of the underlying association may release it. In TCAP, either entity may release the association.

[c)] ROSE refers to a linked operation as a child operation.

TABLE 29/Q.773

Coding of Return Result Problem

	H	G	F	E	D	C	B	A
Unrecognized Invoke ID	0	0	0	0	0	0	0	0
Return Result Unexpected	0	0	0	0	0	0	0	1
Mistyped Parameter [a)]	0	0	0	0	0	0	1	0

[a)] TCAP Return Result parameter is equivalent to ROSE Return Result result.

TABLE 30/Q.773

Coding of Return Error Problem

	H	G	F	E	D	C	B	A
Unrecognized Invoke ID	0	0	0	0	0	0	0	0
Return Error Unexpected	0	0	0	0	0	0	0	1
Unrecognized Error	0	0	0	0	0	0	1	0
Unexpected Error	0	0	0	0	0	0	1	1
Mistyped Parameter	0	0	0	0	0	1	0	0

ANNEX A

(to Recommendation Q.773)

Specification of Transaction Capabilities in ASN

```
TCAPMessages{ ccittRecommendationQ.773ModuleA }DEFINITIONs ::=

BEGIN
EXPORTS         OPERATION, ERROR;

-- Transaction Sub-Layer fields

MessageType ::=  CHOICE{ Unidirectional   [APPLICATION 1]   IMPLICIT Unidirectional,
                         begin            [APPLICATION 2]   IMPLICIT Begin,
                         end              [APPLICATION 4]   IMPLICIT End,
                         continue         [APPLICATION 5]   IMPLICIT Continue,
                         abort            [APPLICATION 7]   IMPLICIT Abort}

Unidirectional ::= ComponentPortion
Begin ::=        SEQUENCE{ OrigTransactionID, ComponentPortion OPTIONAL }
End ::=          SEQUENCE{ DestTransactionID, ComponentPortion OPTIONAL }
Continue ::=     SEQUENCE{ OrigTransactionID, DestTransactionID,
                           ComponentPortion OPTIONAL }
Abort ::=        SEQUENCE{ DestTransactionID,
                           CHOICE{  P-AbortCause,
                                    UserAbortInformation OPTIONAL }}

OrigTransactionID ::= [APPLICATION 8] IMPLICIT OCTET STRING
DestTransactionID ::= [APPLICATION 9] IMPLICIT OCTET STRING

P-AbortCause ::= {[APPLICATION 10] IMPLICIT INTEGER{
                      unrecognizedMessageType (0),
                      unrecognizedTransactionID (1),
                      badlyFormattedTransactionPortion (2),
                      incorrectTransactionPortion (3),
                      resourceLimitation (4) }

UserAbortInformation ::= [APPLICATION 11] ANY OPTIONAL

-- COMPONENT PORTION. The last field in the transaction portion of the TCAP message is the
-- ComponentPortion. The Component Portion may be empty.

ComponentPortion ::= [APPLICATION 12] IMPLICIT SEQUENCE OF Component

-- Component Sub-Layer fields.

-- COMPONENT TYPE. Recommendation X.229 defines four Application Protocol Data Units (APDUs).
-- TCAP adds returnResultNotLast to allow for the segmentation of a result. Note: in X.229 EXPLICIT
-- rather than IMPLICIT tagging is used

Component ::=   CHOICE {invoke               [1] IMPLICIT Invoke,
                        returnResultLast     [2] IMPLICIT ReturnResult,
                        returnError          [3] IMPLICIT ReturnError,
                        reject               [4] IMPLICIT Reject,
                        returnResultNotLast  [7] IMPLICIT ReturnResult }

-- The Components are sequences of data elements.
```

```
Invoke ::=          SEQUENCE{
                            invokeID INTEGER,
                            linked-ID[0] IMPLICIT INTEGER, OPTIONAL,
                            operation code OPERATION,
                            parameter ANY DEFINED BY operation code OPTIONAL }
                            -- ANY is filled by the single ASN.1 data type
                            -- following the key word ARGUMENT in the type
                            -- definition of a particular operation.

ReturnResult ::=  SEQUENCE{
                            invokeID INTEGER,
                            SEQUENCE{ operation code OPERATION,
                                      parameters ANY DEFINED BY operation code
                            -- ANY is filled by the single ASN.1 data
                            -- type following the key word RESULT in
                            -- the type definition of a particular operation
                            }OPTIONAL }

ReturnError ::=  'SEQUENCE{
                            invokeID INTEGER
                            error code ERROR,
                            parameter ANY DEFINED BY error code OPTIONAL }
                            -- ANY is filled by the single ASN.1 data type
                            -- following the key word PARAMETER in the type
                            -- definition of a particular error.

Reject ::=          SEQUENCE{
                            invokeID CHOICE { INTEGER NULL }
                            problem CHOICE{
                                [0] IMPLICIT GeneralProblem,
                                [1] IMPLICIT InvokeProblem
                                [2] IMPLICIT ReturnResultProblem,
                                [3] IMPLICIT ReturnErrorProblem }}
-- OPERATIONS.
-- Operations are specified with the OPERATION MACRO. When an operation
-- is specified, the valid parameter set, results, and errors for that
-- operation are indicated. Default values and optional parameters are
-- permitted.

OPERATION MACRO ::=
BEGIN
TYPE NOTATION ::=      Parameter Result Errors Linked Operations
VALUE NOTATION ::=     value(VALUE CHOICE{
                                          localValue INTEGER,
                                          globalValue OBJECT IDENTIFIER })

Parameter ::=          "PARAMETER" NamedTyped | empty
Result ::=             "RESULT"ResultType | empty
ResultType ::=         NamedType | empty
Errors::=              "ERRORS" "{"ErrorNames"}" | empty
LinkedOperations ::=   "LINKED" "{"LinkedOperationNames"}" | empty
```

```
ErrorNames ::=              ErrorList | empty

ErrorList ::=               Error | ErrorList"," Error

Error ::=                   value (ERROR)  -- shall reference an error value
                            | type  -- shall reference an error type if no error value is specified

LinkedOperationNames ::=    OperationList | empty

OperationList ::=           Operation | OperationList","Operation

Operation ::=               value (OPERATION)  -- shall reference an operation value
                            | type  -- shall reference an operation type if no operation value is
                                    -- specified

NamedType ::=               identifier type | type

END
-- ERRORS

-- Errors are specified with the ERROR MACRO. When an error is
-- specified, the valid parameters for that error are indicated.
-- Default values and optional parameters are permitted.


ERROR MACRO ::=

BEGIN

TYPE NOTATION ::=           Parameter

VALUE NOTATION ::=          value (VALUE CHOICE{
                                                  localValue INTEGER,
                                                  globalValue OBJECT IDENTIFIER })

Parameter ::=               "PARAMETER" NamedType | empty

NamedType ::=               identifier type | type

END

-- PROBLEMS.

GeneralProblem ::=          INTEGER{ unrecognizedComponent (0),
                                     mistypedComponent (1),
                                     badlyStructuredComponent (2)}

InvokeProblem ::=           INTEGER{ duplicateInvokeID (0),
                                     unrecognizedOperation (1),
                                     mistypedParameter (2),
                                     resourceLimitation (3),
                                     initiatingRelease (4),
                                     unrecognizedLinkedID (5),
                                     linkedResponseUnexpected (6),
                                     unexpectedLinkedOperation (7) }

ReturnResultProblem ::=     INTEGER{ unrecognizedInvokeID (0),
                                     returnResultUnexpected (1),
                                     mistypedParameter (2) }

ReturnErrorProblem ::=      INTEGER{ unrecognizedInvokeID (0),
                                     returnErrorUnexpected (1),
                                     unrecognizedError (2),
                                     unexpectedError (3),
                                     mistypedParameter (4) }

END
```

APPENDIX I

(to Recommendation Q.773)

Formats and encoding for the Unidirectional message

I.1 *Introduction*

This Appendix provides the formats and encoding for the additional message type: Unidirectional.

I.2 *Structure of the Transaction Portion*

Table I-1/Q.773 relates to § 5.1. It shows the Transaction Portion fields for this message type.

TABLE I-1/Q.773

Transaction Portion fields – Unidirectional message type

Element Form	Fields of Transaction Portion	Mandatory Indication
Constructor	Message Type tag Total message length [a]	Mandatory
Constructor	Component Portion tag Component Portion length	Mandatory [b]
Constructor	One or more Components (Not a part of Transaction Portion) (Described in § 6)	Optional

[a] See Note [a] to Figure 8/Q.773.

[b] The Component Portion Tag is not required if there are no Component being sent in the message.

I.3 *Message type tag*

Table I-2/Q.773 relates to § 5.2. It shows the coding of the Message Type tag. Note that the tag value included here is marked reserved in Table 8/Q.773.

TABLE I-2/Q.773

Coding of Message type tag

Message Type	H	G	F	E	D	C	B	A
Unidirectional	0	1	1	0	0	0	0	1

I.4 *Transaction IDs*

Table I-3/Q.773 shows the usage of Transaction IDs in the Unidirectional message type. No Transaction IDs are present.

TABLE I-3/Q.773

Transaction ID(s) in each message type

Message Type	Originating ID	Destination ID
Unidirectional	No	No

I.5 *Component Portion*

The Component Portion in Unidirectional messages is as specified in § 6.

I.6 *Specification of the Unidirectional message in ASN*

– – *The ASN specification of the Unidirectional message (in*
– – *conjunction with Annex A) is provided here. The following*
– – *line should be added to the CHOICE of Message Type:*
unidirectional ::= [APPLICATION 1] IMPLICIT Uni

– – *The structure of the Unidirectional Message Type is:*
Uni ::= ComponentPortion

Recommendation Q.774

TRANSACTION CAPABILITIES PROCEDURES

1 Introduction

Transaction capabilities (TC) allows TC users to exchange components via transaction capabilities application part (TCAP) messages. Procedures described in this section specify the rules governing the information content and the exchange of TCAP messages between TC users.

1.1 *Basic guideline*

To maximize flexibility in service architecture and implementation style, TCAP procedures restrict themselves to supporting the exchange of components between TC users. Application specific (TC user) procedures are not part of TCAP.

When the selection of a parameter value associated with a primitive that is required by a lower layer (sub-layer) is not relevant to that layer (sub-layer), the value is simply passed down through the primitive interface. The same assumption applies to the parameters received from a lower layer through the primitive interface which are not required for TCAP functions.

1.2 *Overview*

Section 2 describes addressing rules for TC messages. Section 3 describes transaction capabilities based on a connectionless network service. Section 4 describes transaction capabilities based on a connection oriented network service.

2 Addressing

In a Signalling System No. 7 environment using a connectionless network service, TC messages will use any of the addressing options afforded by the signalling connection control part (SCCP). Assignment and use of global titles may be network and/or application specific.

Addressing options available for the intermediate service part (ISP) are for further study. Addressing options when other network providers are used are for further study.

3 Transaction capabilities based on a connectionless network service

3.1 *Sub-layering in TCAP*

TCAP procedure is divided into component sub-layer procedure and transaction sub-layer procedure. The component sub-layer procedure provides a TC user with the capability of invoking remote operations and receiving replies. The component sub-layer also receives dialogue control information from a TC user, and, in turn, uses transaction sub-layer capabilities for transaction control.

The component sub-layer provides two kinds of procedures:

- dialogue handling;
- component handling.

3.2 *Component sub-layer procedures*

3.2.1 *Normal procedure*

3.2.1.1 *Component handling procedure*

3.2.1.1.1 *Mapping of TC component handling service primitives to component types*

Recommendation Q.771 describes the services provided by the component sub-layer by defining the service interface between the TC user and the component sub-layer and the interface between the component sub-layer and the transaction sub-layer. Component handling procedures map component handling service primitives onto components, which constitute the protocol data units (PDUs) of the component sub-layer. A mapping of these primitives to component sub-layer PDUs is indicated in Table 1/Q.774.

3.2.1.1.2 *Management of component IDs*

Component IDs are assigned by the invoking end at operation invocation time. A TC-user need not wait for one operation to complete before invoking another. At any point in time, a TC-user may have any number of operations in progress at a remote end (although the latter may reject an invoke component for lack of resources).

Each component ID value is associated with an operation invocation and its corresponding component state machine. Management of this component ID state machine takes place only at the end which invokes the operation. The other end reflects this component ID in its relies to the operation invocation, and does not manage a state machine for this connection ID. Note that both ends may invoke operations in a full-duplex manner: each end manages state machines for the operations it has invoked, and is free to allocate component IDs independently of the other.

A component ID value may be reallocated when the corresponding state machine returns to idle. However, immediate reallocation could result in difficulties when certain abnormal situations arise. A released ID value (when the state machine returns of idle) should therefore not be real-located immediately; the way this is done is implementation-dependent, and thus is not described in this Recommendation.

Component states and state transitions are described in § 3.2.1.1.3.

TABLE 1/Q.774

Mapping of TC component handling service primitives to components

Service Primitive	Abbreviation	Component Type
TC-INVOKE	INV	INVOKE (Note 1)
TC-RESULT	RR-L	Return Result (Last) (Note 1)
TC-U-ERROR	RE	Return Error (Note 1)
TC-U-REJECT	RJ	Reject (Note 1)
TC-R-REJECT	RJ	Reject (Note 1)
TC-L-REJECT	(Note 2)	
TC-RESULT-NL	RR-NL	Return Result (Not Last)
TC-L-CANCEL	(Note 3)	
TC-U-CANCEL	(Note 3)	

Note 1 – X.219 and X.229 Compatible.

Note 2 – Treatment of this primitive is described in § 3.2.2.2.

Note 3 – There is no component type associated with this primitive since the effect is purely local.

3.2.1.1.3 *Operation classes*

TABLE 2/Q.774

Operation Classes

Operation Class	Description
1	Reporting success or failure
2	Reporting failure only
3	Reporting success only
4	Outcome not reported

A different type of state machine is defined for each class of operation, the state transitions of which are represented by Figures 1/Q.774 to 4/Q.774. These state machines are described here from a protocol point of view (sent/received components), whereas they are described in Recommendation Q.771 from a service (primitives) point of view.

The states of each component state machine are defined as follows:

- Idle:The component ID value is not assigned to any pending operation.
- Operation Sent: The component ID value is assigned to an operation which has not been completed or rejected.
- Wait for Reject: When a component indicating the completion of an operation is received, the receiving TC-user may reject this result. The Wait for Reject State is introduced so that the component ID is retained for some time, thereby making the rejection possible.

State transitions are triggered by:

- a primitive received from the TC-user, causing a component to be built, and eventually sent;
- receipt of a component from the peer entity;
- a number of situations indicated on Figures 1/Q.774 to 4/Q.774, corresponding to the following situations:

  Cancel: A timer is associated with an operation invocation. This invocation timer is started when the invoke component is passed to the transaction sub-layer. The TC-INVOKE request primitive indicates a timer value. A cancel situation occurs when the invoking TC-user decides to cancel the operation (TC-U-CANCEL request primitive) before either the final result (if any) is received, or a timeout situation occurs. On receipt of a TC-U-CANCEL request, the component sub-layer stops the timer; any further replies will not be delivered to the TC-user, and TCAP will react according to abnormal situations as described in § 3.2.2.2.

  End situation: When an End or Abort message is received, or when prearranged end is used, TCAP returns any pending operations to Idle.

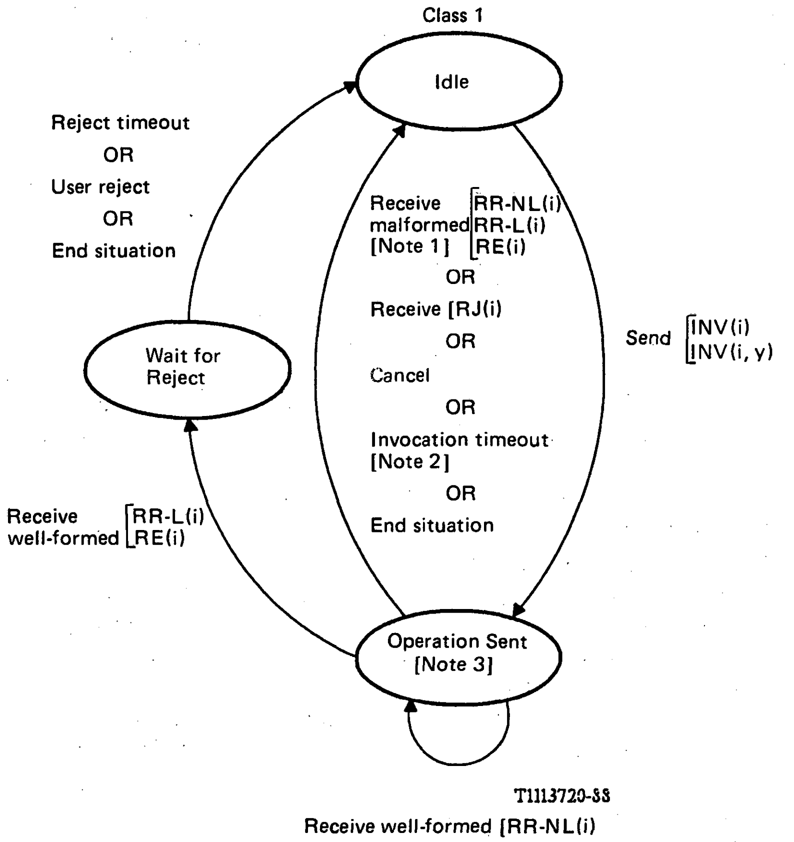
  Invocation timeout: A timeout situation occurs when the timer associated with an operation invocation expires: the state machine returns to idle, with notification to the TC-user by means of a TC-L-CANCEL indication (in the case of a class 1, 2 or 3 operation). This notification indicates an abnormal situation for a class 1 operation, or gives the definite outcome of a class 2 or 3 operation for which no result has been received (normal situation).

  Reject timeout: A Reject timeout situation occurs when the timer associated with the Wait for Reject state expires. If this occurs, the component sub-layer assumes that the TC-user has accepted the component.

  In the diagrams that follow, components contain either single ID values, or ordered pairs of IDs (i, y), where i is the invoke ID and y is the linked ID. The state diagrams are modeled for a single operation invocation with ID i. The value of y is not relevant to the ID i. A linked invoke operation can only be accepted if the linked to state machine is in the Operation Sent state.

  Components can be received "well-formed" or "malformed". The diagrams show where this is significant. If it does matter whether the component is received "well-formed" or "malformed" then the diagram indicates "receive" only.

Class 1 operations report failure or success. A rejection in the case of a protocol error may also occur. Upon invoking a class 1 operation, the invoking end will keep the ID i active until a "last" reply is received and can no longer be rejected. An ID may be released locally, at the option of the TC-user. This is indicated in Figure 1/Q.774.



Note 1 — In these situations, the TC-user is informed and the transition occurs when the sending of the reject is initiated.

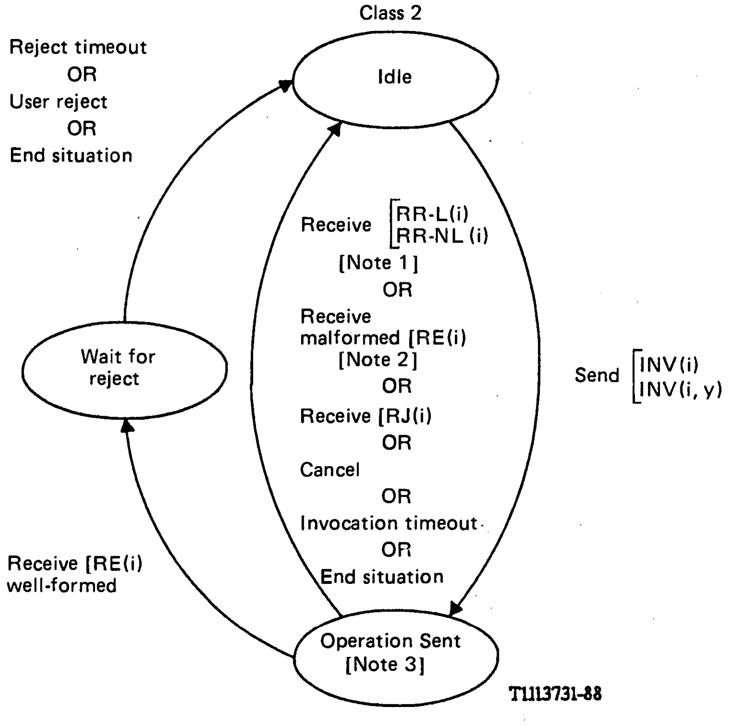
Note 2 — These are abnormal situations.

Note 3 — When an INV(x, i) is received, the existence of the state machine i is checked to ensure it is in the Operation Sent state, but there is no impact on the state machine.

FIGURE 1/Q.774

Operation class 1

Class 2 operations report failure only. A rejection in the case of a protocol error may also occur. Upon invoking a class 2 operation, the invoking end will keep the ID i active until a reply has been received and can no longer be rejected or until a timeout[1] cancel or end situation occurs. This is indicated in Figure 2/Q.774.



Note 1 – These are abnormal situations.

Note 2 – In these situations, the TC-user is informed and the transition occurs when the sending of the reject is initiated.

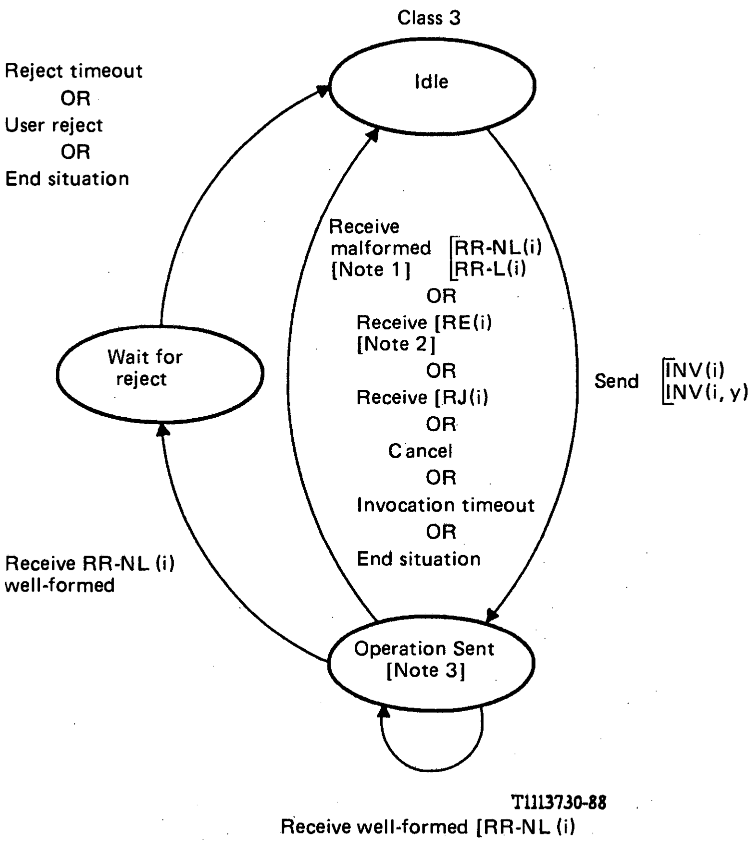
Note 3 – When an INV(x, i) is received, the existence of the state machine i is checked to ensure it is in the Operation Sent state, but there is no impact on the state machine.

FIGURE 2/Q.774

Operation class 2

[1] A timeout for a class 2 operation is a "normal" situation.

Class 3 operations report success only. A rejection in the case of a protocol error may also occur. Upon invoking a class 3 operation, the invoking end will keep the ID i active until a reply has been received and can no longer be rejected or until a timeout[2] cancel or end situation occurs. This is indicated in Figure 3/Q.774.



Note 1 – In these situations, the TC-user is informed and the transition occurs when the sending of the reject is initiated.

Note 2 – These are abnormal situations.

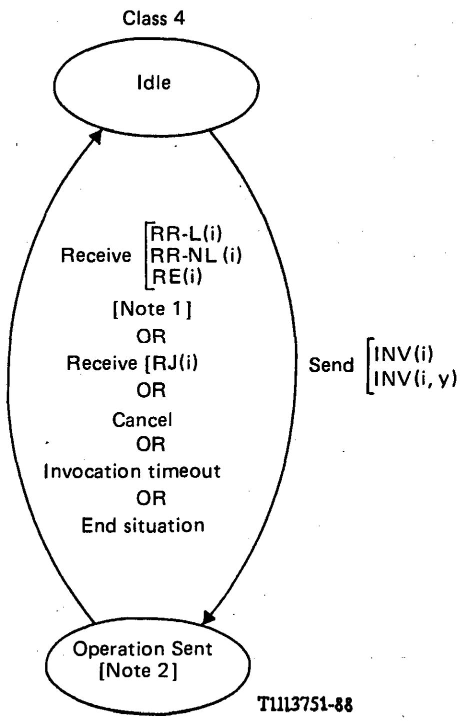
Note 3 – When an INV(x, i) is received, the existence of the state machine i is checked to ensure it is in the Operation Sent state, but there is no impact on the state machine.

FIGURE 3/Q.774

Operation class 3

[2] A timeout for a class 3 operation is a "normal" situation.

Class 4 operations do not report their outcome. A rejection in the case of a protocol error may also occur. Upon invoking a class 4 operation, the invoking end will keep the ID i active until a reject has been received or until a timeout[3] cancel or end situation occurs. This is indicated in Figure 4/Q.774.



Note 1 – These are abnormal situations.

Note 2 – When an INV(x, i) is received, the existence of the state machine i is checked to ensure it is in the Operation Sent state, but there is no impact on the state machine.

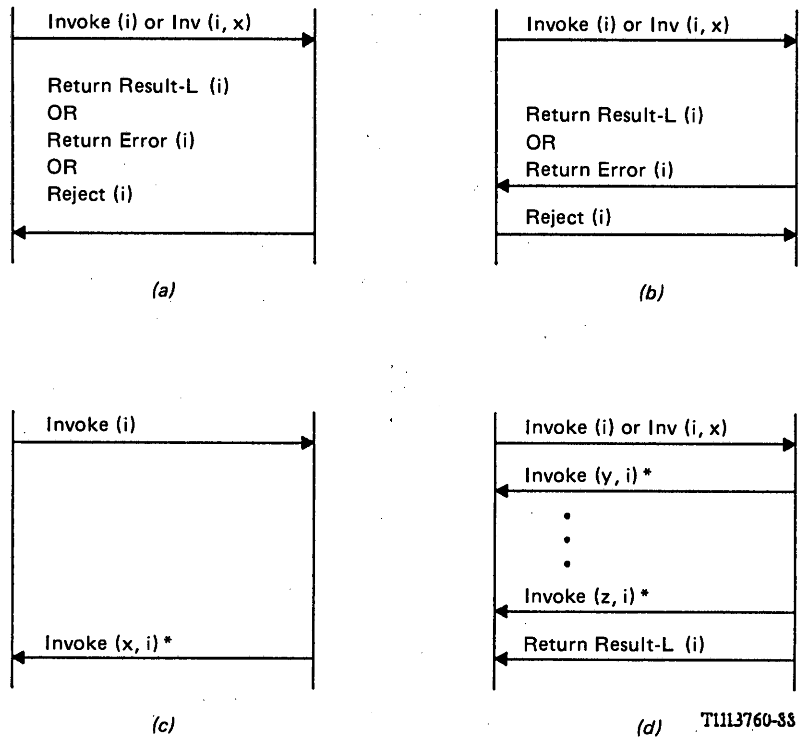
FIGURE 4/Q.774

Operation class 4

[3] A timeout for a class 4 operation is a "normal" situation.

3.2.1.2 *Sample component flows*

Some sample component flows that are compatible with Recommendation X.229 (Remote operations) are indicated in Figure 5/Q.774. The flows show cases of valid component sequences correlated to an invoked operation.



* No change to the component state machine of the original Invoke.

FIGURE 5/Q.774

X.229 compatible component flows

Figure 6/Q.774 depics that, as an extension to Recommendations X.219 and X.229, TCAP permits multiple return results to respond to the same Invoke operation for the purpose of segmenting a result over a connectionless network service.

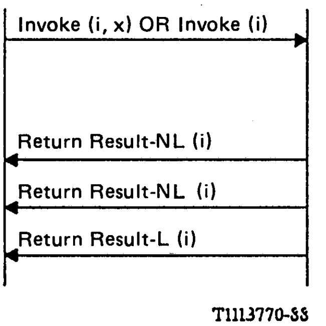


FIGURE 6/Q.774

Segmented result

3.2.1.3 *Dialogue control via TC primitives*

The TC-UNI, TC-BEGIN, TC-CONTINUE and TC-END request primitives are used by a TC-user to control the transfer of components. Components in a message are delivered to the remote TC-user in the same order in which they are received by the originating component sub-layer from the local TC-user. The corresponding indication primitives are employed by the component sub-layer to inform the TC-user at the receiving end of the state of the dialogue.

A TC-user employs a dialogue control request primitive to trigger transmission of all previously passed components with the same dialogue identifier. A component sub-layer dialogue control primitive in turn triggers a corresponding service request to the transaction sub-layer, the sub-layer where the transaction control service is provided. A mapping of TC to TR transaction control primitives is provided in Table 3/Q.774.

TABLE 3/Q.774

Mapping of TC Dialogue Handling Service Primitives to TR Primitives

TC Primitive	TR Primitive
TC-UNI	TR-UNI
TC-BEGIN	TR-BEGIN
TC-CONTINUE	TR-CONTINUE
TC-END	TR-END
TC-U-ABORT	TR-U-ABORT
TC-P-ABORT	TR-P-ABORT

Dialogue begin

A TC-BEGIN request primitive results in a TR-BEGIN request primitive, which begins a transaction, and transmits any (0 or more) components passed on the interface with the same dialogue ID.

At the destination end, a TR-BEGIN indication primitive is received by the component sub-layer. It causes a TC-BEGIN indication primitive starting a dialogue to be delivered to the TC-user, followed by component handling primitives associated with each of the components received (if any).

Dialogue continuation

A TC-CONTINUE request primitive results in a TR-CONTINUE request primitive which transmits any components passed on the interface with the same dialogue ID. If reject components (see § 3.2.2.2) have been built by the component sub-layer for this dialogue, they are also transmitted.

At the destination end, a TR-CONTINUE indication received by the component sub-layer causes a TC-CONTINUE to be delivered to the TC-user, followed by component handling primitives associated with each of the components received.

Dialogue end

In the case of basic end of a dialogue, any components passed on the interface plus any reject components built by the component sub-layer for this dialogue are passed for transmission to the transaction sub-layer in a TR-END request primitive, then the dialogue is ended.

At the destination end, a dialogue ends when each component (if any) accompanying the TR-END indication primitive have been delivered to the TC-user by an appropriate component handling primitive following the TC-END indication.

The component sub-layer does not check, when a TC-user requests the end of a dialogue, that all the component state machines associated with this dialogue have returned to Idle. Similarly, no check is made by the component sub-layer that all the state machines associated with a dialogue have returned to Idle when it has delivered the components accompanying a TR-END indication primitive. In an end situation, any non-idle-state machine is returned to Idle when the TR-END request primitive is passed to the transaction sub-layer (at the originating side), or when all accompanying components have been delivered to the TC-user at the destination side; any components pending transmission are discarded.

Prearranged end and TC-user abort of a dialogue do not trigger transmission of pending components. All state machines associated with the dialogue are returned to idle, and the components are discarded.

3.2.2 *Abnormal procedures*

3.2.2.1 *Dialogue control*

Any abnormal situation detected by the component sub-layer results in the rejection of a component, and in notification to the local TC-user. The component sub-layer never decides to abort a dialogue. Abort of a dialogue is always the reflection of a decision by:

- the transaction sub-layer to abort the underlying transaction. The component sub-layer idles the operation state machines of the dialogue, discards any pending component, and passes an abort indication to the TC-users (TC-P-ABORT indication primitive);
- the TC-user to abort the dialogue. At the originating side, a TC-U-ABORT request is received from the TC-user: active component state machines for this dialogue are idled, and a TR-U-ABORT request is passed to the transaction sub-layer. At the destination side, a corresponding TR-U-ABORT indication is received from the transaction sub-layer, any active component state machines for the dialogue are idled, and a TC-U-ABORT indication is passed to the TC-user;

In both cases, accompanying information (P-Abort cause, or user-provided information) passes transparently through the component sub-layer.

Handling of the notification of abnormal situations which cannot be related to a particular dialogue is for further study.

3.2.2.2 *Abnormal procedures relating to operations*

The following abnormal situations are considered:

- no reaction to class 1 operation invocation (see § 3.2.1.1.3);
- receipt of a malformed component: the component type and/or the Invoke ID cannot be recognized (i.e. the state machine cannot be identified);
- receipt of a well-formed component in violation of authorized state transitions.

The actions taken by the component sub-layer to report component portion errors are shown in Table 4/Q.774. The following considerations have guided the choices indicated in this Table:

- When a protocol error has been detected by the local TC-user, this TC-user is not subsequently advised via the TC-Reject (as indicated in Table 4/Q.774) since it is already aware of the protocol error.
- In other cases (reject by component sub-layer), the local TC-user is always advised so that it can issue a dialogue control primitive (see the reject mechanism described below).

- When a component is rejected, the associated state machine returns to Idle.
- The reject mechanism applies whenever possible: even if the Invoke ID is not assigned or not recognized (i.e. no state machine can be identified), the reject mechanism should be initiated. The only case where rejection is purely local is when the component to be rejected is itself a reject component.

Protocol errors in the component portion of a TCAP message are reported using the Reject component. The Reject component is sent in response to an incorrect component other than Reject.

When an invoke ID is available in a component to be Rejected, this ID is reflected in the Reject component.

TABLE 4/Q.774

Action Taken on Protocol Errors in Component Portion

Local					Remote	
Component Type received	Type of error	Local action	Component State Machine	Local user advised	Component state machine	Remote user advised
INVOKE	Syntax error	Init. Reject	Inv: NA Link: No change	Yes [a]	Return to Idle	Yes
	Linked ID unassigned	Init. Reject	Inv: NA Link: NA	Yes [a]	Inv: Return to Idle	Yes
RETURN_RESULT (L/NL) or RETURN_ERROR	Syntax error	Init. Reject	Return to Idle	Yes [a]	NA	Yes
	Invoke ID unassigned	Init. Reject	NA	Yes [a]	NA	Yes
RETURN_RESULT (L/NL)	Operation Class 2/4	Init. Reject	Return to Idle	Yes [a]	NA	Yes
RETURN_ERROR	Operation Class 3/4	Init. Reject	Return to Idle	Yes [a]	NA	Yes
REJECT	Syntax Error	Local Reject	Return to NA [b]	Yes	NA	No
UNKNOWN	Invoke ID derivable	Init. Reject	No Change (NA)	Yes [a]	Return to Idle	Yes
	Invoke ID non derivable	Init. Reject	(NA)	Yes [a]	NA	Yes

NA: Not applicable.

[a] This is to alert the TC User so it can issue a dialogue control primitive to send the Reject component formulated by the Component Sub-Layer.

[b] If Invoke ID present, and Invoke Problem, return Component State machine to idle.

Component type abbreviations are identified in Table 1/Q.774.

In the case of multiple components within a message, when a malformed component is detected by the component sub-layer, subsequent components in the message are discarded.

Rejection of any portion of a segmented result shall be equivalent to rejecting the entire result.

The associated state machine is returned to idle. Subsequent portions of the same segmented result shall also be rejected on the basis of no active state machine.

The reject mechanism: when the component sub-layer detects a situation where (non-local) reject should be initiated (as per Table 4/Q.774), it builds a reject component, stores it, and informs the local TC-user by means of TC-L-REJECT indication primitive. The TC-user may decide:

a) to continue the dialogue, or

b) to end the dialogue using the basic scenario, or

c) to abort the dialogue.

In cases a) and b), the first dialogue handling primitive (TC-CONTINUE request or TC-END request respectively) issued by the TC-user triggers transmission of the stored reject component(s) built for this dialogue by the component sub-layer. The remote component sub-layer receives the reject component(s) built for this dialogue, idles the corresponding component state machine(s) if possible (as per Table 4/Q.774) and informs the TC-user of the (remote) rejection via TC-R-REJECT information primitive(s).

If the component sub-layer generated reject combined with accumulated components from the TC-user exceeds the message length limitations, then the TC-user, being aware of the reject component, must initiate two dialogue handling primitives. The component sub-layer, also being aware of the length problem, will send all the components, except the reject, with the first primitive. The reject will be sent with the next dialogue handling primitive together with any further components provided by the TC-user.

3.3 *Transaction sub-layer procedures*

3.3.1 *General*

The transaction sub-layer provides for an association between its users (TR-users). This association is called a transaction.

The transaction sub-layer procedure associates each TCAP message and, therefore, all the contained components with a particular transaction.

The transaction sub-layer processes the transaction portion (message type and transaction ID) of a TCAP message. Transaction IDs identify a transaction. Each end assigns a local transaction identification; local transaction IDs are exchanged in the transaction portion of messages as indicated in Q.773.

The component portion of a TCAP message is passed between the component sub-layer and the transaction sub-layer as user data in the transaction sub-layer primitives.

3.3.2 *Mapping of TR service primitives to message types*

Recommendation Q.771 describes the services performed by the transaction sub-layer by defining the service interface between the TR user and the transaction sub-layer and the transaction sub-layer and the SCCP. Similarly, state transition diagrams appear in Recommendation Q.771 based on service primitives. In this section, a message based description of the protocol is provided. A mapping of TR-primitives to transaction sub-layer protocol data units is indicated in Table 5/Q.774.

TABLE 5/Q.774

Mapping of TR Service Primitives to Messages

Service Primitive	Message Type
TR-UNI	Unidirectional
TR-P-ABORT	Abort
TR-BEGIN	Begin
TR-CONTINUE	Continue
TR-U-ABORT	Abort
TR-END	End

3.3.3 *Normal procedures*

3.3.3.1 *Message transfer without establishing a transaction*

3.3.3.1.1 *Actions of the sending end*

The TR-UNI request primitive is used when a TR-user sends a message to another TR-user but does not need to enter into a transaction. A unidirectional message, which does not have a transaction ID, is used in this case.

3.3.3.1.2 *Actions of the receiving end*

The receipt of a unidirectional message causes a TR-UNI indication primitive to be passed to the TR-user. No further action is taken by the transaction sub-layer.

3.3.3.2 *Message transfer within a transaction*

3.3.3.2.1 *Transaction begin*

In the following discussion, the sending node of the first TCAP message is labelled node "A", and the receiving node is labelled node "B".

3.3.3.2.1.1 *Actions of the initiating end*

The TR-user at node "A" initiates a transaction by using a TR-BEGIN request primitive, which causes a begin message to be sent from node "A" to node "B".

The begin message contains an originating transaction ID. This transaction ID value, when included in any future message from node "A" as the originating transaction ID or in a message to node "A" as the destination transaction ID, identifies the transaction to node "A".

Once the transaction sub-layer at node "A" has sent a begin message it cannot send another message to the transaction sub-layer at node "B" for the same transaction until it receives a continue message from node "B" for this transaction.

3.3.3.2.1.2 *Actions of the receiving end*

The receipt of a Begin message causes a TR-BEGIN indication primitive to be passed to the TR-user at node "B". In response to a TR-BEGIN indication primitive, the TR-user at node "B" decides whether or not to establish a transaction. If the TR-user does want to establish a transaction, it passes a TR-CONTINUE request primitive to the transaction sub-layer; otherwise, it terminates the transaction (see § 3.3.3.2.3). These conditions are defined by the TR-user.

The Begin message contains only an originating transaction ID. If, after receiving a Begin message with a given originating transaction ID, the transaction sub-layer receives another Begin message with the same originating transaction ID, the transaction sub-layer does not consider this as an abnormal situation: a second transaction is initiated at node "B".

3.3.3.2.2 *Transaction continuation*

A Continue message is sent from one node to another when a TR-CONTINUE request primitive is passed from the TR-user to the transaction sub-layer at the sending node.

A Continue message includes the destination transaction ID which is identical to the originating transaction ID received in messages from the peer node. Each node assigns its own originating transaction ID at transaction initiation time. The transaction IDs remain constant for the life of the transaction.

A Continue message includes both an originating transaction ID and a destination transaction ID. The originating transaction ID, in successive continue messages is not examined.

Receipt of a Continue message causes a TR-CONTINUE indication primitive to be passed to the destination TR-user.

Once the user at node "B" has responded with a TR-CONTINUE request primitive to establish a transaction, all subsequent interactions at either end between the TR-user and the transaction sub-layer are via TR-CONTINUE primitives until the transaction is to be terminated. In message terms, once a Continue message is sent from node "B", all subsequent messages shall be Continue messages until the transaction is to be terminated.

3.3.3.2.3 *Transaction termination*

The basic method: A TR-user at either end may terminate a transaction by passing a TR-END request primitive (indicating basic end) to the transaction sub-layer. An end message is sent to the peer entity which, in turn, passes a TR-END indication promitive to its TR-user. The end message contains a destination transaction ID.

The pre-arranged method: This method implies that the peer entities know *a priori* – at a given point in the application script – that the transaction will be released. In this case, the TR-user passes a TR-END request primitive (indicating pre-arranged end) to its transaction sub-layer, and no End message is sent.

3.3.3.2.4 *Abort by the TR-user*

When a TR-user wants to abort a transaction, it passes a TR-U-ABORT request primitive to the transaction sub-layer, which sends an abort message with user-provided (cause and diagnostic) information.

At the receiving side, the transaction sub-layer receiving an Abort message containing user-provided information passes this information without analyzing it to the TR-user in a TR-U-ABORT indication primitive.

3.3.3.2.5 *Example of message exchange*

Figure 7/Q.774 depicts an example of exchanges of TCAP messages between two TR-users.

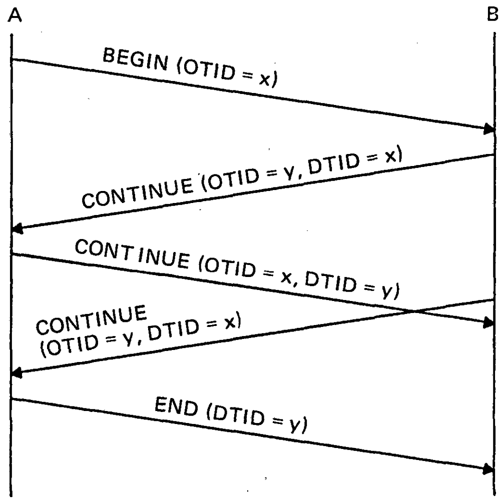


FIGURE 7/Q.774

A simple example of exchange of TCAP messages

3.3.3.2.6 *Transaction state transition diagrams*

A state machine is associated with a transaction at each end of this transaction. Four transaction states are introduced:

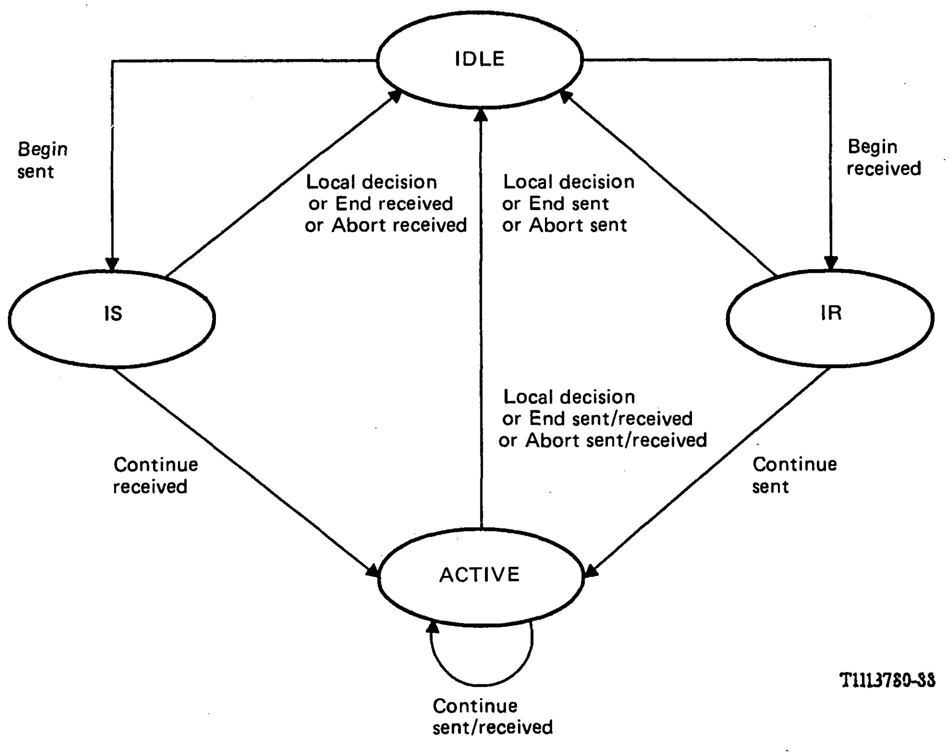
- Idle: no state machine exists;
- Init Sent (IS): a Begin message has been sent; an indication from the peer entity whether the transaction has been established or not is awaited;
- Init Received (IR): a Begin message has been received; a request from the TR-user either to continue the transaction, or to terminate it, is awaited;
- Active: the transaction is established: continue messages can be exchanged in both directions simultaneously.

Figure 8/Q.774 shows the transaction state transition diagram.

3.3.4 *Abnormal procedures relating to transaction control*

The following abnormal situations are covered by the transaction sub-layer:

1) no reaction to transaction initiation;
2) receipt of an indication of abnormal situation from the underlying layer;
3) receipt of a message with an unassigned or non-derivable destination transaction ID (non-derivable means that the information is not found or not recognized): the message cannot be associated with a transaction;
4) receipt of a message with a recognized destination transaction ID: the message can be associated with a transaction, but the message type is not compatible with the transaction state.



Local decision: 1) Prearranged end, 2) See § 3.3.4.

FIGURE 8/Q.774

Transaction state transition diagram

Case 1 is covered by a local, implementation-dependent, mechanism which results in aborting the transaction locally, as described below.

Case 2 is for further study.

When a transaction portion error is found (cases 3 and 4 above), the transaction sub-layer should take the following actions.

The status of the originating transaction ID should be checked. Actions are the following:

1) If the originating transaction ID is not derivable, the local end (which received the message) discards the message and does not take any other action; e.g. it does not send an abort message or terminate the transaction; or,

2) If the originating transaction ID is derivable, the following actions are taken:

   i) The transaction sub-layer should form an abort message with an appropriate P-Abort cause and transmit it to the originating end. The originating end will then take the appropriate action to terminate the transaction if the originating transaction ID is assigned.

   ii) If the destination transaction ID is not derivable or derivable but not assigned, the transaction sub-layer takes no action to terminate the transaction at its end.

   iii) If the destination transaction ID is derivable and assigned:

      a) the transaction sub-layer terminates the transaction at its end, i.e. return to idle;

      b) the transaction sub-layer informs the component sub-layer of the abort of the transaction via the transaction sub-layer abort; and

      c) the component sub-layer should:

         – release all component IDs associated with this transaction,

         – discard any pending components for that transaction,

         – inform the TC-user of the transaction abort.

Finally, regardless of the disposition of the transaction IDs, the entire erroneous TCAP message should be discarded.

TABLE 6/Q.774

Actions when an Abnormal Transaction Portion is Received

Local End (detects protocol error)						Remote End	
Message Type Received	Origin. Tr. Id.	Destin. Tr. Id.	Action	Transaction State Mach.	Local User Advised	Transaction State Mach.	User Advised
UNIDIREC-TIONAL	–	–	Discard	– [c]	No	– [c]	No
BEGIN	not der.	–	Discard	NA	No	NA	No
	der.	–	Abort	NA	No	Ret to Idle [a]	Yes [a]
CONTINUE	not der.	–	Discard	NA	No	NA	No
	der.	not der unass.	Abort	NA	No	Ret to Idle [a]	Yes [a]
	der.	ass.	Abort	Ret to Idle	Yes	Ret to Idle [a]	Yes [a]
END/ABORT	–	not der unass.	Discard	NA	No	NA	No
	–	ass.	Discard	Ret to Idle	Yes	NA	No
UNKNOWN	not der	–	Discard	NA	No	NA	No
	der.	not der unass.	Abort	NA	No	Ret to Idle [b]	Yes [a]
	der.	ass.	Abort	Ret to Idle	Yes	Ret to Idle [a]	Yes [a]

NA: Transition to the Idle state is Not Applicable [b].

not der.: not derivable.

der.: derivable.

ass.: derivable and assigned.

unass.: derivable but unassigned.

[a] If the Transaction ID is assigned at this end, otherwise the state transition is not applicable, and the user is not informed.

[b] The expression NA is used in those cases where the normal procedure of Return to Idle at both ends following the appearance of an abnormal situation is Not Applicable because it is impossible to identify the Transaction ID(s) and therefore to relate the damaged message to a specific transaction at either ends (Local and/or Remote end).

[c] The Unidirectional message does not refer to an explicit transaction and therefore it does not affect the Transaction State Machine.

When receiving an Abort message, the destination transaction sub-layer does the following:

- if the Abort message contains user-abort information (or no information), inform the TR-user by means of the TR-U-ABORT indication primitive;
- if the Abort message contains a P-Abort cause information, inform the TR-user by means of the TR-P-ABORT indication primitive. Notification to the management is for further study;
- in both cases, discard any pending messages for that transaction and return the transaction state machine to Idle.

4 Transaction capabilities based on a connection oriented network service

For further study.

ANNEX A

(to Recommendation Q.774)

Transaction capabilities SDLs

A.1 *General*

This Annex contains the description of the transaction capability procedures described in Recommendation Q.774 by means of SDLs according to the CCITT specification and description language. In order to facilitate the functional description as well as the understanding of the behaviour of the signalling system, the transaction capabilities application part (TCAP) is divided into the component sub-layer and the transaction sub-layer (Figure A-1/Q.774). The component sub-layer again is divided into a component handling block (CHA) and a dialogue handling block (DHA) (Figure A-2/Q.774).

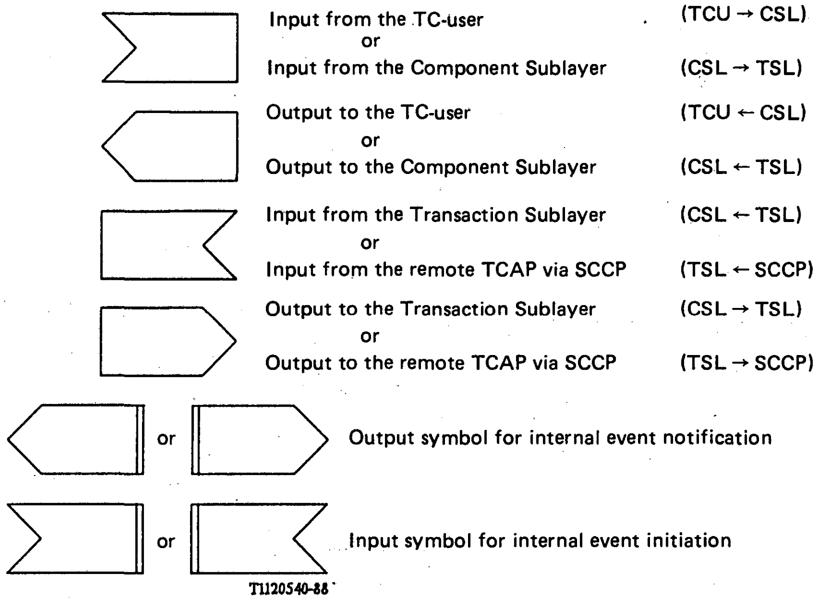
The SDL is provided according to this functional partitioning which is used only to facilitate understanding and is not intended to be adopted in a practical implementation of the TCAP. The functional blocks and their associated service primitives are shown in Figure A-2/Q.774.

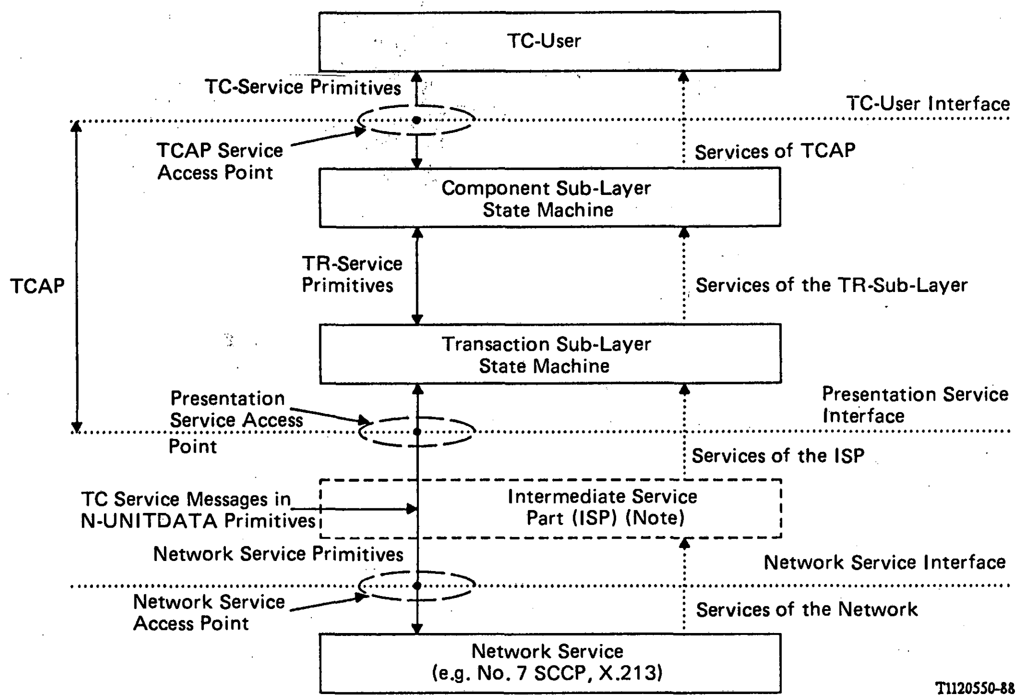
A.2 *Abbreviations used in the SDL diagrams*

CSL	Component sub-layer
L	Last component
NL	Not last component
SCCP	Signalling connection control part
TC	Transaction capabilities
TCAP	Transaction capabilities application part
TCU	TC-user
TSL	Transaction sub-layer
ISP	Intermediate service part
IS	Initiation sent state
IR	Initiation received state
DHA	Dialogue handling
CHA	Component handling
RJ	Reject
RE	Return error
RR	Return result
INV	Invoke
ISM	Invocation state machine
CCO	Component coordinator
UNI	Unidirectional

A.3 *Drafting conventions*

To indicate the direction of each interaction the symbols are used as shown below:

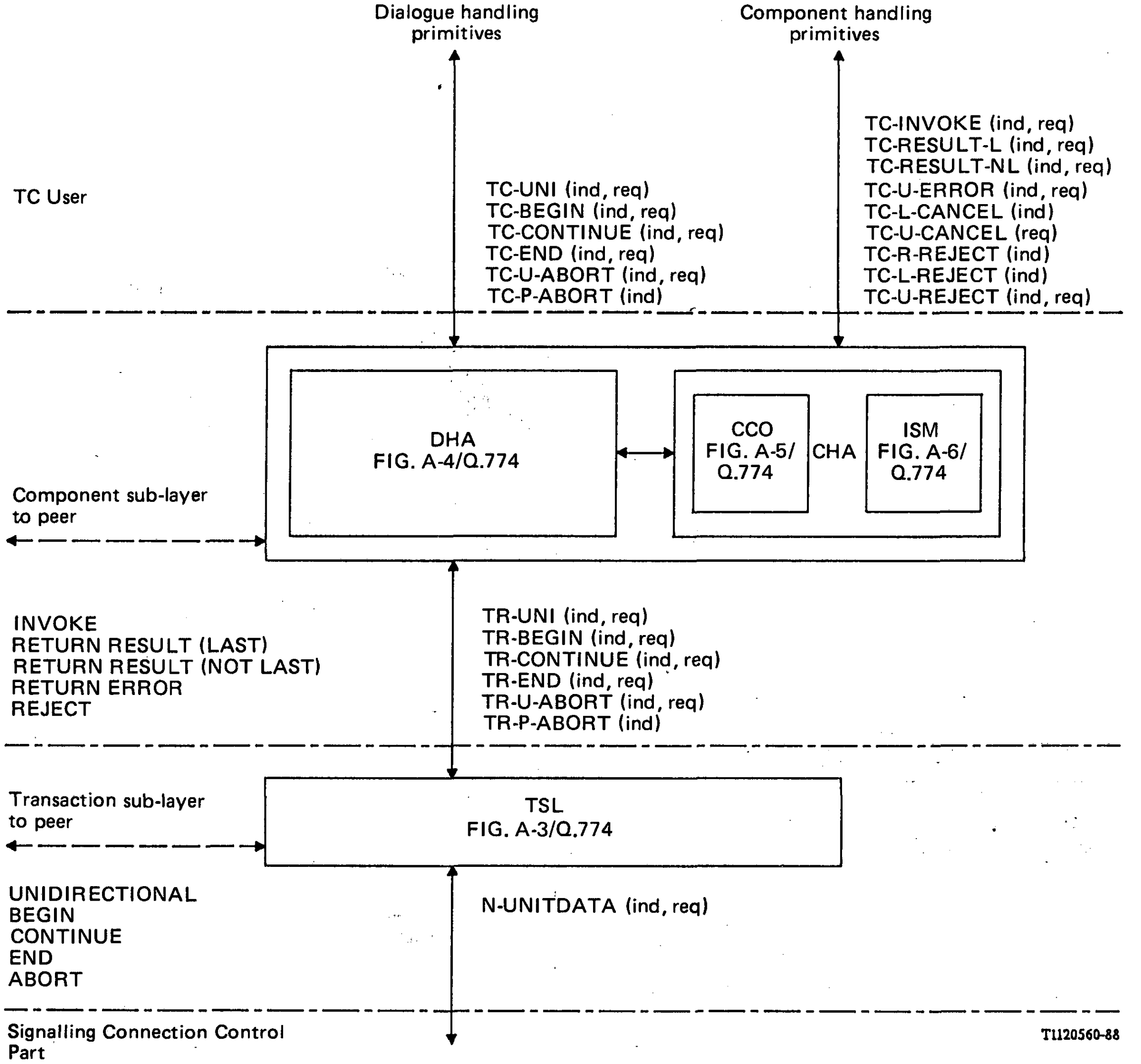




Note — ISP is null for TCAP using a signalling system No. 7 connectionless network layer service.

FIGURE A-1/Q.774

Interfaces of the component and transaction sub-layers (state machines) and service primitives



CHA Component Handling
DHA Dialogue Handling
TSL Transaction Sub-Layer
CCO Component Coordinator
ISM Invocation State-Machine

Note – Other Network Service Primitives are for further study (Q.700-Series of Recommendations).

FIGURE A-2a/Q.774

Overview block diagram of TC

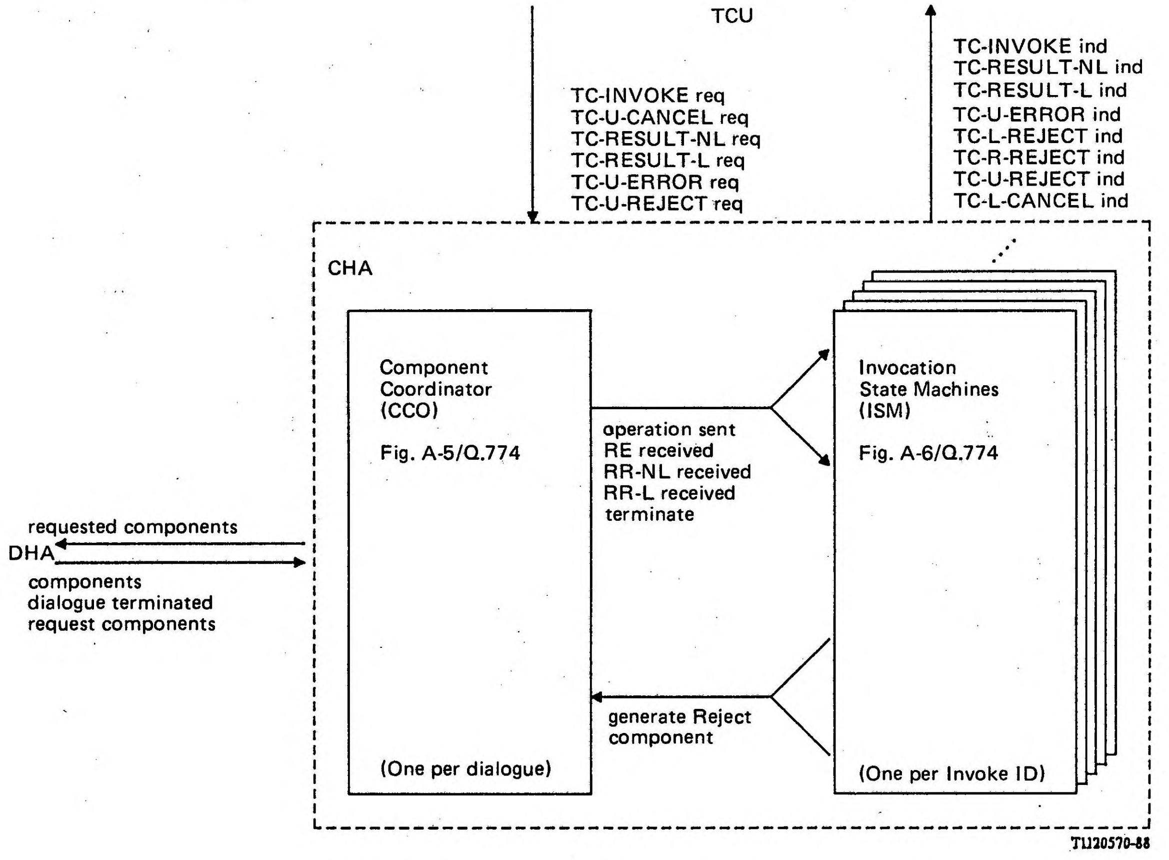


FIGURE A-2b/Q.774

Overview block diagram of CHA

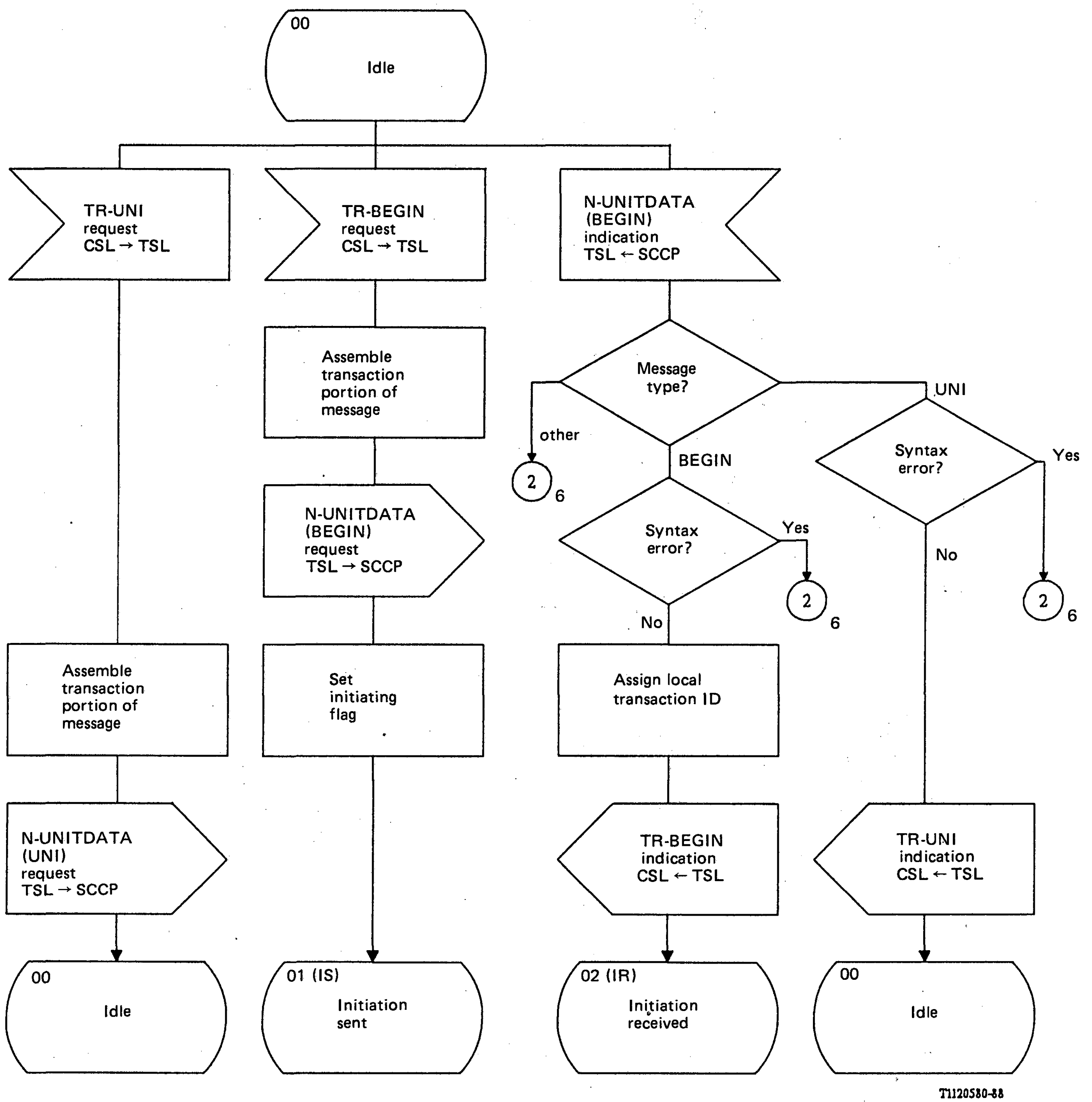


FIGURE A-3/Q.774 (Sheet 1 of 6)

Transaction sub-layer

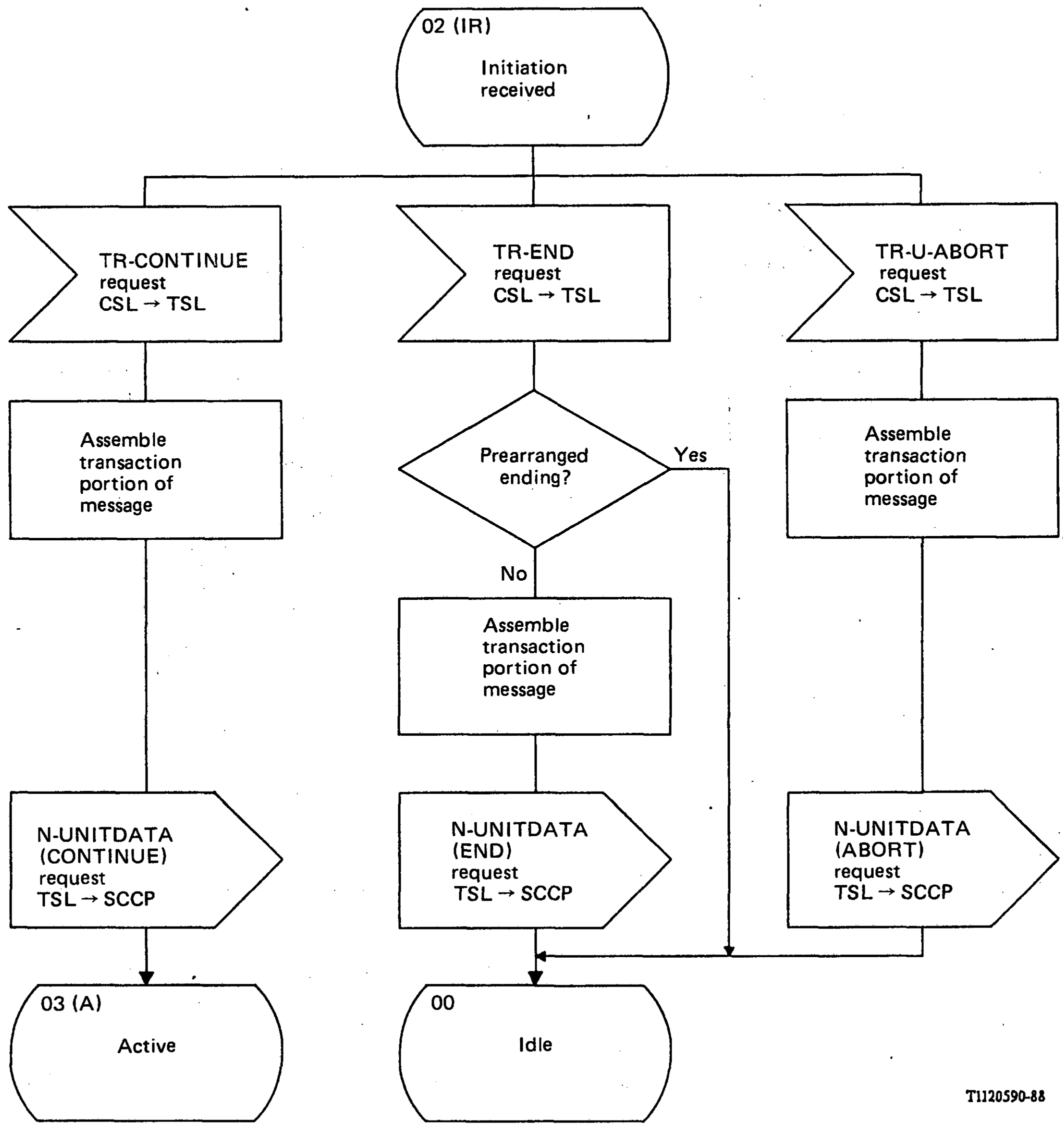
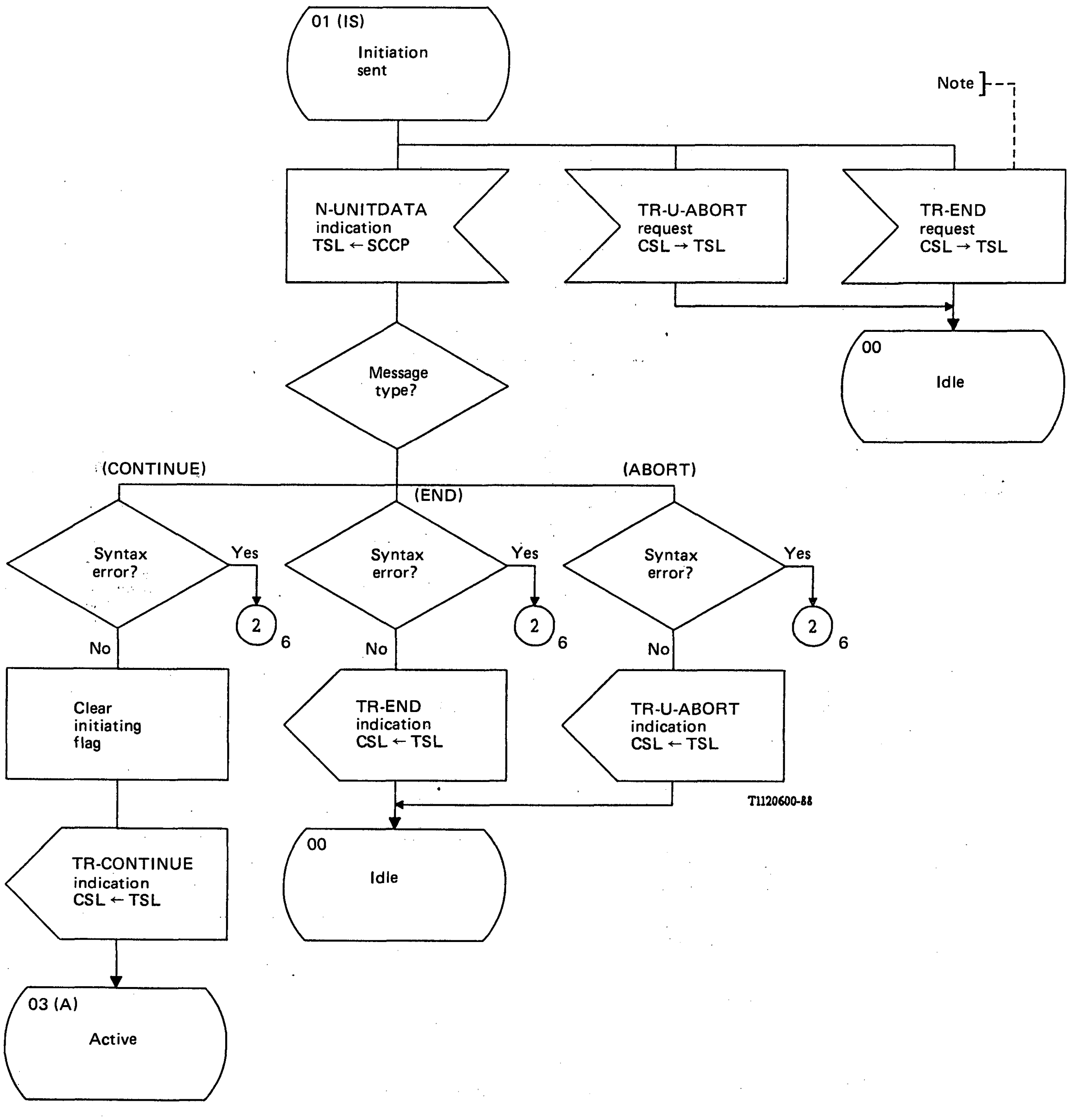


FIGURE A-3/Q.774 (Sheet 2 of 6)

Transaction sub-layer



Note – See Recommendation Q.774, § 3.2.1.3 (prearranged ending).

FIGURE A-3/Q.774 (Sheet 3 of 6)

Transaction sub-layer

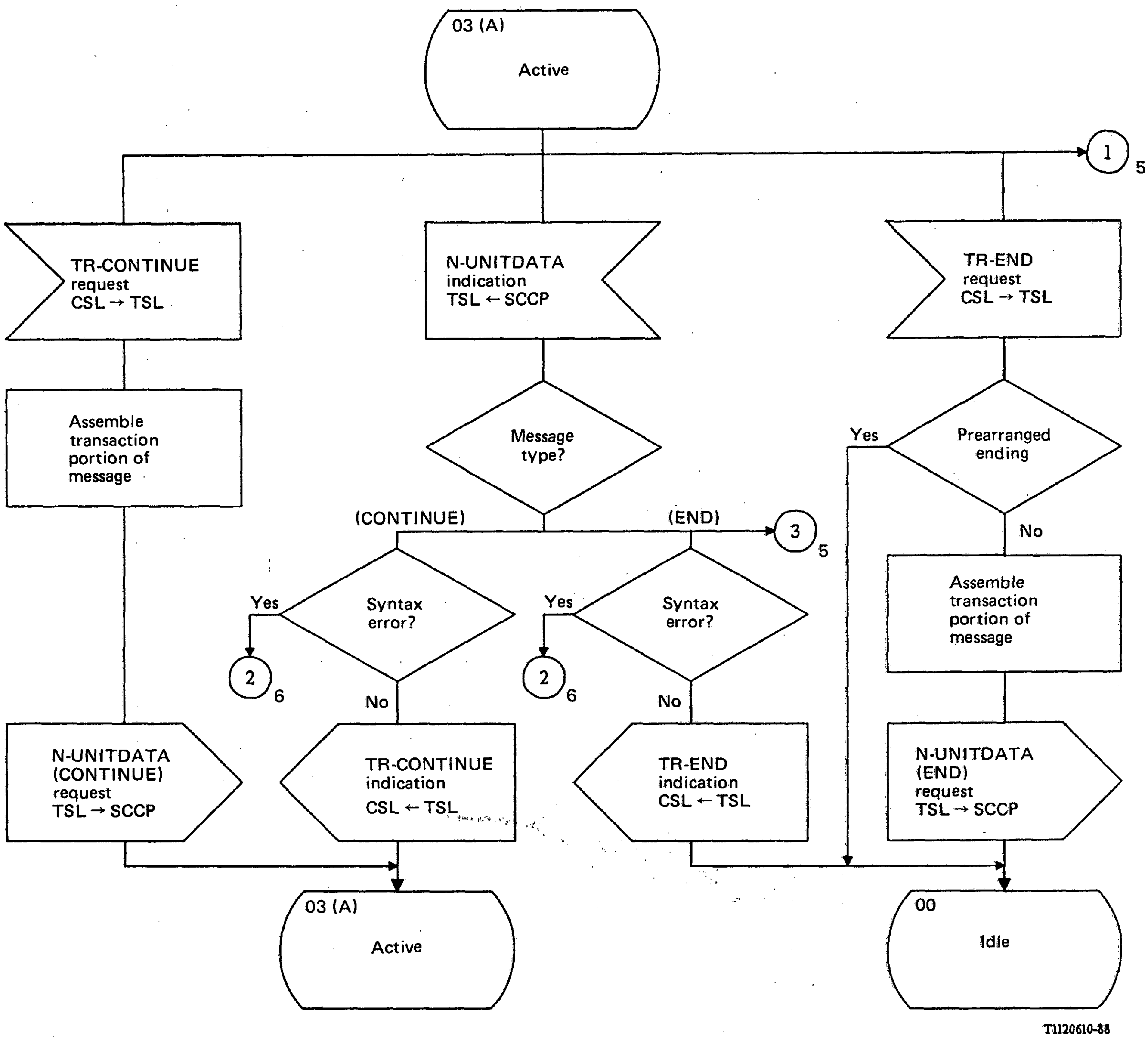


FIGURE A-3/Q.774 (Sheet 4 of 6)

Transaction sub-layer

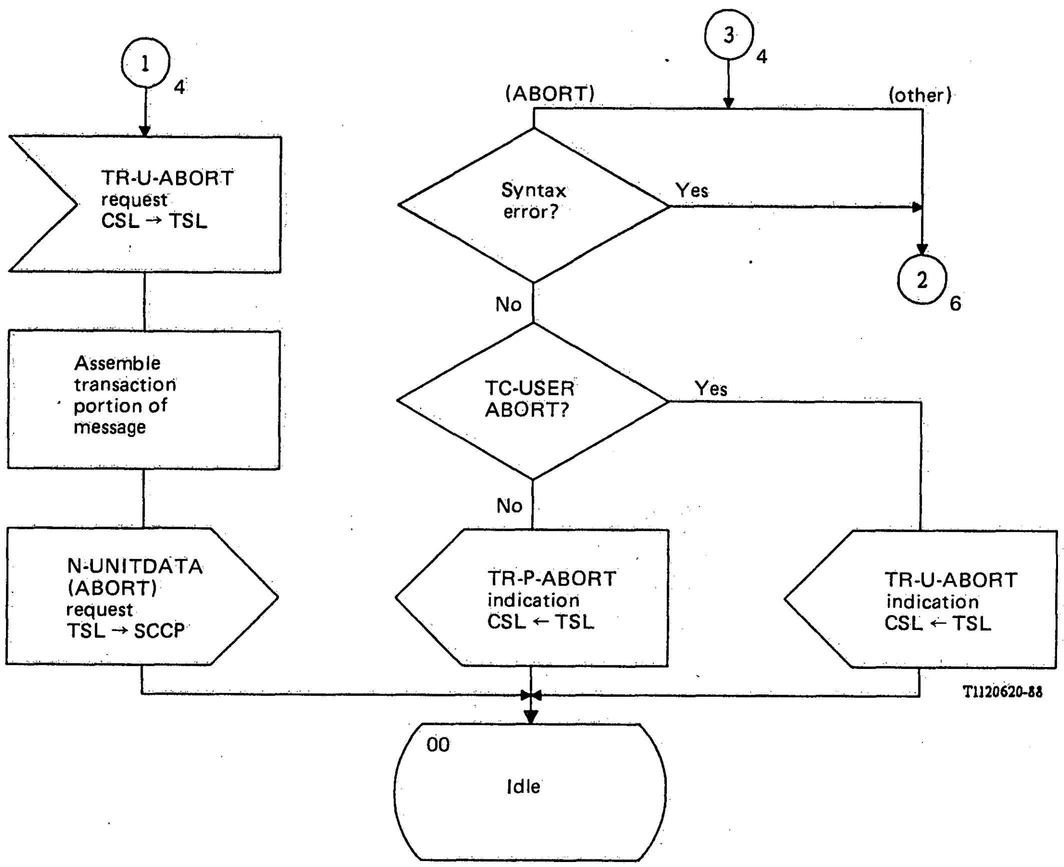
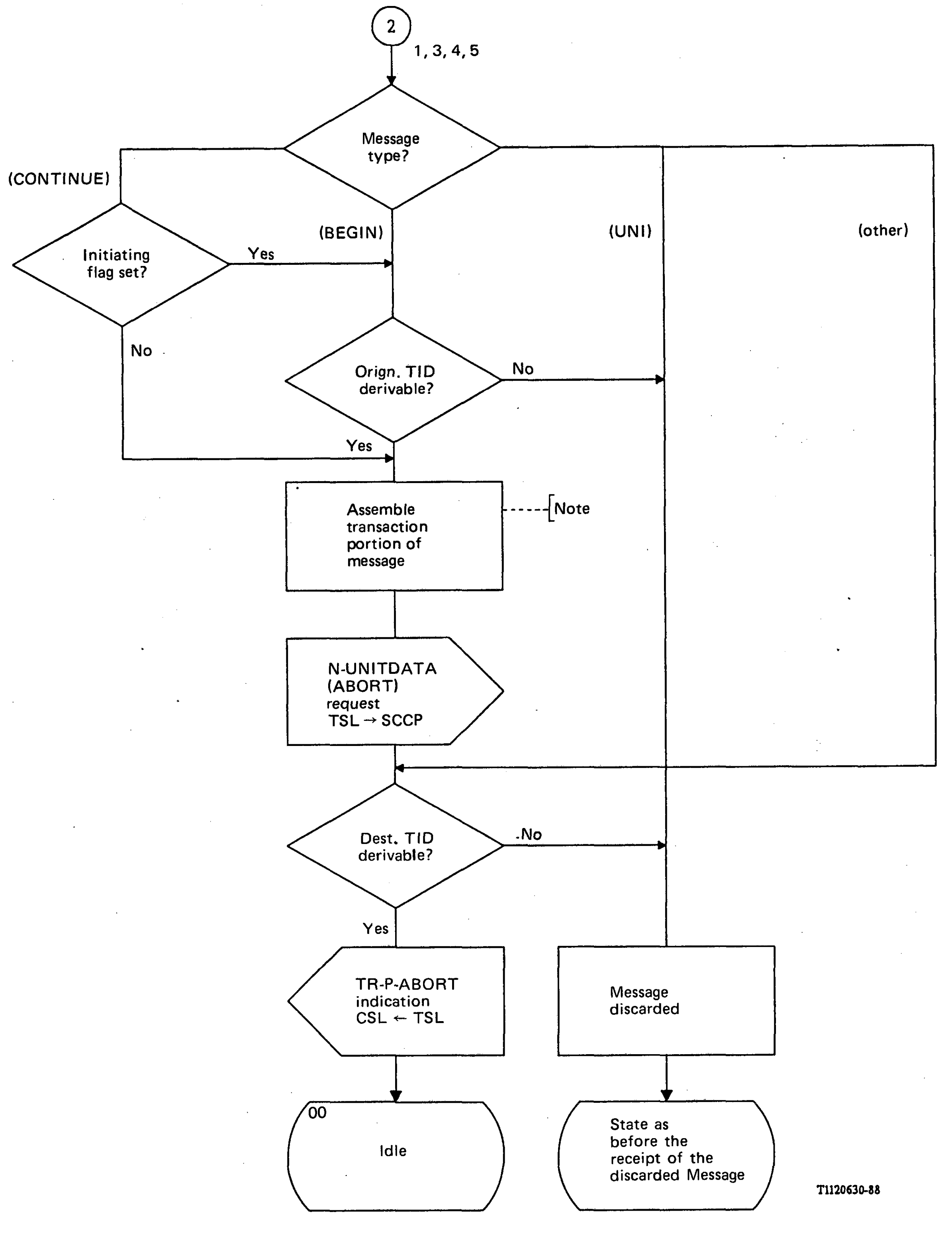


FIGURE A-3/Q.774 (Sheet 5 of 6)

Transaction sub-layer



Note – Abort codings as in Recommendation Q.773.

FIGURE A-3/Q.774 (Sheet 6 of 6)

Transaction sub-layer

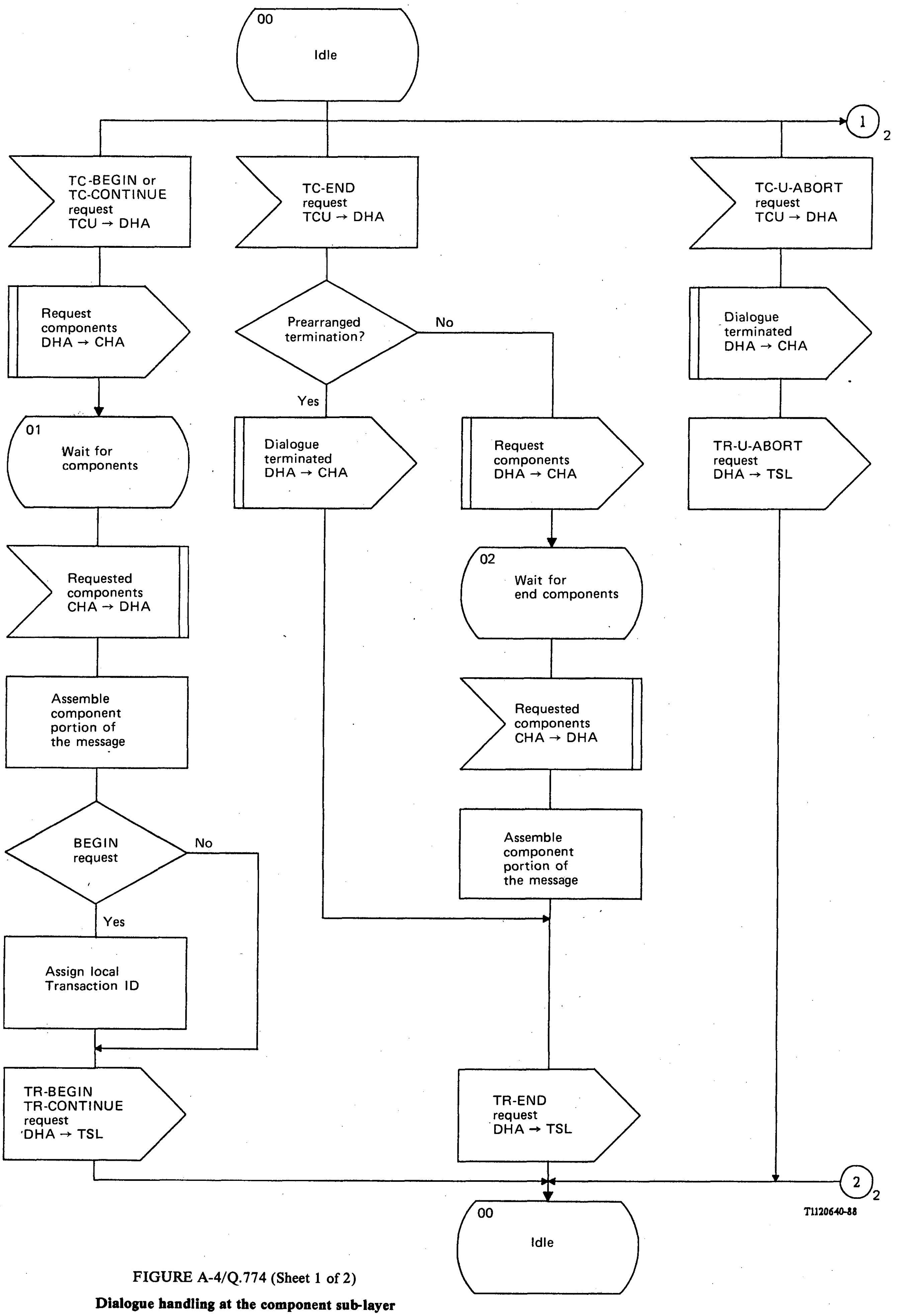


FIGURE A-4/Q.774 (Sheet 1 of 2)

Dialogue handling at the component sub-layer

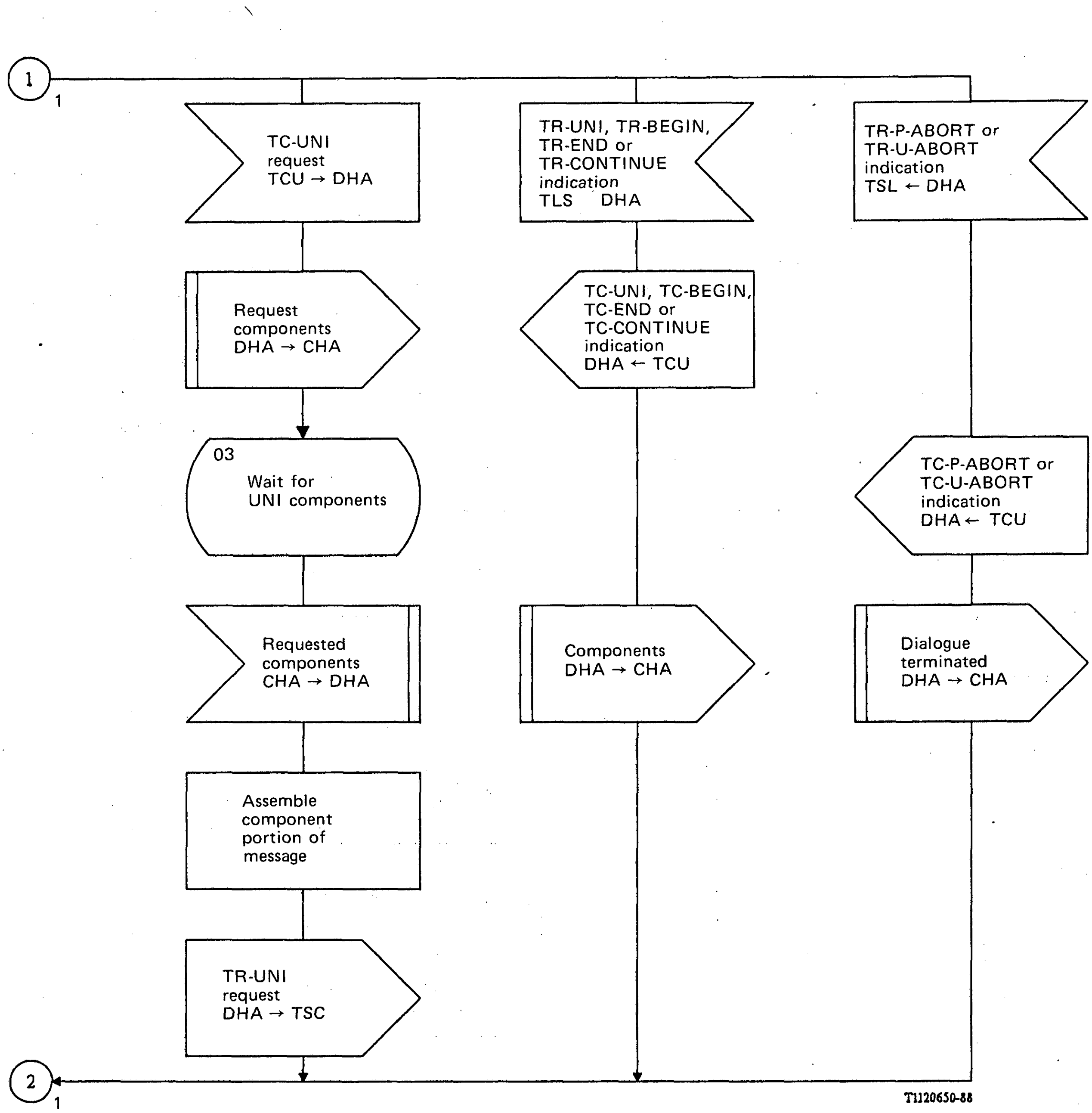
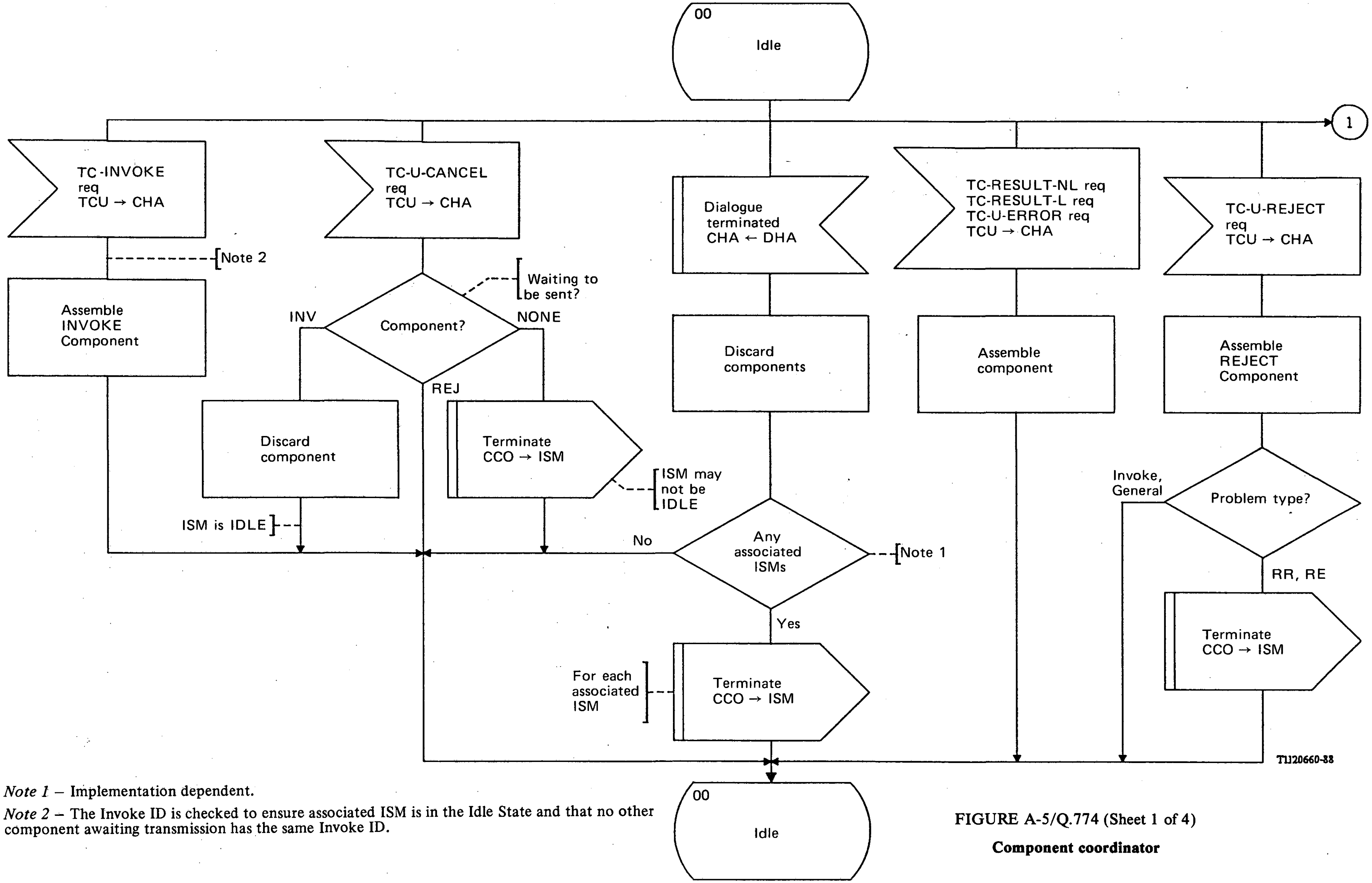


FIGURE A-4/Q.774 (Sheet 2 of 2)

Dialogue handling at the component sub-layer

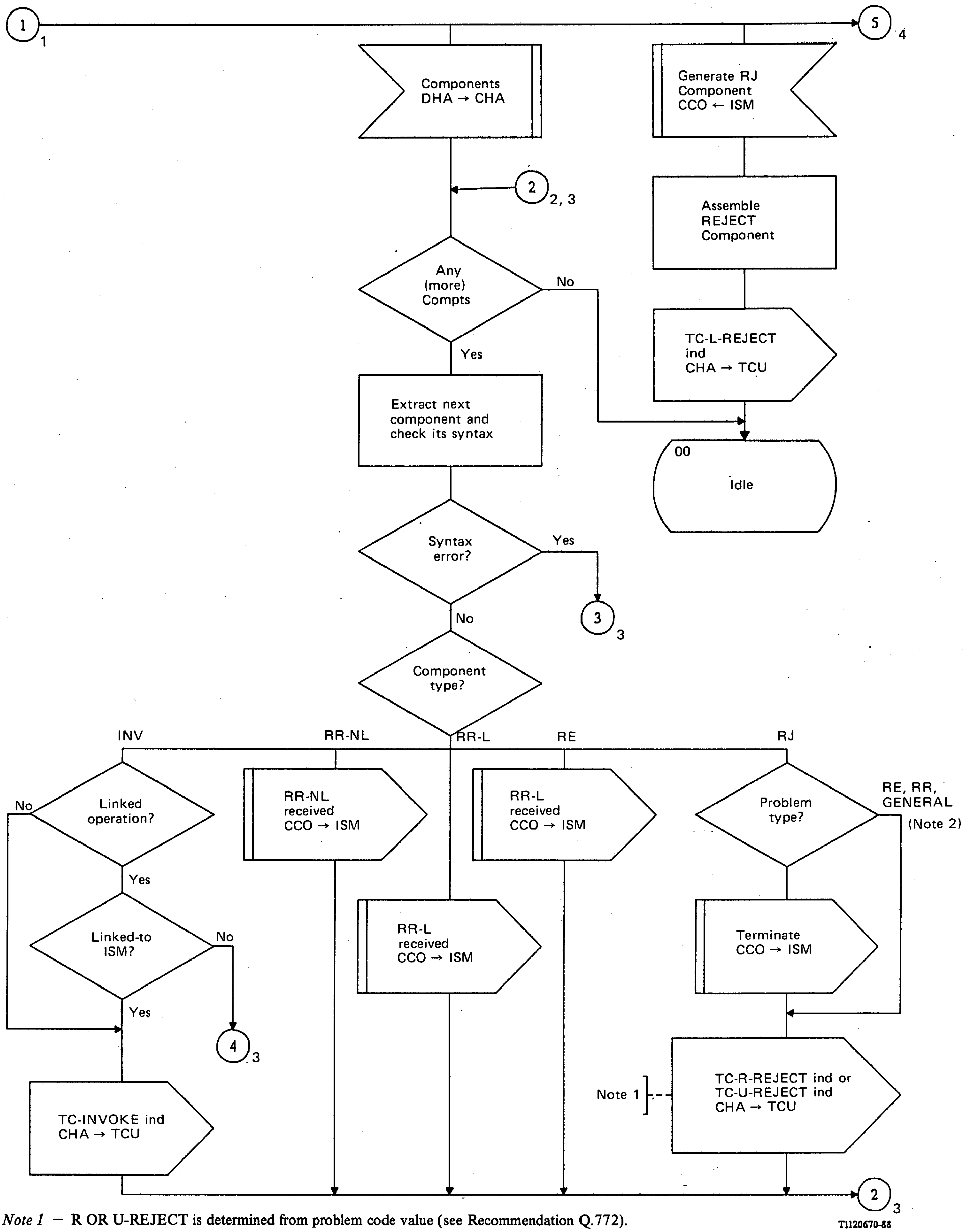


Note 1 – Implementation dependent.

Note 2 – The Invoke ID is checked to ensure associated ISM is in the Idle State and that no other component awaiting transmission has the same Invoke ID.

FIGURE A-5/Q.774 (Sheet 1 of 4)

Component coordinator

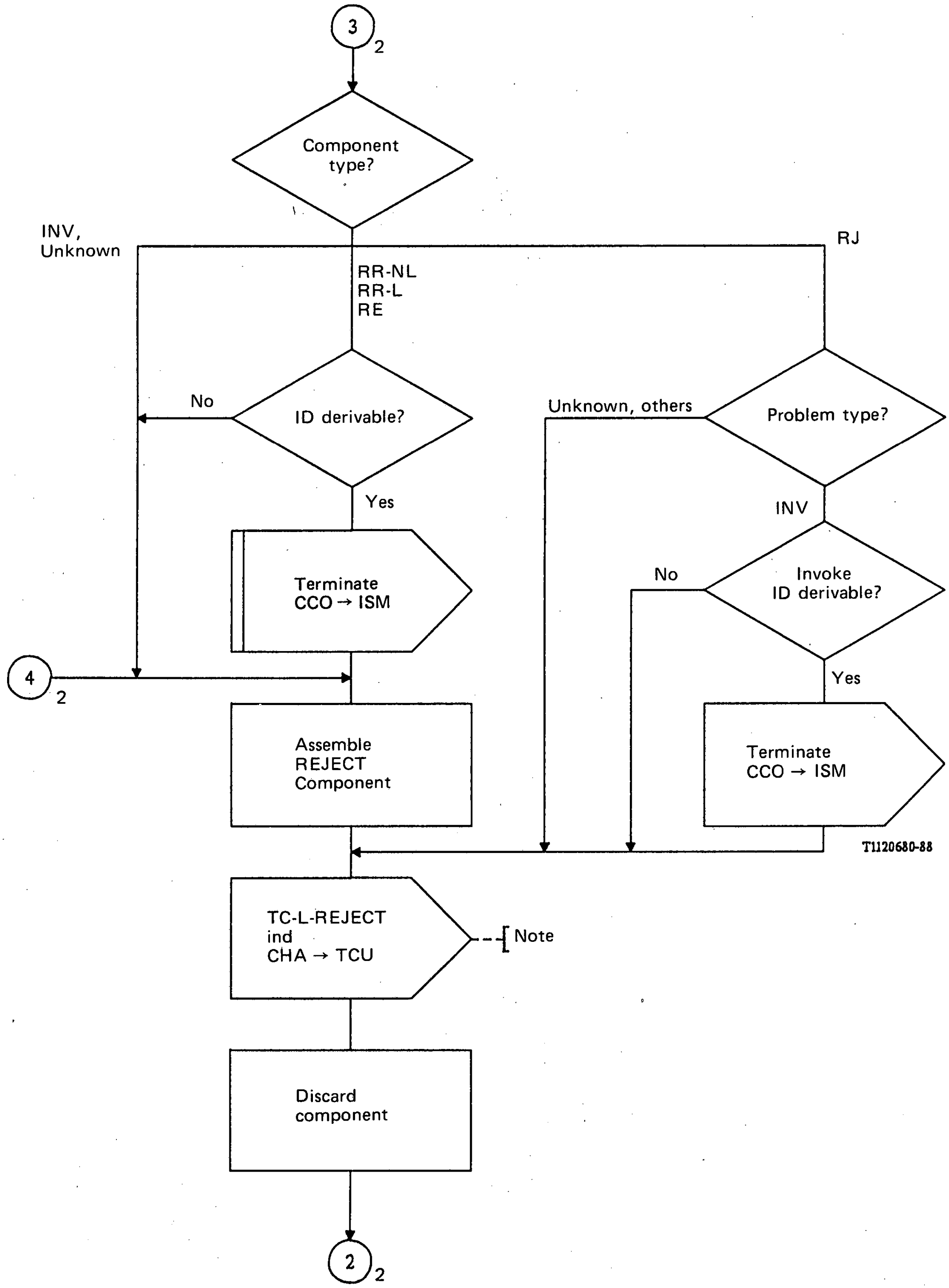


Note 1 – R OR U-REJECT is determined from problem code value (see Recommendation Q.772).

Note 2 – If "general" problem received, ID may refer to an ISM run by the other end. Therefore, a local ISM is not terminated.

FIGURE A-5/Q.774 (Sheet 2 of 4)

Component coordinator



Note – If the component is a Reject, problem type indicates syntax error detected in a received Reject component.

FIGURE A-5/Q.774 (Sheet 3 of 4)

Component coordinator

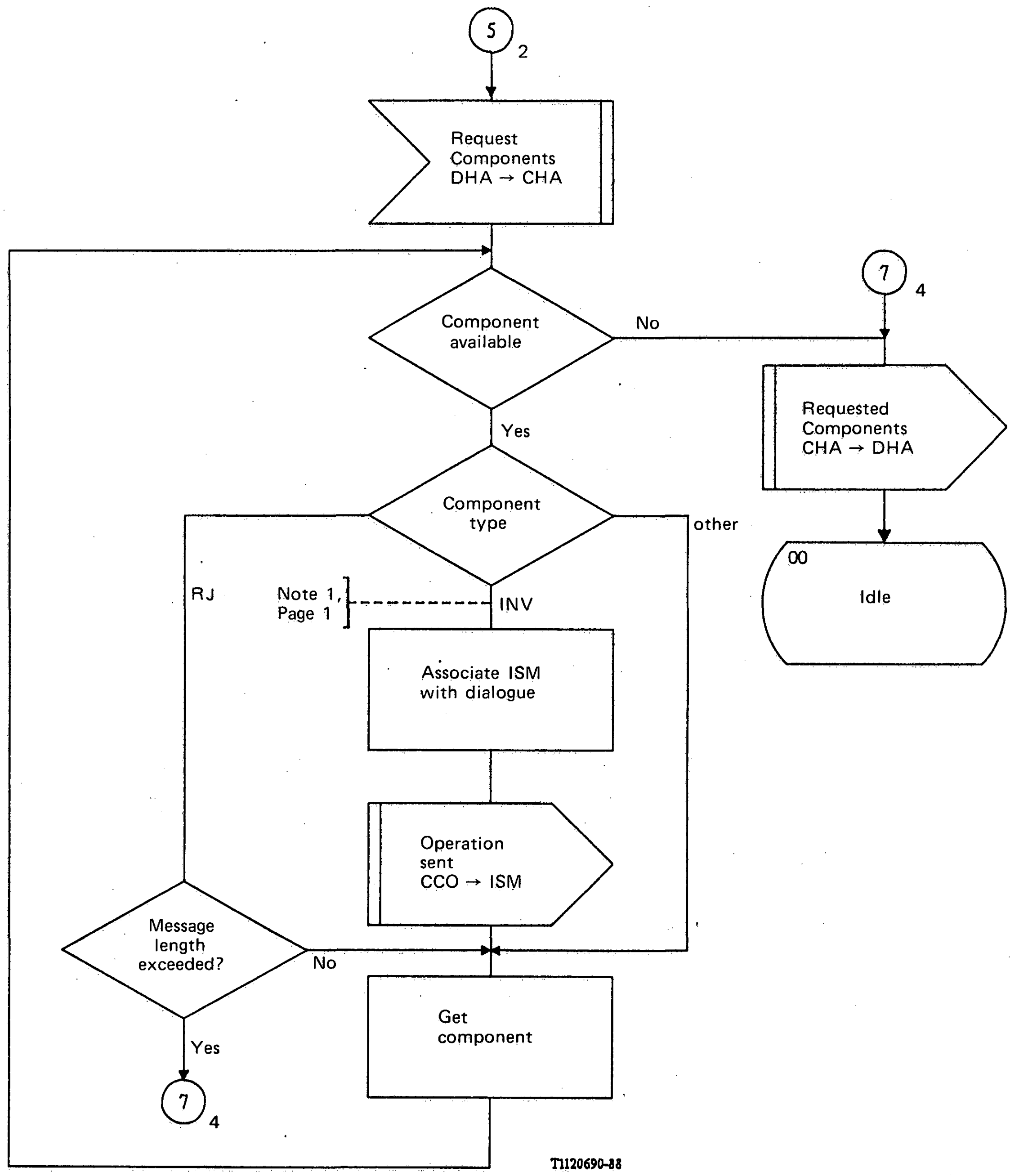


FIGURE A-5/Q.774 (Sheet 4 of 4)

Component coordinator

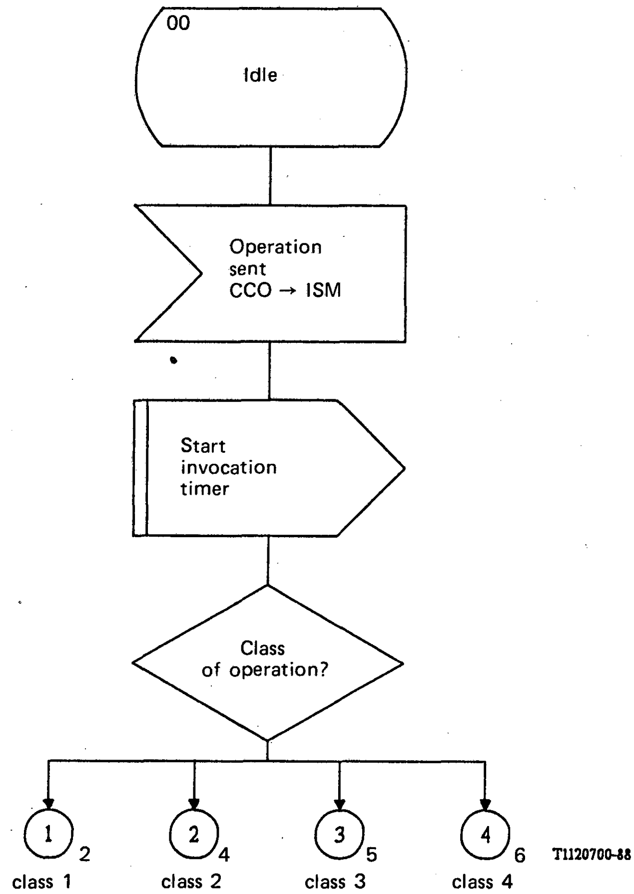


FIGURE A-6/Q.774 (Sheet 1 of 6)

Invocation state machine

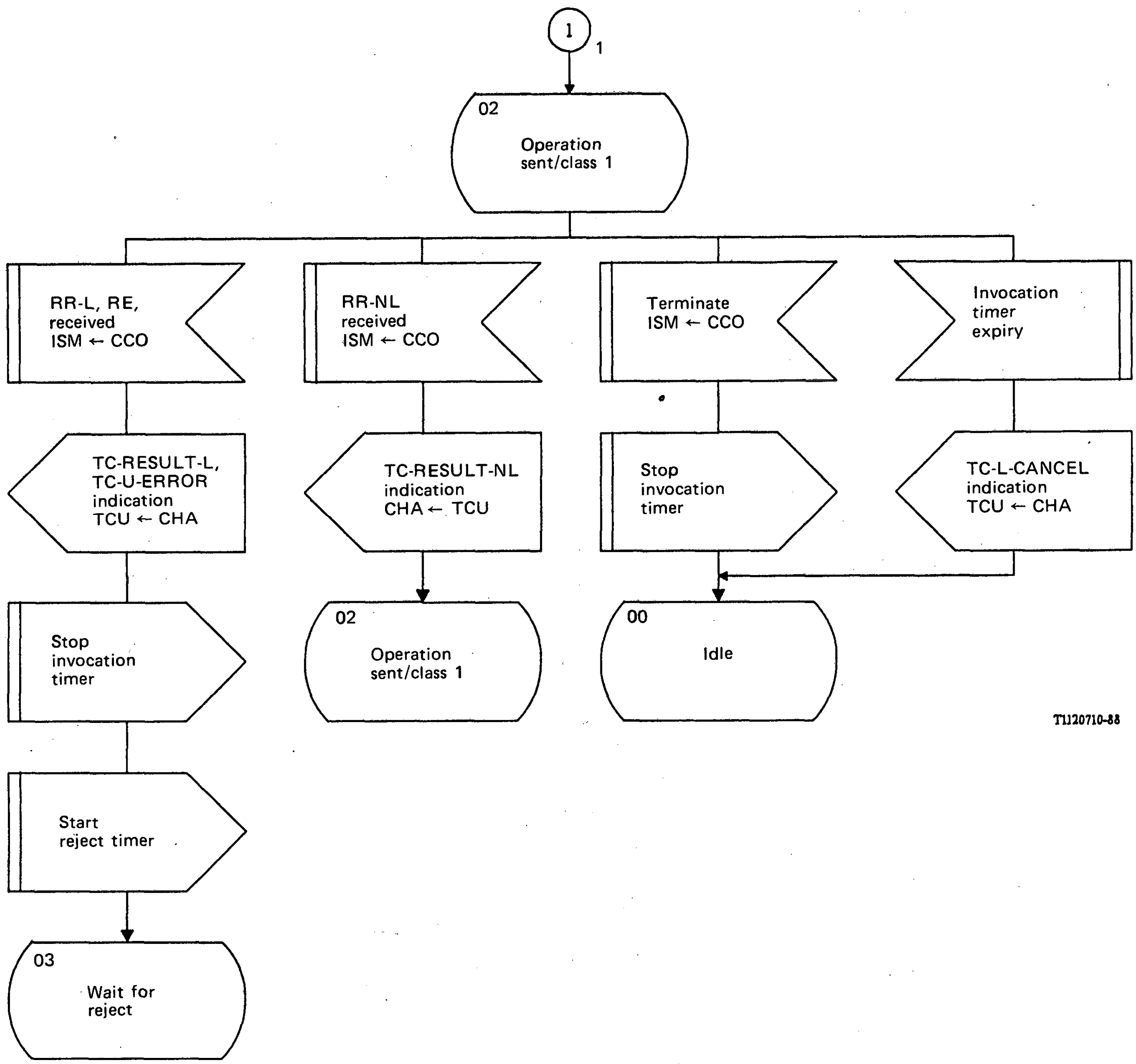


FIGURE A-6/Q.774 (Sheet 2 of 6)

Invocation state machine

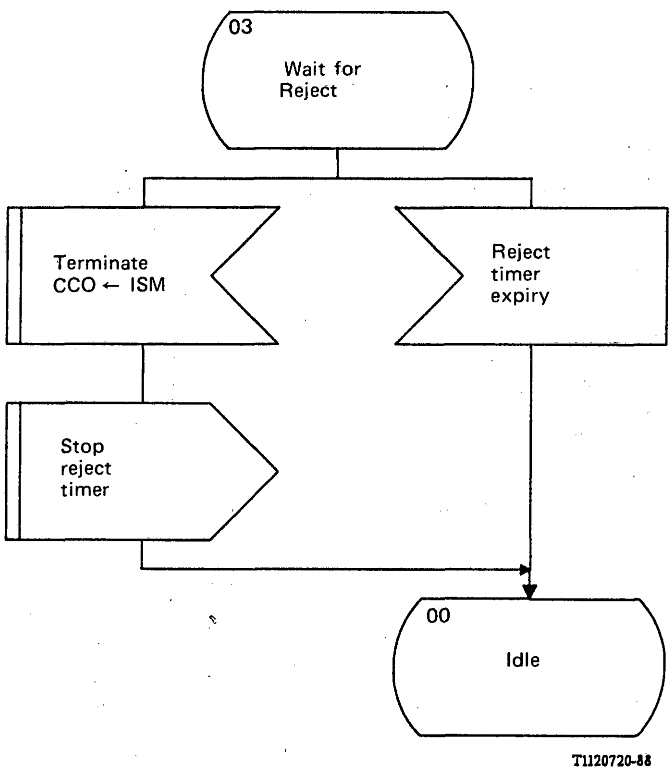


FIGURE A-6/Q.774 (Sheet 3 of 6)

Invocation state machine

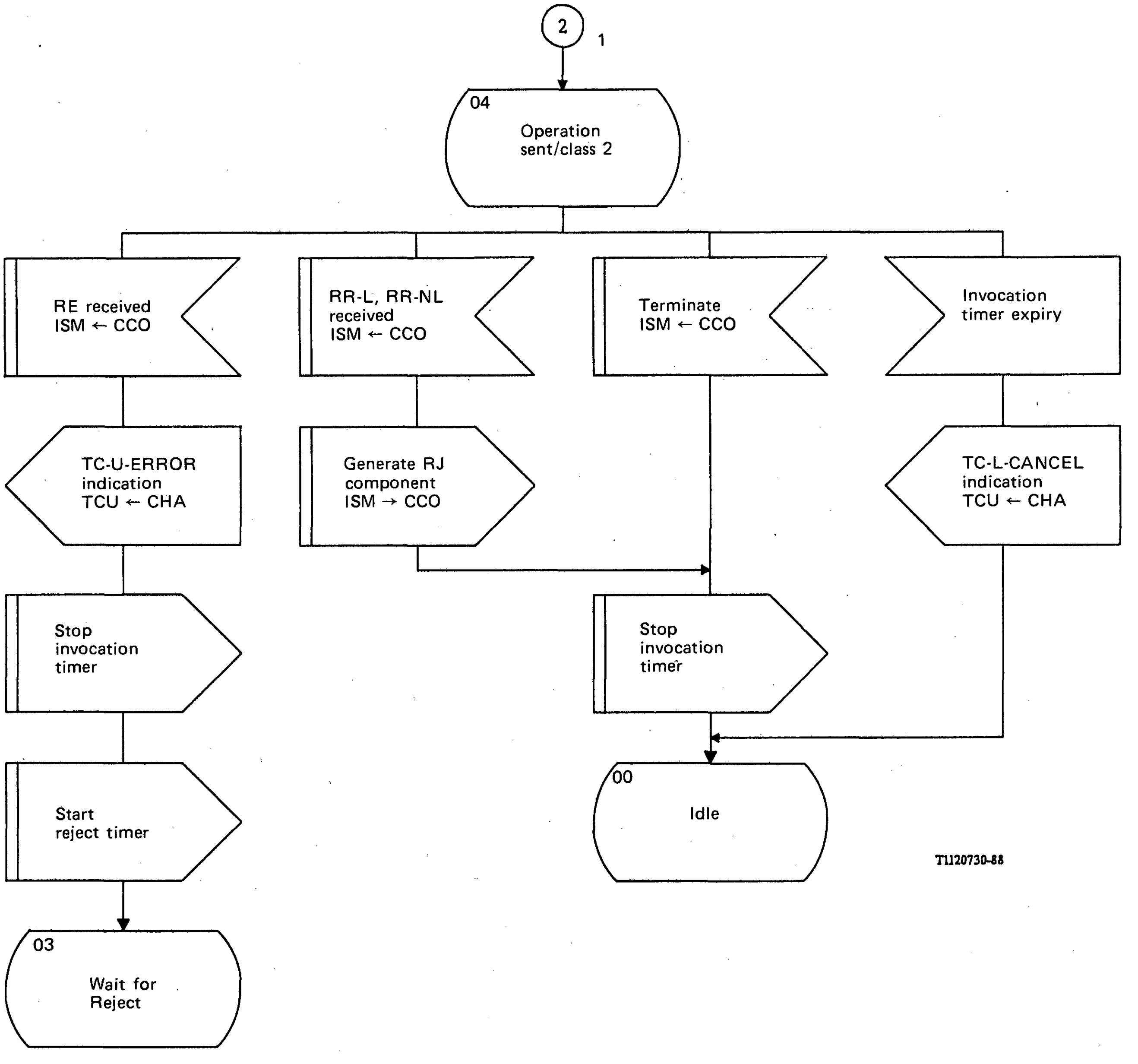
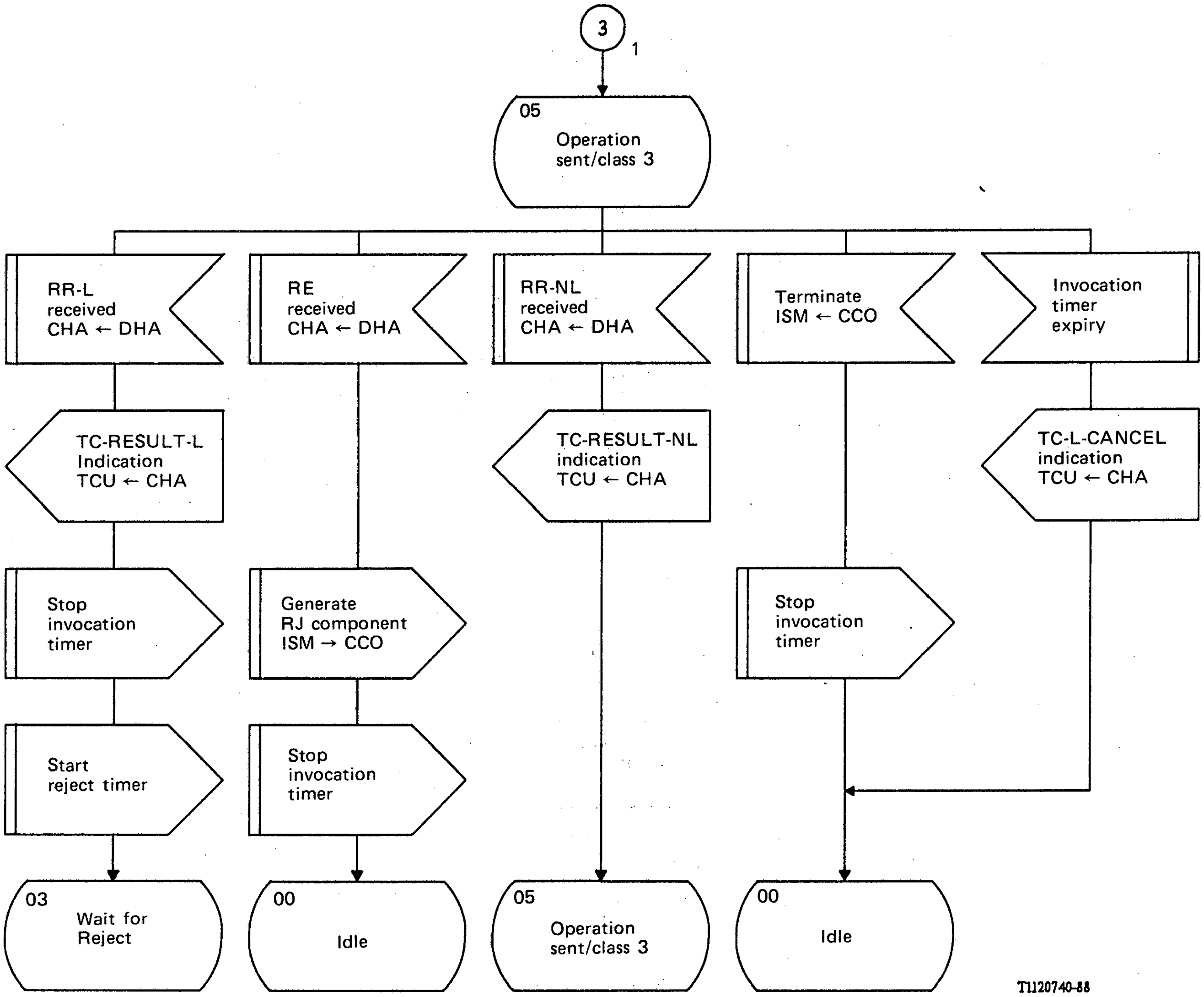


FIGURE A-6/Q.774 (Sheet 4 of 6)

Invocation state machine



Note – This may occur only after at least an RR-NL ind. has been received.

FIGURE A-6/Q.774 (Sheet 5 of 6)

Invocation state machine

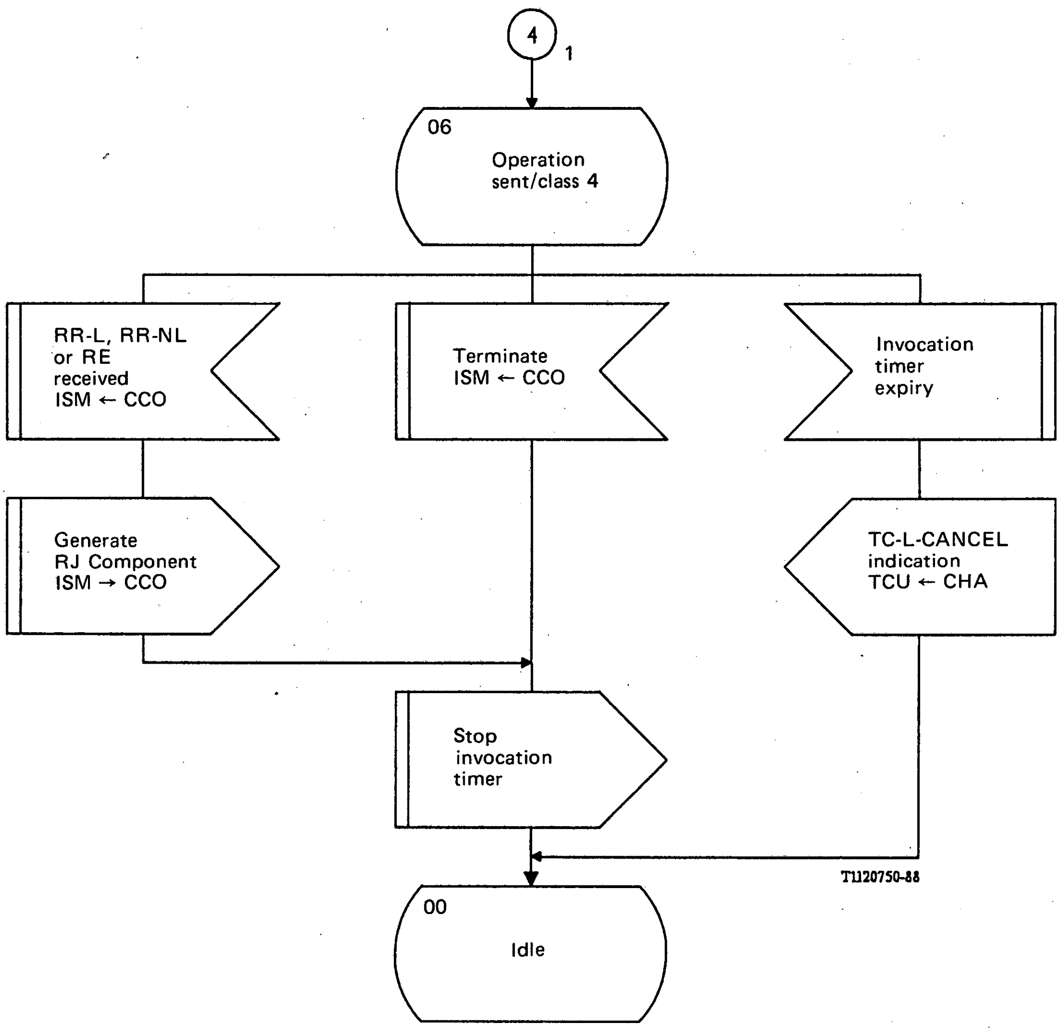


FIGURE A-6/Q.774 (Sheet 6 of 6)

Invocation state machine

Recommendation Q.775

GUIDELINES FOR USING TRANSACTION CAPABILITIES

(Melbourne, 1988)

1 Introduction

1.1 *General*

The purpose of this Recommendation is to provide guidelines to potential users of Transaction Capabilities (TC-users). The examples given are illustrations only; they indicate how an application may use TCAP, not how TCAP must be used in all cases. The technical basis of this document are Recommendations Q.771 to Q.774; in case of misalignment, these should be considered as the primary reference.

The main purpose of TCAP is to provide support for interactive applications in a distributed environment. TCAP is based on Recommendations X.219 and X.229 (ROSE) enhanced as necessary to provide the services needed by TC-users. Interactions between distributed application entities are modelled by Operations. An operation is invoked by an (originating) entity: the other (destination) entity attempts to execute the operation and possibly returns the outcome of this attempt.

The semantics of an operation (represented by its name and parameters) is not relevant to TCAP; TCAP provides facilities which are independent of any particular operation. The TC-user, when defining an application, must:

1) select operations;
2) select TCAP facilities to support these operations. Such facilities include the handling of individual operations, and the ability to have a number of related operations attached to an association between TC-users, called a dialogue;
3) define the application script.

This Recommendation describes the selection process of defining and using operations. The operations appearing hereafter are fictitious, and are taken for illustration purposes only. Also described are the facilities offered by TCAP for handling one or a sequence of operations in a dialogue. The definition of specific sequences of operations belongs to the application protocol definition and is beyond the scope of this Recommendation; however, Chapter 4 gives a brief indication of what information an application specification should contain.

TCAP services are made accessible to TC-users via primitives; these primitives model the interface between TCAP and its users, but do not constrain any implementation of this interface.

1.2 *Environment*

TCAP defines the end-to-end protocol between TC-users which may be located in a Signalling System No. 7 network, and/or another network supporting TCAP protocols.

Two broad categories of users have been considered (see Recommendation Q.771, § 1.3.2). Only the first category is considered here, i.e. those which are real-time sensitive users, and do not need to exchange large amounts of data. It is considered that for these users, protocols defined for OSI layers 4 to 6 in the X series of Recommendations would result in excessive overheads and hence are not used. A basic service has been specified, using a connectionless network service approach. Other categories of users might require connection-oriented network and higher layer services.

As a result, TCAP cannot support all kinds of applications, and a number of applications will still require more elaborate services such as specified in the X series of Recommendations. Besides indicating what TCAP can do, this Recommendation indicates what the connectionless approach cannot do, in order to help the application designer choose how to support an application.

2 Operations

2.1 *Definition*

An operation is invoked by an originating TC-user to request a destination TC-user to perform a given action.

A class is attached to an operation. This indicates whether either a successful outcome (result), or an unsuccessful outcome (error), or both, or none have to be reported by the destination. The outcome is reported in a result.

As well as the class, the definition of the operation includes a timer value indicating when the operation should be completed. This value is not indicated to the remote TC-user; it is assumed that the application at both ends has a common understanding of the operations in use.

An **operation** is defined by:

- its operation code and the type of any parameters associated with the operation request;
- its class;
- if the class requires report of success, the possible results corresponding to successful executions are defined by a list of parameters;
- if the class requires report of failure, the possible results corresponding to situations where the operation could not be executed completely by the remote TC-user. Each such situation is identified by a specific error cause; the list of these error causes is part of the operation definition. Diagnostic information can be added to the error cause: if present, it is part of the definition;
- the list of possible linked operations, if replies consisting of linked operations are allowed for this operation. Linked operations have to be described separately;
- a timer value indicating the interval by which the operation has to be completed. This timer value is used to manage the component ID associated with the operation invocation.

2.2 *Examples*

2.2.1 *Simple operations*

Note – The operation invocation should fit into one message, and so should a report of unsuccessful outcome. Reports of success may be segmented using Return Result-Not last and Return Result-Last.

Class 1 (both success and failure reported):

Translate a freephone number into a called subscriber number; return the called number if the translation can be performed, otherwise indicate why it cannot; time allocated: 2 seconds.

No reply being received when the timer expires indicates an abnormal situation (e.g. the operation invocation may have been lost): the local TC-user is informed (operation cancel by TCAP).

Class 2 (only failure reported):

Perform a routine test and send a reply only in case something went wrong; time allocated: 1 minute.

In the case of a class 2 operation, the TC-user is informed if no result has been received when the timer expires. This is interpreted as a successful outcome, even if the invocation was lost. This aspect should be considered when selecting class 2.

Class 3 (only success reported):

Perform a test: this corresponds to a pessimistic view, where failure is considered as the default option, not requiring any reply.

Timer expiry is indicated to the TC-user: this should be interpreted by the TC-user as a failure of the operation (but is considered normal by TC, which considers that the operation has terminated). This aspect should be considered when selecting class 3.

Class 4 (neither success, nor failure reported):

Send a warning, without expecting a reply or acknowledgement of any kind.

In this case, a result never arises from the invocation of the operation. The TC-user relies upon TCAP and the network to deliver the invocation. Notification of the timer expiry is a local matter.

The diagrams in Figure 1/Q.775 illustrate possible sequences of primitives as seen by the TC-user originating an operation.

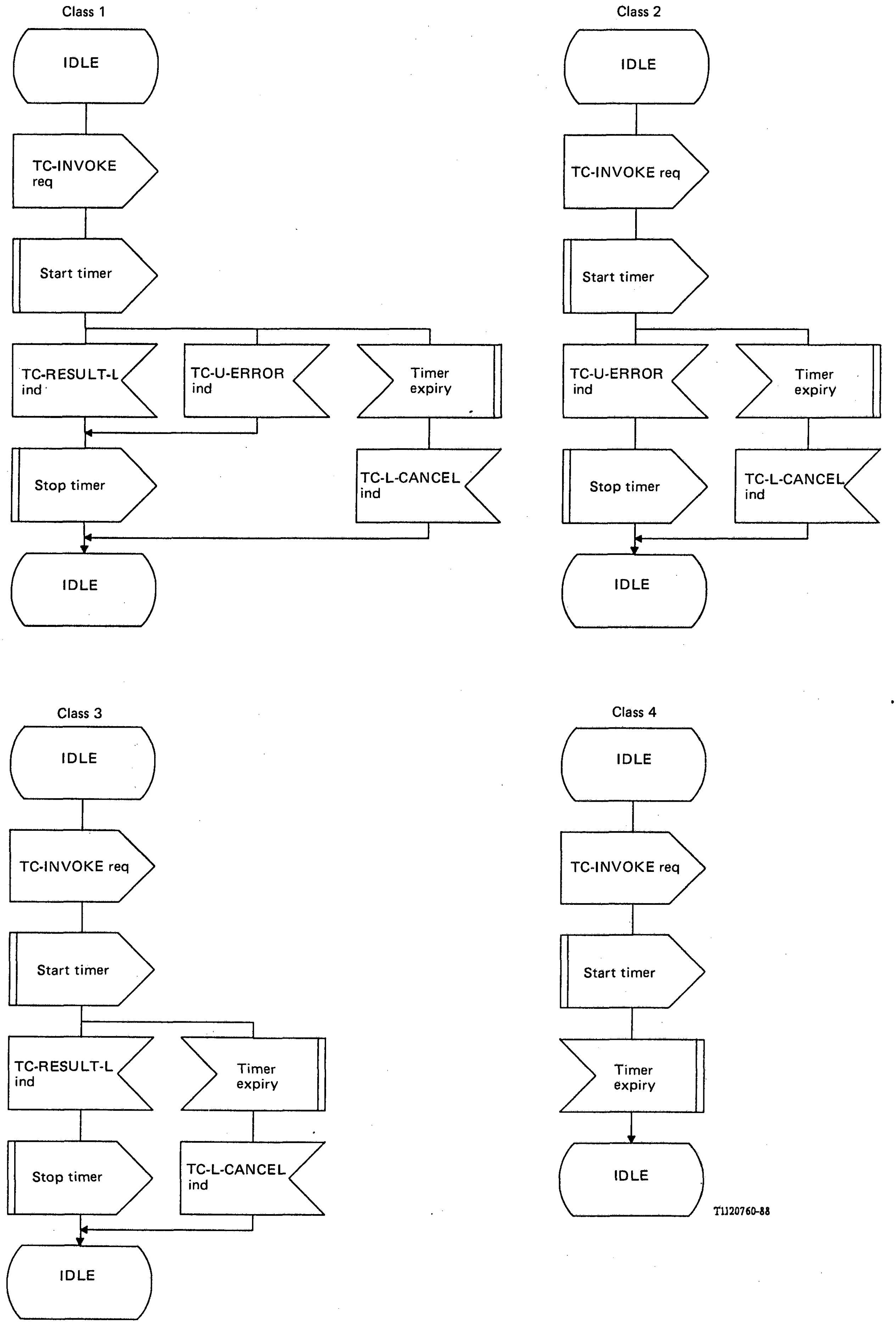


FIGURE 1/Q.775

Comparison with ROSE (Recommendation X.219) operation classes:

ROSE provides for five classes of operations: classes 2 to 5, called asynchronous classes, are identical to classes 1 to 4 of TCAP. ROSE's class 1 is a synchronous class; it has no counterpart in TCAP, where full-duplex exchanges of components are considered. However, a TC-user can decide to operate in a synchronous manner (see § 3.2.1).

2.2.2 *More sophisticated operations*

Operations with segmented results

A successfull result may be divided into several segments, each of which is indicated to the originator of the operation by one primitive. This facility, using the TC-RESULT-NL primitive, can be used by TC-users to overcome the absence of segmentation in the underlying layers. The last segment is indicated by the TC-RESULT-L primitive.

The report of an error cannot be segmented.

Apart from abnormal situations, responses are delivered to the remote TC-user in the order in which they have been passed to TCAP by the sending TC-user.

TC cannot identify a specific segment in the case of a segmented result.

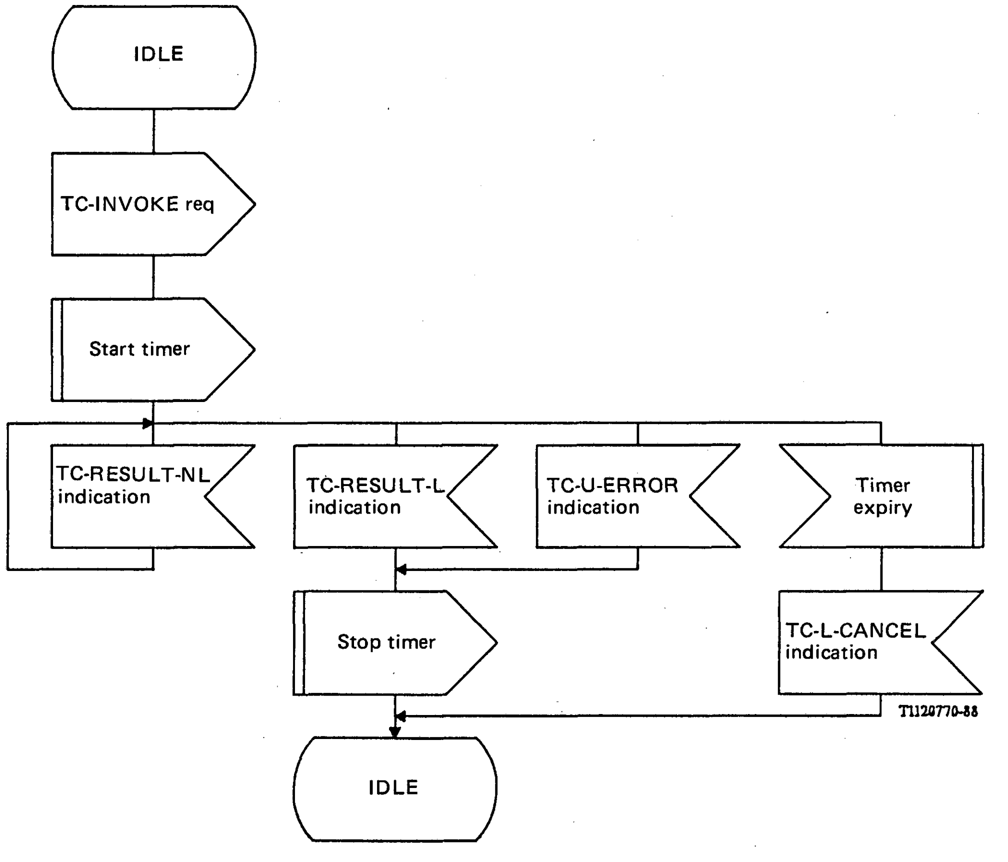
Example E1: An operation requests the execution of a test. The result of a correct execution is segmented in three parts P1, P2 and P3 to be returned to the originator.

A possible primitive sequence for example E1 is given in Table 1/Q.775

TABLE 1/Q.775

TC USER A	TC USER B
TC-INVOKE req (Test, Class = 1)	TC-INVOKE ind (Test) TC-RESULT-NL req (P1)
TC-RESULT-NL ind (P1)	TC-RESULT-NL req (P2)
TC-RESULT-NL ind (P2)	TC-RESULT-L req (P3)
TC-RESULT-L ind (P3)	
Time	

The diagram in Figure 2/Q.775 illustrates possible sequences of primitives seen by the originator of an operation (class 1) with segmented results.



Note – The time-out value is specified by the originating TC-user at invocation time. A non-final result does not restart it.

FIGURE 2/Q.775

Linked operations

Another extension to the basic operation scheme is the ability to link an operation invocation to another operation invocation.

Typically, this facility covers situations where the destination of the original (linked-to) operation requires additional information in order to process this operation: this is the case where menu facilities are used (menu facilities allow a user to make a sequence of choices, each being dependent on the previous ones).

Example E2: The operation is the execution of a test with several options; before the test is executed, these options are offered for selection to the test originator (TC-user A). Two operations are nested: operation 1 is the test; operation 2 is the option selection. TC-user A first responds to operation 2 before TC-user B can perform the test with the indicated option(s).

A possible primitive sequence for example E2 is given in Table 2/Q.775.

TABLE 2/Q.775

TC USER A	TC USER B	
TC-INVOKE req (Test, Class = 1)	TC-INVOKE ind (Test) TC-INVOKE req (Option-selection, Class = 1)	Operation 1 begin Operation 2 begin
TC-INVOKE ind (Option-selection) TC-RESULT-L req (Options)	TC-RESULT-L ind (Options) TC-RESULT-L req (Test-result)	Operation 2 end
TC-RESULT-L ind (Test-result)		Operation 1 end
Time		

There is no limit to the number of operation invocations which may be linked to a given operation invocation.

Note that when an operation B is linked to another operation A, they do not have to be nested. The only condition is that the invocation of B should take place before the outcome of A is reported; however, operation B does not have to terminate before operation A.

2.3 *Component-related facilities offered to TC-users*

2.3.1 *Invocation*

So far, operations have been considered from the static point of view. Invocation introduces a dynamic aspect: a specific invocation of an operation has to be differentiated from other possible concurrent invocations of the same or of another operation.

Each particular activation of an operation is identified by a component ID. This component ID must be non ambiguous. It is selected by the TC-user which originates the operation invocation, and passed to the destination TC-user, which will reflect it in its reply(ies): therefore it correlates the replies to an invocation, and the invocation itself.

The TC-user is free to assign any value to the component ID (index, address, . . .).

The component ID associated with an invocation becomes reusable when the last or only segment of a result is received, or when certain abnormal situations are indicated by TCAP; however, the value should not be reallocated immediately for another operation activation, as immediate reallocation would prevent the correct handling of some situations (see below).

The period during which a component ID is released, but cannot be reallocated, is called the freezing period.

As component IDs receive their value dynamically at the time the operation is invoked, their value cannot appear in the specification of the application protocols; rather, a "logical" value, to which a real value is substituted at execution time, should be indicated in order to identify an operation in a single flow.

Taking component IDs into consideration, the sequence of primitives for example E2 above becomes as shown in Table 3/Q.775.

TABLE 3/Q.775

TC USER A	TC USER B
TC-INVOKE req (1, Test, Class = 1)	TC-INVOKE ind (1, Test) TC-INVOKE req (2, 1, Option-selection, Class = 1)
TC-INVOKE ind (2, 1, Option-selection) TC-RESULT-L req (2, Options)	TC-RESULT-L ind (2, Options) TC-RESULT-L req (1, Test-result)
TC-RESULT-L ind (1, Test-result)	
Time	

where the first parameter of a primitive indicates an invoke ID. When both parameters have to be present, the second one is the linked ID. This is a pure notational convention.

2.3.2 *Cancel (by the TC-user)*

The TC-user requesting invocation of an operation may stop the activity associated with the corresponding component ID, for any reason it finds appropriate. However, cancel should in principle be reserved for abnormal situations: the normal method for terminating an operation is to receive a result or to terminate on timer expiry.

Cancelling has local effect only: it does not prevent the remote TC-user from sending replies to a cancelled operation. When received, these replies will be rejected by TCAP, as illustrated in the following, which represents a sequence of primitives for the example E1 defined above, where TC-user A cancels the test after receiving the first segment of the result.

In Table 4/Q.775, part P2 is not received by TC-user A: TCAP detects a reject situation before delivering it, and any attempt by TC-user B to send more replies is rejected at A's side.

TABLE 4/Q.775

TC USER A	TC USER B
TC-INVOKE req (1, Test, Class = 1)	TC-INVOKE ind (1, Test) TC-RESULT-NL req (1, P1)
TC-RESULT-NL ind (1, P1) Cancel decision: TC-CANCEL req (1) TC-L-REJECT ind (1, Problem Code)	TC-RESULT-NL req (1, P2) ....
Time	

2.3.3 *Reject (by the TC-user)*

A TC-user may decide to reject a component for any reason it finds appropriate, e.g. application protocol error, parameter missing in an operation or a reply, etc.

TCAP covers a number of cases, identified by the list of Problem Codes in Recommendation Q.773. In any of these cases, which correspond to situations where an operation or a reply is not correctly formatted, the TC-user may use the reject facility. Alternately, he may decide to return a failure indication (error component), which allows more detailed error and diagnostic information.

Reject of an operation invocation, or of a result, affect the whole operation: no more replies will be accepted for this invocation. Reject of a linked operation does not affect the linked-to operation.

This is illustrated in Table 5/Q.775 where, in example E2, TC-user A did not expect the option selection process (it may be an optional feature), and rejects the operation with the Problem Code "Unexpected Linked Operation". TC-user B may then decide to execute the test assuming a default option.

TABLE 5/Q.775

TC USER A	TC USER B
TC-INVOKE req (1, Test, Class = 1)	TC-INVOKE ind (1, Test) TC-INVOKE req (2, 1, Option-selection, Class = 1)
TC-INVOKE ind (2, 1, Option-selection) TC-U-REJECT req (2, Problem Code)	
	TC-U-REJECT ind (2, Problem Code) TC-RESULT-L req (1, Test-result)
TC-RESULT-L ind (1, Test-result)	
Time	

When an operation invocation is rejected, the TC-user may decide to reinvoke it (e.g. the invoke component was corrupted); this would be a new invocation (new Invoke ID). It may also decide to abort the dialogue. A very simple dialogue (a question and a response) may not define any recovery mechanisms, except when the operation is of critical importance (e.g. a database update).

2.4 *Component-related abnormal situations*

2.4.1 *Component loss*

TCAP assumes a very low probability of message loss in the network; if this probability is too high for an application, it should use the connection-oriented network service approach. If some protocol information needs an upgraded quality of service (e.g. charging information), the application should introduce its own mechanisms to obtain higher reliability for this information.

Loss of an operation invocation

The Table 6/Q.775 sequence illustrates the case, in example E1, where no response to the test is received before the time limit expires.

TABLE 6/Q.775

TC USER A	TC USER B
TC-INVOKE req (1, Test, Class = 1)	
Time limit: TC-L-CANCEL ind (1)	
Time	

When a class 1 operation is lost, the TC-user is informed when the timer asociated with the operation expires. When a class 1 operation with a single result is lost, TCAP cannot indicate whether either the operation invocation, or the reply, was lost. If the application needs to discriminate between these two cases, it should do it in the application protocol (e.g. using the time-stamping or acknowledging the operation invocation before replying to it).

For a class 2 operation, loss will be considered as a success (whether the invocation, or the failure report, was lost). This, considering the probability of loss, may be acceptable for non critical operations (e.g. statistical measurements).

For a class 3 operation, loss is treated in the same way as operation failure, whether the invocation, or the success report, has been lost.

For a class 4 operation, loss will not be visible to TCAP.

Loss of a result

- Loss of a non final result is never detected by TCAP.
- Loss of a final result will eventually be indicated to the TC-user when the time limit is reached, but cannot always be unambiguously interpreted as the loss of a reply; of no non final result has been received, it may be that the invocation was lost.

Loss of a linked operation

The loss of a linked operation has the same effect as the loss of a non-linked operation. It has no effect on the linked-to operation.

Loss of a reject component

This case should be extremely infrequent, and no application should try to recover from such a situation. If the lost reject concerns an operation invocation, then when the operation timed out the TC-user which invoked the operation will consider that the invocation (or the reply) was lost, and react accordingly; if it concerns a reply, the originator of the reply will consider that it was correct: it will be up to the originator of the operation to detect the loss.

2.4.2 *Component duplication*

As message duplication is very infrequent in the Signalling System No. 7 network, scripts for No. 7 applications need not define sophisticated scenarios in anticipation of such situations. However, any application in which duplication would be unacceptable should either define its own duplication detection mechanism or use a connection-oriented service.

Duplicate operation invocation

When an operation invocation is duplicated (by the service provider), the destination TC-user (B) may, or may not, detect the duplication:

- TC-user B detects the duplication: the best it can do in this case is to ignore the duplicate; rejection could be interpreted by the remote TC-user as rejection of the original invocation;
- TC-user B does not detect the duplication: this may happen when there is a master-slave relationship between A and B, and B executes the operation with no knowledge of the context.

Assuming the second case in exaple E1, a possible sequence could be as given in Table 7/Q.775.

TABLE 7/Q.775

TC USER A	TC USER B	
TC-INVOKE req (1, Test, Class = 1)		
	TC-INVOKE ind (1, Test)	
	TC-INVOKE ind (1, Test)	Undetected duplication of invocation
	TC-RESULT-NL req (1, P1)	
	TC-RESULT-NL req (1, P1)	
TC-RESULT-NL ind (1, P1) TC-RESULT-NL ind (1, P1)		
A detects an abnormal situation and rejects: TC-U-REJECT req (1, Problem Code)	TC-RESULT-NL req (1, P2)	
TC detects an abnormal situation and rejects P2: TC-L-REJECT ind (1, Problem Code)	TC-U-REJECT ind (1, Problem Code)	
	TC-R-REJECT ind (1, Problem Code)	
Time		

In this sequence, TC-user B considers two independent test invocations, and responds to each of them. The first result P1 is accepted; TC-user A detects that P1 is received a second time, and rejects it; this terminates the operation, and causes result P2 to be rejected when received (reject by TCAP). Therefore, both activities at B's side will terminate on receipt of rejects.

Duplicate non-final result

If a non-final result is duplicated, TCAP cannot detect it, and will deliver it twice to the TC-user. Detection of this situation is left to the application.

Duplicate final result

If a final result is duplicated, TCAP can detect the situation: the second final result is considered as abnormal (the operation has been terminated by the first "final" result), and TCAP rejects it.

Table 8/Q.775 shows a sequence for example E1 where the third segment of the result is duplicated (by the network).

TABLE 8/Q.775

TC USER A	TC USER B
TC-INVOKE req (1, Test, Class = 1) TC-RESULT-NL ind (1, P1) TC-RESULT-NL ind (1, P2) TC-RESULT-L ind (1, P3) Duplication of P3: TC-L-REJECT ind (1, Problem Code)	 TC-INVOKE ind (1, Test) TC-RESULT-NL req (1, P1) TC-RESULT-NL req (1, P2) TC-RESULT-L req (1, P3)
	TC-R-REJECT ind (1, Problem Code)
Time	

Comment: Discarding of duplicates in all cases by TCAP would probably appear as a nicer issue. However, it should be noted that:

1) it would require another degree of complexity in TCAP, which contradicts the basic characteristics of TCAP in the connectionless approach;
2) it corresponds to a situation which is extremely infrequent, at least in the No. 7 network.

To cover these situations when required by an application, it would be better to use a connection-oriented network service approach, since duplication could then be detected and handled at the lower layers.

2.4.3 *Component missequencing*

For TCAP, the order of segmented results is not relevant: if the order is important to the TC-user, appropriate mechanisms should be defined in the application protocol (e.g. by introducing a numbering scheme to identify intermediate replies in a parameter of these replies, or by using a connection-oriented service).

Due to missequencing, a non final result may arive after a final result: when this occurs the non final result is rejected by TCAP.

The sequence in Table 9/Q.775 illustrates what happens in example E1 when the last part of the result is received before the second one: both TC-users are informed.

TABLE 9/Q.775

TC USER A	TC USER B
TC-INVOKE req (1, Test, Class = 1)	TC-INVOKE ind (1, Test) TC-RESULT-NL req (1, P1)
TC-RESULT-NL ind (1, P1) TC-RESULT-L ind (1, P3) Missequenced result: reject TC-L-REJECT ind (1, Problem Code)	TC-RESULT-NL req (1, P2) TC-RESULT-L req (1, P3)
	TC-R-REJECT ind (1, Problem Code)
Time	

If a linked operation invocation is received after the final result of the linked-to operation (as a result of a missequencing), the linked operation is rejected.

TCAP assumes a very low probability of missequencing; if the supporting network is not satisfactory in this respect, the connection-oriented network service approach should be considered.

2.4.4 *Reject of a component by TCAP*

A general principle when TCAP receives a component (operation invocation or reply) which is either not formatted correctly, or received out of context (e.g. a reply without a prior operation invocation), is to reject it, which means that:

1) the destination of the faulty component is first informed of the situation; TCAP provides whatever information is available on the nature of the component being rejected
2) in reaction to this, the TC-user may decide to abort, continue, or end the dialogue. In the last two cases, when the TC-user notifies TCAP of its decision, the peer TC-user is informed of the reject.

Possible cases of reject by TCAP have been encountered in the previous sections. Whenever the component ID is recognised, rejection by TCAP causes the termination of the operation: a possible recovery is a new invocation of the terminated operation. When the rejected component is not identifiable, only the local TC-user is informed, and abort of the dialogue may be the appropriate reaction.

2.4.5 *Operation timer expiry*

When TCAP informs the TC-user of timer expiry (TC-L-CANCEL indication), it indicates that no more information related to the operation invocation (in particular, no reject) can be received. If the peer entity still sends information in relation with this invocation, this information will be discarded when received, provided that the component ID of the cancelled operation has not been reallocated. Premature reallocation of component ID values is normally avoided by correctly setting timer values: in order to compensate for uncertainties in the amount of time required to send information from TC-user to another without accounting for the absolute worst case (which is also in general the most unlikely), an implementation-dependent mechanism avoiding premature reallocation of component IDs is required.

Timer expiry indication corresponds to an abnormal situation only in the case of a class 1 operation. The TC-user is then aware that either the invocation, or the reply, was lost. If no undesirable side effects arise, another invocation of the same operation can take place after timer expiry. This is illustrated by the sequence in Table 10/Q.775 for example E1.

TABLE 10/Q.775

TC USER A	TC USER B
TC-INVOKE req (1, Test, Class = 1)	TC-INVOKE ind (1, Test)
Timer expiry: TC-L-CANCEL ind (1) TC-INVOKE req (2, Test, Class = 1)	
Time	

Timer expiry for a class 2 operation indicates that no failure was received nor will be accepted for this invocation: it is a definite indication of success (for class 2). A parallel situation applied to class 3 in case of failure. The indication of timer expiry for a class 4 operation is a local decision.

3 Dialogues

Whenever one of the operation handling primitives considered in § 2 is issued, a request is passed to TCAP, but nothing is sent to the remote TC-user until a primitive requesting transmission is issued. These primitives, and their relation with operation handling primitives, are considered now.

3.1 *Grouping of components in a message*

The effect of TC-user issuing a component handling primitive (unless this primitive has local effect only), is to build a **component** to be included in a **message**. The message is not transmitted until the TC-user requests it.

Note that a component may also be generated as a result of a TCAP reject: in this case this component is put in the next message for the dialogue unless it is aborted.

Provided that the maximum size of a message is not exceeded, several components can be grouped and sent to the remote end as a single message, thereby saving transmission overhead. This is done under control of the TC-user, which explicitly specifies when it wants (a) component(s) to be sent.

Example E3, as given in Table 11/Q.775, shows the beginning of a dialogue with a network service centre where a switch requests instructions (operation 1) and receives a request to connect the call to a given destination address, and a request to send information (e.g. announcement or message to be displayed) to the calling party. Both components are contained in a single message.

TABLE 11/Q.775

TC USER A	TC USER B
TC-INVOKE req (1, Provide-Instructions, Class = 1) TC-BEGIN req (control parameters)	
	TC-BEGIN ind (control parameters) TC-INVOKE ind (1, Provide-instructions) TC-INVOKE req (2, 1, Connect-Call) TC-RESULT-L req (1, Send-Info) TC-CONTINUE req (control parameters)
TC-CONTINUE ind (control parameters) TC-INVOKE ind (2, 1, Connect-Call) TC-RESULT-L ind (1, Send-Info)	
Time	

TC-BEGIN and TC-CONTINUE are transmission primitives described in § 3.2 below.

There may be one transmission primitive for each component, but the separation of primitives allows the grouping of components within a message. In addition, the information contained in the parameters of the transmission primitives (e.g. addressing information) applies to all the components included in the message.

At the originating side, the primitive requesting transmission appears after a component handling primitive; this indicates that transmission of the preceeding components has to take place immediately; it avoids indicating specific components to be transmitted with a given transmission primitive, and allows transmission primitives without any associated component.

At the destination side, the primitive requesting transmission appears first: it contains control information which is necessary for TCAP to deliver each of the components (if any) in the message; the last component of the message is indicated to the TC-user by the "Last Component" parameter. The components are delivered to the destination TC-user in the same order as they were passed to TCAP by the originating TC-user.

3.2 *Dialogue handling facilities*

When two TC-users co-operate in an application, more than one operation invocation is generally required. The resulting flow of components has to be identified so that:

1) components of the same flow can be related

2) flows corresponding to several instances of the same application can be identified and allowed to run in parallel.

Each such flow is identified, for the TC-user, by a dialogue and a corresponding Dialogue ID parameter. The dialogue handling facility provided for this purpose is the structured dialogue.

When only a single message is required to complete a distributed application, the Unidirectional message of the unstructured dialogue may be used. The originator does not expect a report of the outcome of the operation (i.e. may only invoke class 4 operations), but may receive a report of a protocol error if one occurs.

3.2.1 *Structured dialogue*

3.2.1.1 *General*

The use of dialogues allows several flows of components to co-exist between two TC-users. The Dialogue ID parameter is used in both operation handling and transmission (dialogue) handling primitives to determine which component(s) pertain(s) to which dialogue.

The Dialogue ID parameter is represented (by convention) by the first parameter in these primitives, starting with letter D. Each TC-user has its own reference for a given dialogue. Local references (those used on the interface) are represented here; mapping of these local references onto protocol references included in messages is done by TCAP.

Three primitives have been defined for handling dialogues under normal circumstances; they indicate dialogue begin (TC-BEGIN), continuation (TC-CONTINUE) or end (TC-END). Each of these primitives may be used to request transmission of 0, 1 or several components; these components may contain information relating to one or several operations.

Table 12/Q.775 illustrates a possible sequence for example E2, where the test request starts the dialogue, which ends when the test result has been sent.

TABLE 12/Q.775

TC USER A	TC USER B
TC-INVOKE req (D1, 1, Test, Class = 1) TC-BEGIN req (D1, Address)	
	TC-BEGIN ind (D2, Address) TC-INVOKE ind (D2, 1, Test) TC-INVOKE req (D2, 2, 1, Option-selection, Class = 1) TC-CONTINUE req (D2)
TC-CONTINUE ind (D1) TC-INVOKE ind (D1, 2, 1, Option-selection) TC-RESULT-L req (D1, 2, Options) TC-CONTINUE-req (D1)	
	TC-CONTINUE ind (D2) TC-RESULT-L ind (D2, 2, Options) TC-RESULT-L req (D2, 1, Test-result) TC-END req (D2)
TC-END ind (D1, normal) TC-RESULT-L ind (D1, 1, Test-result)	
Time	

Note – D1 and D2 are local references for the same dialogue and map onto transaction IDs which appear in the messages.

Any grouping of components is allowed in the messages of a dialogue: TCAP does not check, for instance, that a message terminating a dialogue does not include operation invocations of class 1. Full-duplex exchange of components is assumed: if a TC-user wants to introduce some restrictions, e.g. working in a synchronous mode as defined in ROSE, it would have to introduce the necessary procedures itself.

3.2.1.2 *Exchange of messages*

Transmission of messages is accomplished with the quality of service of the underlying layer services: no flow control or error recovery mechanisms are provided by TCAP.

- The first dialogue handling primitive of a dialogue must indicate dialogue begin (TC-BEGIN). Further messages must not be sent from the side originating the dialogue until a message is received in the backward direction, indicating dialogue continuation.
- If a TC-user tries to send a large number of messages in a short amount of time, no flow control mechanism in TCAP will prevent it.
- SCCP class 1 in-sequence delivery can be requested as an option, indicated by the Quality of Service parameter. Note that this option may not be available end to end when interworking with a network which does not provide it.

3.2.1.3 *Dialogue end*

TCAP places no restriction on the ability for a TC-user to request dialogue end. It follows that messages may be lost if no precautions are taken in the application on when the dialogue may end. In particular, if the application protocol allows both TC-users to issue TC-END primitives at about the same time, and if these primitives trigger transmission of components, it is likely that some (if not all) of these components will not be delivered to their respective destination TC-users.

It is up to the application to define, if necessary, its own rules concerning the right to end a dialogue: TCAP will not check them. Any message received for a terminated dialogue is discarded if it requests dialogue end, and otherwise causes the dialogue to be aborted at the remote entity.

The differences between the three ways of ending a dialogue are as follows.

Prearranged end

A typical application is the access to a distributed database, where the requesting user (TC-user A) does not know where the information it seeks is located. TC-user A broadcasts a request to each location which might have the information required, and will eventually receive a response from the TC-user which holds this information. Prearranged end avoids messages from the other destinations saying: "I do not have this information". Only the responding destination may continue the dialogue (if so wished); all other destination will, by convention, end the dialogue locally; the originator of the requests will also end the dialogues with the non-responding destinations locally, when it receives the response to its request. Note that the convention is between applications: TCAP does not check that it is respected, nor is it indicated in the TCAP protocol.

Example E4 in Table 13/Q.775 illustrates this situation, with two destinations B1 and B2; two dialogues (D1, D2) and (D3, D4) are started; B1 happens to own the requested information, and decides to continue the dialogue.

TABLE 13/Q.775

<table>
<tr><th>TC USER A</th><th>TC USER B1</th><th>TC USER B2</th></tr>
<tr><td>TC-INVOKE req
(D1, 1, Question)
TC-BEGIN req
(D1, Address)
TC-INVOKE req
(D3, 1, Question)
TC-BEGIN req
(D3, Address)

TC-CONTINUE ind
(D1)
TC-RESULT-L ind
(D1, 1, Response)
D1 goes on
D3 ends locally
TC-END req
(D3, local)</td><td>TC-BEGIN ind
(D2, Address)
TC-INVOKE ind
(D2, 1, Question)

TC-RESULT-L req
(D2, 1, Response)
TC-CONTINUE req
(D2)
......</td><td>TC-BEGIN ind
(D4, Address)
TC-INVOKE ind
(D4, 1, Question)
B2 does not have the information:
TC-END req
(D4, local)</td></tr>
<tr><td colspan="3">Time</td></tr>
</table>

Prearranged end may also be used when a TC-user wants to send information, and does not expect a reply of any kind afterwards.

Basic end

When a TC-user issues the TC-END request primitive, it causes transmission of any pending components to the remote end. TCAP does not check that all operation invocations have received a response when dialogue end is requested: no notification is given to the TC-user that any pending operation invocations have not received a final result.

At the receiving end, the dialogue is considered terminated when all the components received within the message indicating the end have been delivered to the TC-user.

Example: the dialogue ends when the test in example E1, Table 14/Q.775, receives a response.

TABLE 14/Q.775

TC USER A	TC USER B
......	......
	TC-RESULT-NL req (D2, 1, P1)
	TC-RESULT-NL req (D2, 1, P2)
	TC-RESULT-L req (D2, 1, P3)
	TC-END req (D2, normal)
TC-END ind (D1)	End of dialogue for B
TC-RESULT-NL ind (D1, 1, P1)	
TC-RESULT-NL ind (D1, 1, P2)	
TC-RESULT-L ind (D1, 1, P3)	
End of dialogue for A	
Time	

Abort by the TC-user

The abort facility allows the TC-user to stop the dialogue at any time. A typical case is when the user abandons the service. The main differences between this and normal ending are:

– any components for which transmission is pending are not sent to the peer entity;

– peer-to-peer information can be indicated at the time the abort is issued, and this is delivered to the remote TC-user.

The sequence given in Table 15/Q.775 shows a user abandonment in example E2.

3.2.1.4 *Message-related abnormal situations*

These are considered independently from the effects of such events in the Component sub-layer.

Message loss

TCAP provides no protection against message loss. Three cases are identified:

1) the message begins a new dialogue: the dialogue will exist at the originating side only, and no message will be allowed in either direction. Eventually, an implementation-dependent mechanism of TCAP ends the dialogue at the originating end;

2) the message continues an existing dialogue: loss is not detected. TCAP will react (or not) to the loss of included components as indicated in § 2.4.1 above;

3) the message ends a dialogue: TCAP will eventually react if this message contained a response to a class 1 operation: otherwise an implementation-dependent mechanism may end the dialogue at the destination end.

TABLE 15/Q.775

TC USER A	TC USER B
TC-INVOKE req (D1, 1, Test, Class = 1) TC-BEGIN req (D1, Address)	
	TC-BEGIN ind (D2, Address) TC-INVOKE ind (D2, 1, Test) TC-INVOKE req (D2, 2, 1, Option-selection, Class = 1) TC-CONTINUE req (D2)
TC-CONTINUE ind (D1) TC-INVOKE ind (D1, 2, 1, Option-selection) User abandon: TC-U-ABORT req (D1, Cause)	
	TC-U-ABORT ind (D2, Cause)
Time	

Message duplication

Duplication of a BEGIN message causes two transactions to be opened, as indicated below: each of these transactions has its own local ID, and the same destination ID. The TC-user eventually detects that something is wrong, and both dialogues are aborted.

The sequence given in Table 16/Q.775 illustrates a duplication of the BEGIN message in Example E2.

TABLE 16/Q.775

TC USER A	TC USER B
TC-INVOKE req (D1, 1, Test, Class = 1) TC-BEGIN req (D1, Address)	
TC-CONTINUE ind (D1) TC-INVOKE ind (D1, 2, 1, Option-select)	TC-BEGIN ind (D2, Address) TC-INVOKE ind (D2, 1, Test) Duplicated BEGIN: TC-BEGIN ind (D3, Address) TC-INVOKE ind (D3, 1, Test) Response to the first Begin TC-INVOKE req (D2, 2, 1, Option-select, Class = 1) TC-CONTINUE req (D2) Response to the second Begin TC-INVOKE ind (D3, 2, 1, Option-select, Class = 1) TC-CONTINUE req (D3)
TC-CONTINUE ind (D1) TC-INVOKE ind (D1, 2, 1, Option-select) TC-user considers that this invocation is abnormal, and may reject it, or abort one of the dialogues: TC-U-ABORT req (D1, Cause)	
	TC-U-ABORT ind (D3, Cause)
Time	

At that moment, there is still one dialogue (with local ID D2) at TC-user B's side, but no dialogue at A's side. TC-user B will receive an indication from TCAP when operation 2 of dialogue D2 timeouts with no reply (TC-L-CANCEL ind), and may then decide to abort D2. Note that the situation would be more difficult to detect, had TC-user B not invoked a class 1 operation.

Duplication of a CONTINUE message is not detected by TCAP.

When an END message is duplicated, the second message is received with an ID which does not correspond to an active dialogue: TCAP reacts by discarding the duplicate message.

Missequencing of messages

When the missequenced messages involve neither the beginning, nor the end of a dialogue, missequencing is not detected by TCAP, and may result in component missequencing, to which TCAP would react as indicated in § 2.5.3 above.

When a message indicating dialogue continuation arrives after a message indicating the end of the same dialogue, it is not delivered, and causes TCAP to abort the dialogue; the TC-user will probably detect the loss when receiving a premature dialogue end indication. If the application needs to recover from this case, a new dialogue should be started.

Message corruption

When receiving a corrupted message, TCAP reacts as indicated in Recommendation Q.774.

Table 17/Q.775 shows the sequence of primitives when TCAP decides to abort the dialogue after receiving a corrupted message in example E2.

TABLE 17/Q.775

TC USER A	TC USER B
TC-INVOKE req (D1, 1, Test, Class = 1) TC-BEGIN req (D1, Address)	
	TC-BEGIN ind (D2, Address) TC-INVOKE ind (D2, 1, Test) TC-INVOKE req (D2, 2, 1, Option-select, Class = 1) TC-CONTINUE req (D2)
Corrupted message: TC-ABORT ind (D1, Cause)	TC-ABORT ind (D2, Cause)
Time	

3.2.1.5 *Relations between dialogue handling and operation handling*

Depending on the moment when the dialogue end is requested, the TCAP facilities associated with an operation will be available until the end of the dialogue, or not. The following gives some guidelines on when dialogue end can be requested; if these are not respected, TCAP will not refuse the request for dialogue end.

The problems that may result from the collision of messages requesting dialogue end have been considered above.

Normal end should not be requested when:

– there are operation invocations pending for the dialogue;

– the application protocol anticipates that replies being transmitted with the termination request could be rejected.

In addition, a request for dialogue end must not trigger transmission of operation invocations, since no reply could be received for these operations.

Many applications might not define recovery scenarios in response to a rejected reply. This legitimises the transmission of replies or of class 4 operations in a message indicating dialogue end. The other applications should either use the connection-oriented network service approach, or end the dialogue with a message containing no component, that would be sent only when a reject indication can no longer be received.

3.2.2 *Unstructured dialogue*

A Unidirectional message will contain either only class 4 operation invocations or reports of protocol errors in such invocations. Multiple components can be transmitted in a Unidirectional message provided that the maximum size of a message is not exceeded.

4 **Application service elements and application entities**

4.1 *Introduction*

This material supplements preceding material providing guidelines on the usage of TC by describing what needs to be included in an Application Entity (AE) specification. This material is based on CCITT Recommendations X.219 and X.229 and requires further study.

CCITT Recommendation Q.700, § 3.2.3.6, describes how Application Service Elements (ASEs) and Application Entities (AEs) are structured and how an AE is addressed in Signalling System No. 7.

This section illustrates that architecture, considering the functional decomposition of an application, and describes how AEs, ASEs, operations and errors should be defined.

4.2 *Decomposition of functionality*

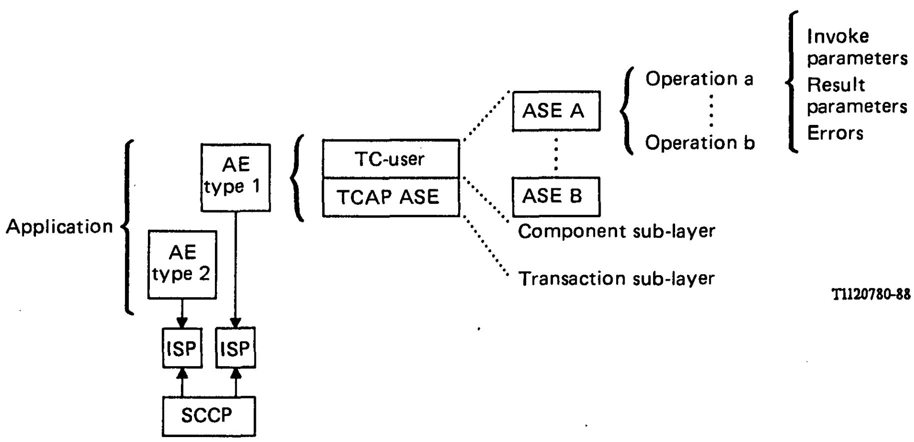
Application process functions communicate through one or more Application Entities (AEs). The combination of two peer AEs plus their interaction is called the Application Context. An AE consists of communications for one or more functions of an application. Each communications function forms an ASE which is an integrated set of actions and may be used in more than an AE. TCAP is itself an ASE which is used by other ASEs as well as being common to AEs (see § 3.2.3.6/Q.700). An ASE identifies one or more operations and specifies how those operations are used; that is, which peer entity may invoke which operations, and in what order. Operations may be selected from one or more libraries.

An ASE provides a service to the user of the ASE. An ASE is used by two complementary AEs: the consumer of the service and the supplier of the service. The consumer of the service is the end that initiates the AE to AE communication. An ASE user is thus generally asymmetric.

Within an ASE, the mechanism for providing the ASE service is the invocation of operations by the service requestor on the service provider. Each operation provides a part of the service in an inherently asymmetric manner since it is invoked by one AE and executed by the peer AE. An ASE generally includes more than one operation. An ASE user is, in general, not limited to either invoking or performing operations, but may both invoke or perform the same or different operations. Also, an ASE user may exist at a pair of nodes such that either node may request the same service from the other node. That is, the AEs at the nodes may be symmetric, both invoking and executing the same operations.

Note – Primitives which provide a standard service interface for the access of ASEs within AEs are for further study.

Figure 3/Q.775 illustrates the decomposition of this functionality and provides examples.



Example:

Application	Application Entity	ASE	Operation
OA&M	OMAP AE	MRVT	confirmedAction eventReport

FIGURE 3/Q.775

Decomposition of functionality

4.3 *How to specify an AE*

CCITT Recommendation Q.700, § 3.2.3.6, describes how two Signalling System No. 7 Application Processes communicate via Application Entities, and also the structure of an AE.

The application designer should provide a definition for each type of AE. It should contain:

– A general description of the services supported by the combination of the two peer AEs and communicating by a dialogue. (In Recommendation X.229 terminology, this corresponds to the "Application Context").

– A definition of the complete application protcol between the peer AEs by:

  – identifying each ASE constituting the AE, and

  – indicating which of the peer AEs initiates the service.

– Any special constraints to ensure that peer AEs with different versions are compatible.

A formal specification of the application context using the Recommendation X.229 APPLICATION-CONTEXT macro is for further study.

Since each AE constitutes a single coding domain for operation and error code values (addressed by SCCP subsystem number in a connectionless network service environment), each operation or error code value must be unique within the AE (see § 4.5).

4.4 *How to specify an ASE*

The definition of an ASE is part of the stage 3 of the service description methodology, as defined by Recommendation I.220.

The ASE description should provide:

- A general description of the ASE and its procedures.
- The information flows between the entities which are communicating to support the service, based on stage 2, with additions and enhancements that are needed as part of the protocol design.
- A detailed description of the ASE protocol. This includes the sequence in which operations may be invoked, and the reaction to abnormal situations. The definition should include how protocol version interwork. Dialogue begin, continuation and end should be specified. This section should describe the interaction between the ASE and the TCAP component sub-layer expressed in terms of the primitive interface.
- SDL diagrams.

Recommendation X.229 (ROSE) defines an APPLICATION-SERVICE-ELEMENT macro which may be used to specify an ASE formally. It identifies which operations are contained in the AE and how they are invoked. The use of this macro in Signalling System No. 7 is for further study.

4.5 *How to specify operations and errors*

4.5.1 *Information needed to specify operations and errors*

To specify an operation, the following items must be defined:

- The operation name.
- The operation code. This may be local or global. See § 4.5.2.
- The operation class. A value in the range 1 to 4 as defined in § 2.2.1.
- The parameters accompanying the operation invocation (input parameters). Further essential information to supplement that provided in the parameters with the original invocation may be requested using linked operations.
- The parameters that may be returned as the result of a successful outcome (Return Result), whenever the operation reports success (possitive output parameters). The way these parameters are actually passed (in a single component or several) is no part of the operation description.
- The error codes and associated parameters that may be returned as the result of an unsuccessful outcome (Return Error) of the operation execution, whenever this operation reports failure (negative output parameters). An error code must be present when reporting failure, and all the possible values be defined as part of the operation description.
- The allowed linked operations (see § 2.2.2).
- The timer value for completion of the operation.

The operation description consists of a Table indicating the eight items above, together with a short prose description of what the operation does. A formal definition using Annex A/Q.773 OPERATION and ERROR macros should also be included to unambiguously indicate which parameters are mandatory, which are optional with default values as applicable, and which individual, sets or sequences of parameters are legal as input, positive output, and negative output. The OPERATION and ERROR type (macro) definitions are exported from the TCAP definitions (Annex A/Q.773) and need to be imported into the ASE being defined in order to define operations and errors.

The syntax of the OPERATION MACRO (reproduced from Annex A/Q.773) is as follows:

```
OPERATION MACRO ::=
BEGIN
TYPE NOTATION ::=         Parameter Result Errors Linked Operations
VALUE NOTATION ::=        value{VALUE CHOICE{
                                         localValue INTEGER,
                                         globalValue OBJECT IDENTIFIER }}

Parameter ::=             "PARAMETER" Named Type | empty
Result ::=                "RESULT" ResultType | empty
ResultType ::=            NamedType | empty
Errors ::=                "ERRORS" "{"ErrorNames"}" | empty
LinkedOperations ::=      "LINKED" "{"LinkedOperationNames"}" | empty
ErrorNames ::=            ErrorList | empty
ErrorList ::=             Error | ErrorList "," Error
Error ::=                 value (ERROR)   -- shall reference an error value
                          | type   -- shall reference an error type if no error value
                                   -- is specified

LinkedOperationNames ::=  OperationList | empty
OperationList ::=         Operation | OperationList "," Operation
Operation ::=             value (OPERATION)   -- shall reference an operation value
                          | type   -- shall reference an operation type if no error value
                                   -- is specified

NamedType ::=             identifier type | type
END

ERROR MACRO ::=
BEGIN
TYPE NOTATION ::=         Parameter
VALUE NOTATION ::=        value (VALUE CHOICE{
                                         localValue INTEGER,
                                         globalValue OBJECT IDENTIFIER })

Parameter ::=             "PARAMETER" NamedType | empty
NamedType ::=             identifier type | type
END
```

The use of local and global values is explained in § 4.5.2.

As an example, the CUGCheck2 operation, which is used to check whether an incoming call is compatible with the CUG characteristics of the called party, is described here in both (abbreviated) formal notation, and in the form of a table.

4.5.2 *Example of operation description*

(*Note* – Arbitrary section numbers are used in this example.)

3.4.3.1 *Description of operations*

3.4.3.1.1 *CUG check 1*

This operation is used between the originating exchange of a call and a dedicated point for CUG validation check of the calling user.

3.4.3.1.2 *CUG check 2*

This operation is used between the terminating exchange of a call and a dedicated point for CUG validation check of the called user.

3.4.3.2 *Parameters of operations and outcomes*

3.4.3.2.1 *CUG Check 1*

CUG Check 1	Timer = x sec	Class = 1	Code = 00000001
Parameters with Invoke		Opt/Man	Reference
CallingUserIndex CUGCallIndicator CallingPartyNumber		O M M	3.4.3.3.1 3.4.3.3.2 3.4.3.3.3
Parameters with Return Result			
CUGInterlockCode CUGCallIndicator		O M	3.4.3.3.5 3.4.3.3.2
Linked Operations			
Not applicable			
Errors			
UnsuccessfulCheck			3.4.3.3.7

```
cUGCheck1      OPERATION
      PARAMETER      SEQUENCE{ callingUserIndex OPTIONAL, cUGCallIndicator,
                               callingPartyNumber }
      RESULT         SEQUENCE{ cUGInterlockCode OPTIONAL, cUGCallIndicator }
      ERRORS                 { unsuccessfulCheck }
      ::= 1
```

3.4.3.2.2 *CUG check 2*

CUG Check 2	Timer = x sec	Class = 1	Code = 00000010
Parameters with Invoke		Opt/Man	Reference
CUGInterlockCode CUGCallIndicator CalledPartyNumber		M M M	3.4.3.3.5 3.4.3.3.2 3.4.3.3.4
Parameters with Return Result			
CalledUserIndex CUGCallIndicator		O M	3.4.3.3.6 3.4.3.3.2
Linked Operations			
Not applicable			
Errors			
UnsuccessfulCheck			3.4.3.3.7

```
cUGCheck 2        OPERATION
     PARAMETER      SEQUENCE{ cUGInterlockCode, cUGCallIndicator,
                              calledPartyNumber }
     RESULT         SEQUENCE{ calledUserIndex OPTIONAL, cUGCallIndicator }
     ERRORS                  { unsuccessfulCheck }
     ::= 2
```

3.4.3.3 *Parameter coding*

3.4.3.3.1 The CallingUserIndex is the local index at the calling user to identify a particular CUG he belongs to.

CallingUserIndex	Code = 10000001
Contents	Meaning
IA5 Character String	One IA5 character represents one digit of the CUG index value

```
callingUserIndex ::=      [1] IMPLICIT LocalIndex
LocalIndex ::=            IA5 STRING
-- The maximum number of digits is four.
```

3.4.3.3.2 The CUGCallIndicator indicates whether the call is requested or designated as a CUG call and whether outgoing access is requested or allowed.

CUGCallIndicator	Code = 10000010
Contents	**Meaning**
00000000 00000001 00000010 00000011	Non-CUG call Non-CUG call CUG call with outgoing access CUG call without outgoing access

```
cUGCallIndicator ::=    [2] IMPLICIT CallIndicator
CallIndicator ::=       INTEGER{
                            nonCUGCall (0),
                            nonCUGCall (1),
                            outgoingAccessAllowedCUGCall (2),
                            outgoingAccessNotAllowedCUGCall (3) }
```

3.4.3.3.3 The CallingPartyNumber is the network (e.g. E.164) number of the calling party. It is expressed in the same manner as the ISUP Calling party number in § 3.7 of Recommendation Q.763. The code of this parameter is "10000011".

CallingPartyNumber	Code = 10000011
Contents	Meaning
– – encoded per § 3.7/Q.763	

callingPartyNumber ::= [3] IMPLICIT OCTET STRING
– – *contents encoded per § 3.7/Q.793*

3.4.3.3.4 The CalledPartyNumber is the network (e.g. E.164) number of the called party. It is expressed in the same manner as the ISUP Called party number in § 3.6 of Recommendation Q.763. The code of this parameter is "10000100".

CalledPartyNumber	Code = 10000100
Contents	Meaning
– – encoded per § 3.6/Q.763	

calledPartyNumber ::= [4] IMPLICIT OCTET STRING
– – *contents encoded per § 3.6/Q.793*

3.4.3.3.5 The CUGInterlockCode is the code to uniquely identify a CUG inside the network. It is expressed in the same manner as the ISUP CUG interlock code in § 3.13 of Recommendation Q.763. The code of this parameter is "10000101".

CUGInterlockCode		Code = 10000101
Contents	Meaning	
– – encoded per § 3.13/Q.763		

CUGInterlockCode ::= [5] IMPLICIT OCTET STRING
– – contents encoded per § 3.13/Q.793

3.4.3.3.6 The CalledUserIndex is the local index at the called user to identify a particular CUG he belongs to. Refer to § 3.4.3.3.1. The code of this parameter is "10000110".

CalledUserIndex		Code = 10000110
Contents	Meaning	
IA5 Character String	One IA5 character represents one digit of the CUG Index value	

CalledUserIndex ::= [6] IMPLICIT LocalIndex

3.4.3.3.7 *Errors*

UnsuccessfulCheck	Code = 00000001
Parameters	
Cause	3.4.3.3.8

```
unsuccessfulCheck ERROR
        PARAMETER{ Cause }
        ::= 1
```

3.4.3.3.8 The Cause indicates the reason why the CUG check is unsuccessful.

Cause	Code = 10000111
Contents binary (decimal)	Meaning
00110010 (50)	Requested facility not subscribed
00110101 (53)	Outgoing calls barred within CUG
00110111 (55)	Incoming calls barred within CUG
00111110 (62)	InconsistencyInDesignatedOutgoingAccessInformationAndSubscriberClass
01010110 (90)	Non-existent CUG
01010111 (87)	Called user not member of CUG
01011000 (88)	Incompatible destination
10000000 (110)	Inconsistency in data

```
cause ::=          [7] IMPLICIT CauseCode
CauseCode ::=      INTEGER{
                       requestedFacilityNotSubscribed (50),
                       outgoingCallsBarredWithinCUG(53),
                       incomingCallsBarredWithinCUG(55),
                       inconsistencyInDesignatedOutgoingAccessInformationAndsubscriberClass(62),
                       nonExistentCUG(90),
                       calledUserNotMemberOfCUG(87),
                       incompatibleDestination(88),
                       inconsistencyInData(110) }
```

4.5.3 *Allocation and management of operation and error codes*

The simple approach is to provide one module containing the definition of the operations and errors it uses as a self-contained local domain.

Before defining a new operation, the application designer should check all modules to see whether a similar operation already exists. To avoid redefining the operation in a number of modules, methods are required which allow a module to import the definition of the operations it uses from other modules. If the opertion does not exist, the designer should specify it locally.

Example: Operation code 00000010 has one meaning for ASE1, and probably a completely different meaning for ASE2; two domains are involved.

Note that many domains may be used by one ASE; however, for simplicity, it is assumed in the following that an ASE uses only one domain.

In addition to its local operation, an ASE may need to make use of operations which are already defined in another domain. There are two methods for doing so:

- import operation and error types from other modules;
- import operation and error values from other modules.

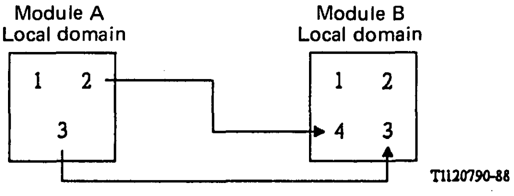
4.5.3.1 *Import of types*

The definition of an operation type includes the notational aspects (see the OPERATION MACRO above), without allocating the code values.

It may be desirable to import the type of an already existing operation, however the importing module may want to allocate its own local codepoint to the imported operation or error. The imported operation or error becomes a member of the local domain of that module.

If two different modules import a given operation by type, its codepoint in each of the importing local domains is generally different.

Importing by type allows a common description of operations. A module importing by types only uses a single domain (its local domain), as represented in Figure 4/Q.775.



Operations 2 and 3 in module A's domain become operations 4 and 3, respectively, in module B's domain.

FIGURE 4/Q.775

Importing by type

4.5.3.2 *Import of values*

When operation values are imported, the type and the coding are the same in the exporting and importing ASEs.

A module importing operations or errors by value makes use of:

– a local domain for its local operations and

– the exporting domains for its imported operations.

A global value is required in the second case to avoid ambiguity between local codepoints and imported codepoints, as represented in Figure 5/Q.77.

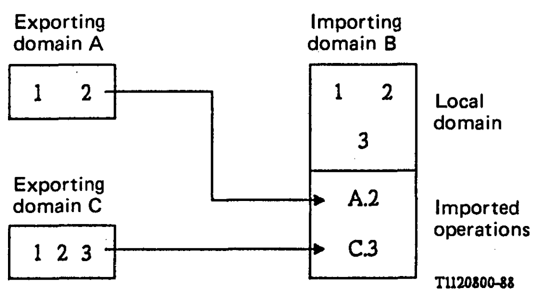


FIGURE 5/Q.775

Importing by global value

4.6 *Applying the concept to service protocols*

The first step, before assigning operation codes, is to examine the service ASEs (each an integrated set of actions) and assign them to AEs. The extremes are, on one hand, that all service ASEs are assigned to one AE and, on the other hand, that each AE is composed of only one service ASE. The likely case is several groupings of service ASEs.

Each AE should be identified by a SSN, but not necessarily a fixed SSN specified in Recommendation Q.713. Within an AE, an operation code assignment scheme is used, so that no two operations can have the same operation code.

SECTION 2

TEST SPECIFICATION

Recommendation Q.780

SIGNALLING SYSTEM NO. 7 TEST SPECIFICATION GENERAL DESCRIPTION

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-Q.783. 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 Geneal principles of test specifications

The test specification aims at testing protocol conformance in a given implementation. This 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.

3 Scope of the test specification

The test specification is intended to cover all aspects of Signalling System No. 7. However the initial Recommendations cover the message transfer part Q.701-Q.707, and the telephone user part Q.721-Q.724. The test specification is not a definition of the protocol, this is contained in Recommendations Q.701-Q.707 and Q.721-Q.724 as appropriate.

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 beween the two or more Administrations/RPOAs concerned.

5 Method of application

The test specification fulfils the requirements for both validation testing and compatibility testing. See §§ 5.1 and 5.2 for an explanation of these terms.

All tests in the test specification are validation tests (VAT), and in addition those marked with an asterisk are also compatibility tests (CPT).

5.1 *Validation testing*

The function of validation testing is to check that a given implementation conforms to the relevant CCITT Recommendations of the Signalling System. These validation tests could apply both in the national and international networks. The validation test is a pre-requisite of compatibility testing (see § 5.2) and is performed under the responsibility of each Administration/RPOA. These tests will generally be performed without the cooperation of another Administration/RPOA, 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 one signalling point.

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 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 under test is called SP"A".

5.2 *Compatibility testing*

The objective of compatibility testing is to check for the correct interworking of two implementations. To perform compatibility testing the two 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, but also on a signalling point 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/RPOAs concerned.

Certain of the tests identified in the test list as compatibility test 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/RPOAs.

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, each signalling point may in turn consider itself to be SP"A", i.e. tests are performed on both signalling points involved.

5.3 *Test configuration*

For both validation and compatibility 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 linksets (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 analyze messages to the appropriate degree.

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 Recommendation Q.701, § 2.2.1.

6.1 *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 the actual signalling data link that will be used in service.

6.2 *Level 2*

The level 2 test environment consists of four items (see Figure 1/Q.780):

- the level 3 simulator;
- the test simulator;
- the signalling link monitor (see § 7);
- the signalling data link.

6.2.1 *Level 3 simulator*

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

6.2.2 *Test simulator*

During level 2 testing it is necessary to inject some abnormal signal units (as well as normal signal units) to fully test the 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 level 2 under test. The generation of certain abnormal sequences of signal units should also be a capability of the test simulator.

6.3 *Level 3*

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

The level 3 test environment consists of 3 items (see Figure 2/Q.780):

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

6.3.1 *Simulator of upper levels*

During level 3 testing it is necessary to inject signalling messages into 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 level 3 under test must use an already tested level 2.

6.3.2 *Simulated network including test simulator*

During level 3 testing it is necessary to inject some abnormal messages (as well as normal messages) to check the 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 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 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.

The TUP test environment consists of three items (see Figure 3/Q.780):

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

6.4.1 *TUP tester*

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

6.4.2 *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.

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 Recommendation Q.702, § 4.

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 link 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 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 oserved 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.

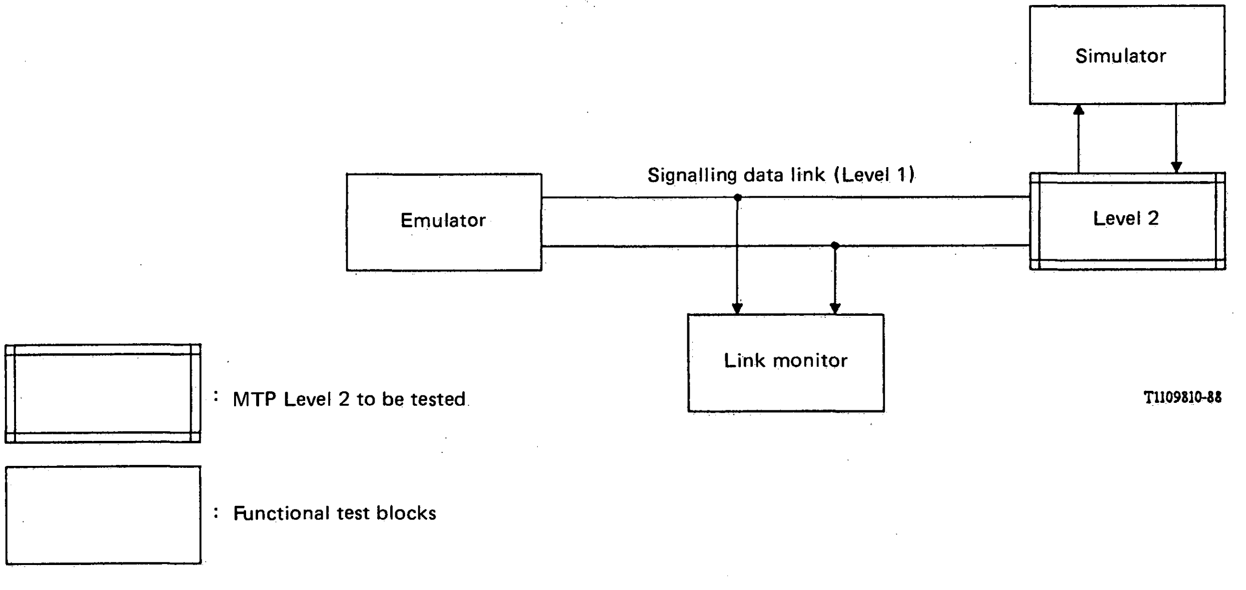


FIGURE 1/Q.780

Level 2 Test environment

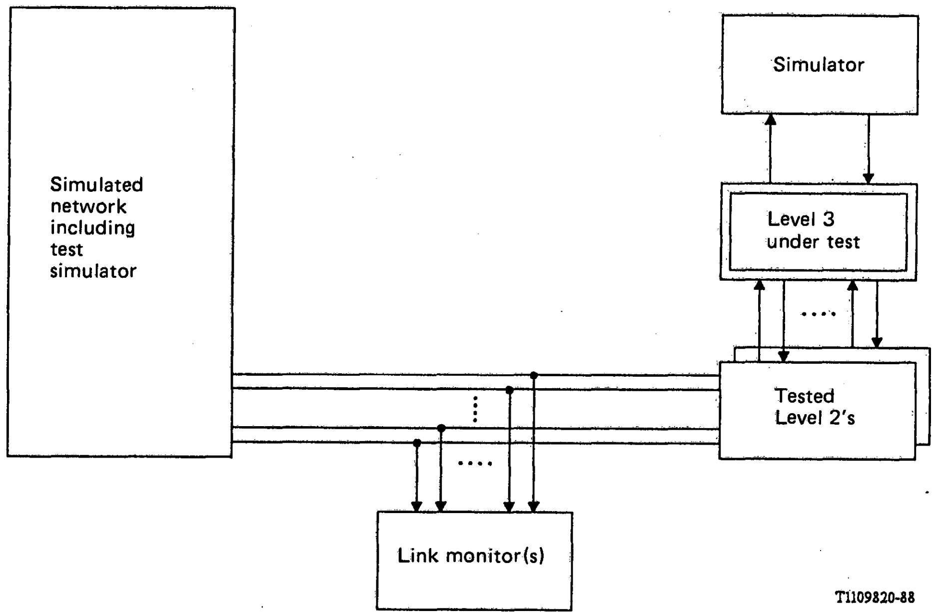


FIGURE 2/Q.780

Level 3 Test environment

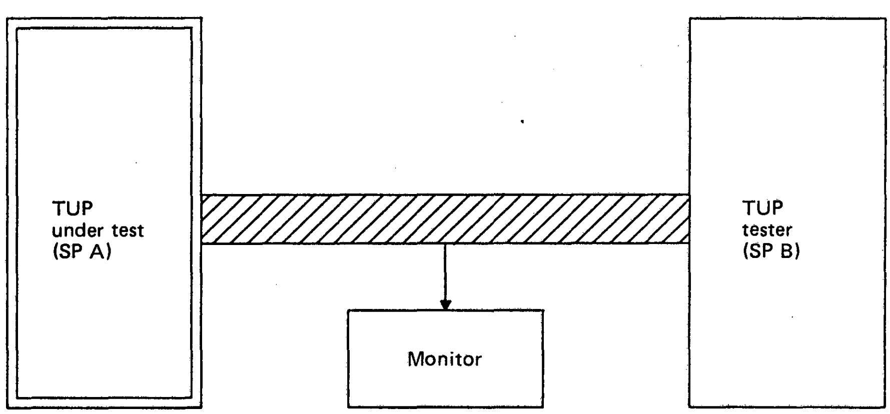


FIGURE 3/Q.780

TUP Test environment

MTP LEVEL 2 TEST SPECIFICATION

1 Introduction

This Recommendation contains a set of detailed tests of signalling system No. 7 MTP level 2 protocol. These tests intend to validate the protocol specified in Recommendation Q.703.

This Recommendation conforms to Recommendation Q.780 which describes the basic rules of the Test Specification. In addition the conditions which are specific to level 2 tests are described in the following sections.

2 General principles of level 2 tests

2.1 *Presentation of test descriptions*

The level 2 tests aim at testing the level 2 protocol conformance in a given implementation.

Each test description indicates in the "type of test" column; "Validation" (VAT) or "Validation" (VAT) and "compatibility" (CPT).

Although signal units are transmitted and received continuously on level 2, only the signal units which cause and/or indicate the changes of level 2 status are shown in the EXPECTED SIGNAL UNIT SEQUENCE column of each test description.

2.2 *Presentation of the test list*

These tests as a whole, aim at a complete validation of the level 2 protocol without redundancies. Each test is described as simply as possible to check precisely each elementary function of the protocol, which is referred in the columns "reference", "title" and "sub-title" of each test description.

This list is presented in the form of a succession of tests. The presentation order is essentially functional. However, the operator performing these tests may change this order, taking into account some other practical criteria such as: use pre-test conditions to order the list, the end of a given test may be the pre-test condition of another test.

3 Test configuration

A single link will be used for level 2 tests. Figure 1/Q.781 shows a single link between SP A and SP B. Test specifications are written to test the level 2 of the SP A.

4 Test environment

See Recommendation Q.780, § 6.2.

5 Test list

Note – Compatibility test items are indicated in this list by an asterisk (*).

– The abbreviations *PO*, *LPO*, *RPO*, *EM* and *EDA* are used for processor outage, local processor outage, remote processor outage, emergency and expected delay of acknowledgement respectively.

1 *Link State Control – Expected signal units/orders* (Figures 8/Q.703 and 9/Q.703)

* 1.1 Initialisation (Power-up)

* 1.2 Timer T2

1.3 Timer T3

1.4 Timer T1 and T4 (Normal)

* 1.5 Normal alignment – correct procedure (FISU)

1.6 Normal alignment – correct procedure (MSU)

1.7 SIO received during normal proving period

1.8 Normal alignment with PO set (FISU)
1.9 Normal alignment with PO set (MSU)
1.10 Normal alignment with PO set and clear
1.11 Set RPO when "Aligned not ready"
1.12 SIOS received when "Aligned not ready"
1.13 SIO received when "Aligned not ready"
1.14 Set and clear LPO when "Initial alignment"
1.15 Set and clear LPO when "Aligned ready"
1.16 Timer T1 in ""Aligned not ready" state
1.17 No SIO sent during normal proving period
1.18 Set and cease emergency prior to "start alignment"
* 1.19 Set emergency while in "not aligned state"
1.20 Set emergency when "aligned"
1.21 Both ends set emergency
1.22 Individual end sets emergency
1.23 Set emergency during normal proving
1.24 No SIO sent during emergency alignment
* 1.25 Deactivation during initial alignment
1.26 Deactivation during aligned state
1.27 Deactivation during aligned not ready
1.28 SIO received during link in service
* 1.29 Deactivation during link in service
1.30 Deactivation during LPO
1.31 Deactivation during RPO
* 1.32 Deactivation during the proving period
1.33 SIO received instead of FISUs
1.34 SIOS received instead of FISUs
1.35 SIPO received instead of FISUs

2 *Link State Control – Unexpected signal units/orders* (Figure 8/Q.703)

2.1 Unexpected signal units/orders in "Out of service" state
2.2 Unexpected signal units/orders in "Not aligned" state
2.3 Unexpected signal units/orders in "Aligned" state
2.4 Unexpected signal units/orders in "Proving" state
2.5 Unexpected signal units/orders in "Aligned ready" state
2.6 Unexpected signal units/orders in "Aligned not ready" state
2.7 Unexpected signal units/orders in "In service" state
2.8 Unexpected signal units/orders in "Processor outage" state

3 *Transmission failure* (Figure 8/Q.703)

3.1 Link aligned ready (Break Tx path)
3.2 Link aligned ready (Corrupt FIBs)
3.3 Link aligned not ready (Break Tx path)
3.4 Link aligned not ready (Corrupt FIBs)

* 3.5 Link in service (Break Tx path)

3.6 Link in service (Corrupt FIBs)

3.7 Link in processor outage (Break Tx path)

3.8 Link in processor outage (Corrupt FIBs)

4 *Processor Outage Control* (Figure 10/Q.703)

4.1 Set and clear LPO while link in service

4.2 RPO during LPO

4.3 Clear LPO when "Both processor outage"

5 *SU Delimitation, Alignment, Error Detection and Correction* (Figures 11/Q.703 and 12/Q.703)

5.1 More than seven "1"s between MSU opening and closing flags

5.2 Greater than maximum signal unit length

5.3 Below minimum signal unit length

5.4 Reception of single and multiple flags between FISUs

5.5 Reception of single and multiple flags between MSUs

6 *SUERM Check* (Figure 18/Q.703)

6.1 Error rate of 1 in 256 – Link remains in service

6.2 Error rate of 1 in 254 – Link into out of service

6.3 Consecutive corrupted SUs

6.4 Time controlled break of the link

7 *AERM check* (Figure 17/Q.703)

7.1 Error rate below the normal threshold

7.2 Error rate at the normal threshold

7.3 Error rate above the normal threshold

7.4 Error rate at the emergency threshold

8 *Transmission and reception control (Basic)* (Figures 13/Q.703 and 14/Q.703)

8.1 MSU transmission and reception

8.2 Negative acknowledgement of MSU

8.3 Check RTB full

8.4 Single MSU with erroneous FIB

8.5 Duplicated FSN

8.6 Erroneous retransmission – Single MSU

8.7 Erroneous retransmission – Multiple FISUs

8.8 Single FISU with corrupt FIB

8.9 Single FISU prior to RPO being set

8.10 Abnormal BSN – Single MSU

8.11 Abnormal BSN – Two consecutive FISUs

8.12 Excessive delay of acknowledgement

8.13 Level 3 Stop Command

9 *Transmission and reception control (PCR)* (Figures 15/Q.703 and 16/Q.703)

* 9.1 MSU transmission and reception

9.2 Priority control

9.3 Forced retransmission with the value N1

9.4 Forcéd retransmission with the value N2

9.5 Forced retransmission cancel

9.6 Repetition of forced retransmission

9.7 MSU transmission while RPO set

9.8 Abnormal BSN – Single MSU

9.9 Abnormal BSN – Two MSUs

9.10 Unexpected FSN

9.11 Excessive delay of acknowledgement

9.12 FISU with FSN expected for MSU

9.13 Level 3 Stop Command

10 *Congestion Control* (Figure 19/Q.703)

10.1 Congestion abatement

10.2 Timer T7

10.3 Timer T6

6 Test descriptions

TEST NUMBER: 1.1	PAGE: 1 OF 1
REFERENCE: Q.703 § 7 STD: Fig. 8; Fig. 12; Fig. 13	
TITLE: Link State Control – Expected signal units/orders	
SUB TITLE: Initialization (Power-up)	
PURPOSE: To check that the No. 7 terminal equipment enters the correct state on power-up	
PRE-TEST CONDITIONS: Line equipment – ON; No. 7 equipment – OFF	
CONFIGURATION: 1	TYPE OF TEST: VAT, CPT

EXPECTED SIGNAL UNIT SEQUENCE:

	SP B			SP A
Link			Link	
1 – 0	SIOS	------------------------->		
				: Power ON
		<-------------------------	1 – 0	SIOS

TEST DESCRIPTION

1. Check link enters correct state.
2. At "Power – On" or Initialization the FIB, BIB, FSN, and BSN shall be as follows: FIB = BIB = 1 : FSN = BSN = 127 (HEX 7F).
3. Repeat test in reverse direction.

TEST NUMBER: 1.2	PAGE: 1 OF 1
REFERENCE: Q.703 § 7 STD: Fig. 8; Fig. 9, Fig. 11, Fig. 13; Fig. 14	
TITLE: Link State Control – Expected signal units/orders	
SUB TITLE: Timer T2	
PURPOSE: To check "Not Aligned" Timer T2	
PRE-TEST CONDITIONS: Link out of service	
CONFIGURATION: 1	TYPE OF TEST: VAT, CPT

EXPECTED SIGNAL UNIT SEQUENCE:

```
            SP   B                                         SP   A

  Link                                             Link

  1 – 0     SIOS      ------------------------>
                      <------------------------    1 – 0      SIOS
                                                            : start
                      <------------------------    1 – 0      SIO
                                                               |
                                                               | T2
                                                               |
                      <------------------------    1 – 0      SIOS
```

TEST DESCRIPTION

1.	Timer T2 shall be in the range 5 secs to 150 secs.

TEST NUMBER: 1.3	PAGE: 1 OF 1
REFERENCE: Q.703 § 7 STD: Fig. 9; Fig. 14	
TITLE: Link State Control – Expected signal units/orders	
SUB TITLE: Timer T3	
PURPOSE: To check "Aligned" Timer T3	
PRE-TEST CONDITIONS: Link out of service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

Link	SP B		Link	SP A
		<-------------------------	1 – 0	SIOS
1 – 0	SIOS	------------------------->		
				: start
		<-------------------------	1 – 0	SIO
1 – 0	SIO	------------------------->		
		<-------------------------	1 – 0	SIN
				T3
		<-------------------------	1 – 0	SIOS

TEST DESCRIPTION

1.	Timer T3 shall be in the range 1 sec to 1.5 secs.

TEST NUMBER: 1.4	PAGE: 1 OF 1
REFERENCE: Q.703 § 7 STD: Fig. 8; Fig. 9	
TITLE: Link State Control – Expected signal units/orders	
SUB TITLE: Timer T1 & Timer T4 (Normal)	
PURPOSE: To check "Aligned ready" Timer T1 and "Proving period" Timer T4 (Normal)	
PRE-TEST CONDITIONS: Link out of service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

Link	SP B		Link	SP A
		<-------------------------	1 – 0	SIOS
1 – 0	SIOS	------------------------->		
				: start
		<-------------------------	1 – 0	SIO
1 – 0	SIO	------------------------->		
		<-------------------------	1 – 0	SIN
1 – 0	SIN	------------------------->		
				T4 (Pn)
		<-------------------------	1 – 0	FISU
				T1
		<-------------------------	1 – 0	SIOS

TEST DESCRIPTION

1.	At 64 kbit/s Timer T4 shall be in the range 7.5 secs to 9.5 secs (nominally 8.2 secs) and Timer T1 shall be in the range 40 secs to 50 secs.
2.	At 4.8 kbit/s Timer T4 shall be in the range 100 secs to 120 secs (nominally 110 secs) and Timer T1 shall be in the in the range 500 secs to 600 secs.

TEST NUMBER: 1.5	PAGE: 1 OF 1
REFERENCE: Q.703 § 7 STD: Fig. 8; Fig. 9	
TITLE: Link State Control – Expected signal units/orders	
SUB TITLE: Normal alignment – correct procedure (FISU)	
PURPOSE: To check normal alignment procedure	
PRE-TEST CONDITIONS: Link out of service	
CONFIGURATION: 1	TYPE OF TEST: VAT, CPT

EXPECTED SIGNAL UNIT SEQUENCE:

SP B			SP A	
Link			Link	
		<-------------------------	1 – 0	SIOS
1 – 0	SIOS	------------------------->		
				: start
		<-------------------------	1 – 0	SIO
1 – 0	SIO	------------------------->		
		<-------------------------	1 – 0	SIN
1 – 0	SIN	------------------------->		
		<-------------------------	1 – 0	FISU
1 – 0	FISU	------------------------->		

TEST DESCRIPTION

1. Start normal alignment procedure.
2. Check link aligns and enters "In service" state.
3. Check that "In service" state is maintained.

TEST NUMBER: 1.6	PAGE: 1 OF 1
REFERENCE: Q.703 § 7 STD: Fig. 8; Fig. 9	
TITLE: Link State Control – Expected signal units/orders	
SUB TITLE: Normal alignment – correct procedure (MSU)	
PURPOSE: To check normal alignment procedure	
PRE-TEST CONDITIONS: Link out of service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

Link	SP B		Link	SP A
		<-------------------------	1 – 0	SIOS
1 – 0	SIOS	------------------------->		
				: start
		<-------------------------	1 – 0	SIO
1 – 0	SIO	------------------------->		
		<-------------------------	1 – 0	SIN
1 – 0	SIN	------------------------->		
		<-------------------------	1 – 0	FISU
1 – 0	MSU	------------------------->		

TEST DESCRIPTION

1.	Start normal alignment procedure.
2.	Check link aligns and enters "In service" state.
3.	Check that "In service" state is maintained.

TEST NUMBER: 1.7	PAGE: 1 OF 1
REFERENCE: Q.703 §§ 7, 10.3 STD: Fig. 9; Fig. 17	
TITLE: Link State Control – Expected signal units/orders	
SUB TITLE: SIO received during normal proving period	
PURPOSE: To test the response to the reception of an SIO during the normal proving period.	
PRE-TEST CONDITIONS: Link out of service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

Link	SP B		Link	SP A
		<-------------------------	1 – 0	SIOS
1 – 0	SIOS	------------------------->		
				: start
		<-------------------------	1 – 0	SIO
1 – 0	SIO	------------------------->		
		<-------------------------	1 – 0	SIN
1 – 0	SIN	------------------------->		T4 Stopped
1 – 0	SIN (one only)	------------------------->		
1 – 0	SIN	------------------------->		
		<-------------------------	1 – 0	SIN T4 (Pn)
		<-------------------------	1 – 0	FISU

TEST DESCRIPTION

1. Send an SIO at B during normal proving period.
2. Check that new normal proving period is entered.

TEST NUMBER: 1.8	PAGE: 1 OF 1
REFERENCE: Q.703 §§ 7, 8 STD: Fig. 8	
TITLE: Link State Control – Expected signal units/orders	
SUB TITLE: Normal alignment with PO set (FISU)	
PURPOSE: To check the response following normal alignment when PO has been set	
PRE-TEST CONDITIONS: Link out of service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

Link	SP B		Link	SP A
		<-------------------------	1 – 0	SIOS
1 – 0	SIOS	------------------------->		
				: set LPO
				: start
		<-------------------------	1 – 0	SIO
1 – 0	SIO	------------------------->		
		<-------------------------	1 – 0	SIN
1 – 0	SIN	------------------------->		
		<-------------------------	1 – 0	SIPO
1 – 0	FISU	------------------------->		
		<-------------------------	1 – 0	SIPO

TEST DESCRIPTION

1.	Check that normal alignment is carried out with PLO set at A.
2.	Check that SIPO is returned when aligned, and that A stays in “processor outage” state.
3.	Repeat test with LPO set at B.

TEST NUMBER: 1.9	PAGE: 1 OF 1
REFERENCE: Q.703 §§ 7, 8 STD: Fig. 8	
TITLE: Link State Control – Expected signal units/orders	
SUB TITLE: Normal alignment with PO set (MSU)	
PURPOSE: To check the response following normal alignment when PO has been set	
PRE-TEST CONDITIONS: Link out of service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

Link	SP B		Link	SP A
		<-------------------------	1 – 0	SIOS
1 – 0	SIOS	------------------------->		
				: set LPO
				: start
		<-------------------------	1 – 0	SIO
1 – 0	SIO	------------------------->		
		<-------------------------	1 – 0	SIN
1 – 0	SIN	------------------------->		
		<-------------------------	1 – 0	SIPO
1 – 0	MSU	------------------------->		
		<-------------------------	1 – 0	SIPO

TEST DESCRIPTION

1.	Check that normal alignment is carried out with LPO set at A.
2.	Check that SIPO is returned when aligned, and that A stays in "processor outage" state.
3.	Repeat test with LPO set at B.

TEST NUMBER: 1.10	PAGE: 1 OF 1
REFERENCE: Q.703 §§ 7, 8 STD: Fig. 8	
TITLE: Link State Control – Expected signal units/orders	
SUB TITLE: Normal alignment with PO set and clear	
PURPOSE: To check the response following normal alignment when PO has been set and cleared	
PRE-TEST CONDITIONS: Link out of service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

SP B			SP A	
Link			Link	
		<------------------------	1 – 0	SIOS
1 – 0	SIOS	------------------------>		
				: set LPO
				: clear LPO
				: start
		<------------------------	1 – 0	SIO
1 – 0	SIO	------------------------>		
		<------------------------	1 – 0	SIN
1 – 0	SIN	------------------------>		
		<------------------------	1 – 0	FISU
1 – 0	FISU	------------------------>		

TEST DESCRIPTION

1.	Check that normal alignment is carried out.
2.	Check that link aligns and enters "In service" state.

TEST NUMBER: 1.11	PAGE: 1 OF 1
REFERENCE: Q.703 §§ 7, 8 STD: Fig. 8	
TITLE: Link State Control – Expected signal units/orders	
SUB TITLE: Set RPO when "Aligned not ready"	
PURPOSE: To check the response following normal alignment when PO has been set	
PRE-TEST CONDITIONS: Link out of service; ability to set PO	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

Link	SP B		Link	SP A
		<------------------------	1 – 0	SIOS
1 – 0	SIOS	------------------------>		
	: set LPO			: set LPO
				: start
		<------------------------	1 – 0	SIO
1 – 0	SIO	------------------------>		
		<------------------------	1 – 0	SIN
1 – 0	SIN	------------------------>		
		<------------------------	1 – 0	SIPO
1 – 0	SIPO	------------------------>		

TEST DESCRIPTION

1. Set LPO at A and B.
2. Start alignment.
3. Check that both LPO and RPO after alignment completes.

TEST NUMBER: 1.12	PAGE: 1 OF 1
REFERENCE: Q.703 §§ 7, 8 STD: Fig. 8	
TITLE: Link State Control – Expected signal units/orders	
SUB TITLE: SIOS received when "Aligned not ready"	
PURPOSE: To check the response following normal alignment when PO has been set	
PRE-TEST CONDITIONS: Link out of service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

Link	SP B		Link	SP A
		<-------------------------	1 – 0	SIOS
1 – 0	SIOS	------------------------->		
				: set LPO
				: start
		<-------------------------	1 – 0	SIO
1 – 0	SIO	------------------------->		
		<-------------------------	1 – 0	SIN
1 – 0	SIN	------------------------->		
		<-------------------------	1 – 0	SIPO
	: stop			
1 – 0	SIOS	------------------------->		
		<-------------------------	1 – 0	SIOS

TEST DESCRIPTION

1. Soon after alignment completes, A enters "Aligned not ready".
2. Before alignment completes, stop command is given at B.
3. Check that, on reception of SIOS, A enters "Out of service" state.
4. Repeat test with LPO set at B.

TEST NUMBER: 1.13	PAGE: 1 OF 1
REFERENCE: Q.703 §§ 7, 8 STD: Fig. 8	
TITLE: Link State Control – Expected signal units/orders	
SUB TITLE: SIO received when "Aligned not ready"	
PURPOSE: To check the response following normal alignment when PO has been set	
PRE-TEST CONDITIONS: Link out of service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

Link	SP B		Link	SP A
		<-------------------------	1 – 0	SIOS
1 – 0	SIOS	------------------------->		
				: set LPO
				: start
		<-------------------------	1 – 0	SIO
1 – 0	SIO	------------------------->		
		<-------------------------	1 – 0	SIN
1 – 0	SIN	------------------------->		
		<-------------------------	1 – 0	SIPO
1 – 0	SIO	------------------------->		
		<-------------------------	1 – 0	SIOS

TEST DESCRIPTION

1. Soon after alignment completes, A enters "Aligned not ready".
2. Before alignment completes at B, SIO is sent to A.
3. Check that, on reception of SIO, A enters "Out of service" state.
4. Repeat test with LPO set at B.

TEST NUMBER: 1.14	PAGE: 1 OF 1
REFERENCE: Q.703 §§ 7, 8 STD: Fig. 8	
TITLE: Link State Control – Expected signal units/orders	
SUB TITLE: Set and clear LPO when "Initial alignment"	
PURPOSE: To check normal alignment with PO set and clear during "Initial alignment"	
PRE-TEST CONDITIONS: Link out of service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

SP B			SP A	
Link			Link	
		<-------------------------	1 – 0	SIOS
1 – 0	SIOS	------------------------->		
				: start
		<-------------------------	1 – 0	SIO
1 – 0	SIO	------------------------->		
		<-------------------------	1 – 0	SIN
				: set LPO
1 – 0	SIN	------------------------->		
				: clear LPO
		<-------------------------	1 – 0	FISU
1 – 0	FISU	------------------------->		
		<-------------------------	1 – 0	FISU

TEST DESCRIPTION

1. Set LPO at A during "Initial alignment" state.
2. Check A remains in "Initial alignment" state.
3. Clear LPO before alignment completes at A.
4. Check A enters "In service" state after normal alignment.
5. Repeat the test at B.

TEST NUMBER: 1.15	PAGE: 1 OF 1
REFERENCE: Q.703 §§ 7, 8 STD: Fig. 8	
TITLE: Link State Control – Expected signal units/orders	
SUB TITLE: Set and clear LPO when "aligned ready"	
PURPOSE: To test the response to LPO when "aligned ready" and to ensure that the aligned ready state resumes when LPO is cleared.	
PRE-TEST CONDITIONS: Link out of service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

Link	SP B		Link	SP A
		<-------------------------	1 – 0	SIOS
1 – 0	SIOS	------------------------->		
				: start
		<-------------------------	1 – 0	SIO
1 – 0	SIO	------------------------->		
		<-------------------------	1 – 0	SIN
1 – 0	SIN	------------------------->		
		<-------------------------	1 – 0	FISU
				: set LPO
		<-------------------------	1 – 0	SIPO
				: wait 5 secs.
				: clear LPO
		<-------------------------	1 – 0	FISU

TEST DESCRIPTION

1.	Start link at A.
2.	At "aligned ready" state set LPO at A. (Suppress return of FISUs at B to maintain "aligned ready" state).
3.	Clear LPO at A.
4.	Check A resumes "aligned ready" state.

TEST NUMBER: 1.16	PAGE: 1 OF 1
REFERENCE: Q.703 §§ 7, 8 STD: Fig. 8	
TITLE: Link State Control – Expected signal units/orders	
SUB TITLE: Timer T1 in "aligned not ready" state	
PURPOSE: To test the operation of Timer T1 when in the "aligned not ready" state.	
PRE-TEST CONDITIONS: Link out of service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

```
             SP   B                                                  SP   A

 Link                                                   Link

                              <------------------------  1 – 0       SIOS
 1 – 0       SIOS             ------------------------>
                                                                   : set LPO
                                                                   : start
                              <------------------------  1 – 0       SIO
 1 – 0       SIO              ------------------------>
                              <------------------------  1 – 0       SIN
 1 – 0       SIN              ------------------------>
                              <------------------------  1 – 0       SIPO
                                                                      | T1
                              <------------------------  1 – 0       SIOS
```

TEST DESCRIPTION

1.	Set LPO and start link at A.
2.	Check A enters the "aligned not ready" state.
3.	Check A takes the link out of service after time T1.
4.	Timer T1 shall be in the range 40 secs to 50 secs.

TEST NUMBER: 1.17	PAGE: 1 OF 1
REFERENCE: Q.703 § 7 STD: Fig. 9	
TITLE: Link State Control – Expected signal units/orders	
SUB TITLE: No SIO sent during normal proving period	
PURPOSE: To ensure that normal alignment still occurs when SIO is omitted	
PRE-TEST CONDITIONS: Link out of Service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

Link	SP B		Link	SP A
		<------------------------	1 – 0	SIOS
1 – 0	SIOS	------------------------>		
				: start
		<------------------------	1 – 0	SIO not aligned
1 – 0	SIN	------------------------>		
		<------------------------	1 – 0	SIN
1 – 0	SIN	------------------------>		T3
				T4 (Pn)
		<------------------------	1 – 0	FISU

TEST DESCRIPTION

1.	Check normal alignment occurs with no SIO sent from SP B.

TEST NUMBER: 1.18	PAGE: 1 OF 1
REFERENCE: Q.703 § 7 STD: Fig. 8	
TITLE: Link State Control – Expected signal units/orders	
SUB TITLE: Set and cease emergency prior to "start alignment"	
PURPOSE: To test the normal proving period is employed having "emergency" set and cleared	
PRE-TEST CONDITIONS: Link out of service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

SP B Link			SP A Link	
		<-------------------------	1 – 0	SIOS
1 – 0	SIOS	------------------------->		
				: set Em
				: clear Em
				: start
		<-------------------------	1 – 0	SIO
1 – 0	SIO	------------------------->		
		<-------------------------	1 – 0	SIN
1 – 0	SIN	------------------------->		
				T4 (Pn)
		<-------------------------	1 – 0	FISU

TEST DESCRIPTION

1. Check emergency set and cleared prior to start of alignment.
2. Check normal proving period is carried out.

TEST NUMBER: 1.19	PAGE: 1 OF 1
REFERENCE: Q.703 § 7 STD: Fig. 8; Fig. 9	
TITLE: Link State Control – Expected signal units/orders	
SUB TITLE: Set emergency while in "not aligned state"	
PURPOSE: To test that emergency proving can be set during normal initial alignment.	
PRE-TEST CONDITIONS: Link out of service	
CONFIGURATION: 1	TYPE OF TEST: VAT, CPT

EXPECTED SIGNAL UNIT SEQUENCE:

	SP B			PS A
Link			Link	
		<------------------------	1 – 0	SIOS
1 – 0	SIOS	------------------------>		
				: start
		<------------------------	1 – 0	SIO
				: set EM
1 – 0	SIO	------------------------>		
		<------------------------	1 – 0	SIE
1 – 0	SIN	------------------------>		
				T4 (Pe)
		<------------------------	1 – 0	FISU

TEST DESCRIPTION

1.	Check that emergency proving period is used after set EM during normal initial alignment.
2.	The timing of this test is critical, emergency must be set once the start command has been given and before SIO is received. (i.e. during Timer T2 operation).
3.	At 64 kbit/s Timer T4 shall be in the range 0,4 sec to 0,6 sec (nominally 0,5 sec).
4.	At 4,8 kbit/s, Timer T4 shall be in the range 6 secs to 8 secs (nominally 7 secs).

TEST NUMBER: 1.20	PAGE: 1 OF 1

REFERENCE: Q.703 § 7 STD: Fig. 9

TITLE: Link State Control – Expected signal units/orders

SUB TITLE: Set emergency when "aligned"

PRE-TEST CONDITIONS: To test that emergency proving period is used when emergency set prior to receiving SIN

CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

```
              SP   B                                               SP   A

 Link                                                Link

                          <-------------------------   1 – 0     SIOS
 1 – 0        SIOS        ------------------------->
                                                               : start
                          <-------------------------   1 – 0     SIO
 1 – 0        SIO         ------------------------->

                          <-------------------------   1 – 0     SIN
                                                               : set EM
                          <-------------------------   1 – 0     SIE
 1 – 0        SIN         ------------------------->              |
                                                                  | T4 (Pe)
                                                                  |
                          <-------------------------   1 – 0     FISU
```

TEST DESCRIPTION

1.	Check that emergency proving period is used after SIE sent during "aligned" state.
2.	The timing of this test is critical. Emergency must be set once SIN has been sent but before Timer T3 expires.

TEST NUMBER: 1.21	PAGE: 1 OF 1
REFERENCE: Q.703 § 7 STD: Fig. 8; Fig. 9	
TITLE: Link State Control – Expected signal units/orders	
SUB TITLE: Both ends set emergency	
PURPOSE: To check the emergency alignment procedure and Timer T4 (Pe)	
PRE-TEST CONDITIONS: Link out of service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

SP B			SP A	
Link			Link	
		<-------------------------	1 – 0	SIOS
1 – 0	SIOS	------------------------->		
				: set EM
				: start
		<-------------------------	1 – 0	SIO
1 – 0	SIO	------------------------->		
		<-------------------------	1 – 0	SIE
1 – 0	SIE	------------------------->		
				T4 (Pe)
		<-------------------------	1 – 0	FISU

TEST DESCRIPTION

1.	Check correct emergency alignment procedure is performed.

TEST NUMBER: 1.22	PAGE: 1 OF 1
REFERENCE: Q.703 § 7 STD: Fig. 9	
TITLE: Link State Control – Expected signal units/orders	
SUB TITLE: Individual end sets emergency	
PURPOSE: To check emergency alignment procedure, Emergency set at the other end	
PRE-TEST CONDITIONS: Link out of service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

SP B Link			SP A Link	
		<------------------------	1 – 0	SIOS
1 – 0	SIOS	------------------------>		
1 – 0	SIO	------------------------>		
				: start
		<------------------------	1 – 0	SIO
1 – 0	SIE	------------------------>		
		<------------------------	1 – 0	SIN
				T4 (Pe)
		<------------------------	1 – 0	FISU

TEST DESCRIPTION

1. Emergency alignment set at B.
2. Start alignment at A.
3. Check that alignment occurs with the emergency proving period.

TEST NUMBER: 1.23	PAGE: 1 OF 1
REFERENCE: Q.703 § 7 STD: Fig. 9	
TITLE: Link State Control – Expected signal units/orders	
SUB TITLE: Set emergency during normal proving	
PURPOSE: To test that setting emergency during normal proving stops normal proving and starts the emergency proving	
PRE-TEST CONDITIONS: Link out of service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

Link	SP B		Link	SP A
		<-------------------------	1 – 0	SIOS
1 – 0	SIOS	------------------------->		
				: start
		<-------------------------	1 – 0	SIO
1 – 0	SIO	------------------------->		
		<-------------------------	1 – 0	SIN
1 – 0	SIN	------------------------->		
				: set EM
		<-------------------------	1 – 0	SIE
1 – 0	SIN	------------------------->		T4 (Pe)
		<-------------------------	1 – 0	FISU

TEST DESCRIPTION

1.	Set emergency during normal proving period at A.
2.	Check A sends SIE.
3.	Repeat test in reverse direction.

TEST NUMBER: 1.24	PAGE: 1 OF 1
REFERENCE: Q.703 § 7 STD: Fig. 9	
TITLE: Link State Control – Expected signal units/orders	
SUB TITLE: No SIO sent during emergency alignment	
PURPOSE: To ensure that emergency alignment still occurs when SIE is received following SIOS	
PRE-TEST CONDITIONS: Link out of service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

Link	SP B		Link	SP A
		<-------------------------	1 – 0	SIOS
1 – 0	SIOS	------------------------->		
				: set EM
				: start
		<-------------------------	1 – 0	SIO
1 – 0	SIE	------------------------->		
		<-------------------------	1 – 0	SIE
				T4 (Pe)
		<-------------------------	1 – 0	FISU

TEST DESCRIPTION

1. Set emergency and start link at A.
2. A receives SIE after sending SIO.
3. Check that link aligns OK after emergency proving.

TEST NUMBER: 1.25	PAGE: 1 OF 1
REFERENCE: Q.703 § 7 STD: Fig. 8; Fig. 9	
TITLE: Link State Control – Expected signal units/orders	
SUB TITLE: Deactivation during initial alignment	
PURPOSE: To test the response to the receipt of the stop command while in the initial alignment state (initial alignment is Not Aligned State)	
PRE-TEST CONDITIONS: Link out of service	
CONFIGURATION: 1	TYPE OF TEST: VAT, CPT

EXPECTED SIGNAL UNIT SEQUENCE:

SP B Link	SP B		SP A Link	SP A
		<-------------------------	1 – 0	SIOS
1 – 0	SIOS	------------------------->		
				: start
		<-------------------------	1 – 0	SIO
				: wait 5 secs.
				: stop
		<-------------------------	1 – 0	SIOS

TEST DESCRIPTION

1.	Check that alignment ceases after Stop command given.
2.	The stop command must be issued before timer T2 expires.
3.	Timer T2 shall be in the range 5 secs to 150 secs.

TEST NUMBER: 1.26	PAGE: 1 OF 1
REFERENCE: Q.703 § 7 STD: Fig. 8; Fig. 9	
TITLE: Link State Control – Expected signal units/orders	
SUB TITLE: Deactivation during aligned state	
PURPOSE: To test the response to the receipt of the stop command while in the initial alignment state (initial alignment is aligned state).	
PRE-TEST CONDITIONS: Link out of service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

SP B Link			SP A Link	
		<------------------------	1 – 0	SIOS
1 – 0	SIOS	------------------------>		
				: start
		<------------------------	1 – 0	SIO
1 – 0	SIO	------------------------>		
		<------------------------	1 – 0	SIN
				: stop
		<------------------------	1 – 0	SIOS

TEST DESCRIPTION

1.	Check that alignment ceases after STOP command given.
2.	The stop command must be issued before timer T3 expires.
3.	Timer T3 shall be in the range 1 sec to 1.5 secs.

TEST NUMBER: 1.27	PAGE: 1 OF 1
REFERENCE: Q.703 §§ 7, 8 STD: Fig. 8	
TITLE: Link State Control – Expected signal units/orders	
SUB TITLE: Deactivation during aligned not ready	
PURPOSE: To check the response following normal alignment when PO has been set	
PRE-TEST CONDITIONS: Link out of service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

Link	SP B		Link	SP A
		<------------------------	1 – 0	SIOS
1 – 0	SIOS	------------------------>		
				: set LPO
				: start
		<------------------------	1 – 0	SIO
1 – 0	SIO	------------------------>		
		<------------------------	1 – 0	SIN
1 – 0	SIN	------------------------>		
		<------------------------	1 – 0	SIPO
				: stop
		<------------------------	1 – 0	SIOS

TEST DESCRIPTION

1.	Soon after alignment completes, A enters "Aligned not ready".
2.	Before alignment completes at B, stop command is given at A.
3.	Check that A enters "Out of service" state.
4.	Repeat test with LPO set at B.

TEST NUMBER: 1.28	PAGE: 1 OF 1
REFERENCE: Q.703 § 7 STD: Fig. 8; Fig. 14	
TITLE: Link State Control – Expected signal units/orders	
SUB TITLE: SIO received during link in service	
PURPOSE: To check the deactivation of a signalling link from the "In Service" state.	
PRE-TEST CONDITIONS: Link in service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

SP B			SP A	
Link			Link	
1 – 0	FISU	------------------------->		
		<-------------------------	1 – 0	FISU
1 – 0	SIO	------------------------->		
		<-------------------------	1 – 0	SIOS

TEST DESCRIPTION

1.	SIO is sent to A during link in service.
2.	Check that an "in service" link can be taken out of service at A.

TEST NUMBER: 1.29	PAGE: 1 OF 1
REFERENCE: Q.703 § 7 STD: Fig. 8; Fig. 14	
TITLE: Link State Control – Expected signal units/orders	
SUB TITLE: Deactivation during link in service	
PURPOSE: To check the deactivation of a signalling link from the "In service" state	
PRE-TEST CONDITIONS: Link in service	
CONFIGURATION: 1	TYPE OF TEST: VAT, CPT

EXPECTED SIGNAL UNIT SEQUENCE:

SP B			SP A	
Link			Link	
1 – 0	FISU	------------------------->		
		<-------------------------	1 – 0	FISU
	: stop			
1 – 0	SIOS	------------------------->		
		<-------------------------	1 – 0	SIOS

TEST DESCRIPTION

1. Check that an "In service" link can be taken out of service by command at B.
2. Repeat test, command given at A.

TEST NUMBER: 1.30	PAGE: 1 OF 1
REFERENCE: Q.703 §§ 7, 8 STD: Fig. 10	
TITLE: Link State Control – Expected signal units/orders	
SUB TITLE: Deactivation during LPO	
PURPOSE: To check the response to the stop command during LPO	
PRE-TEST CONDITIONS: Link in service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

SP B			SP A	
Link			Link	
		<------------------------	1 – 0	FISU
1 – 0	FISU	------------------------>		
				: set LPO
		<------------------------	1 – 0	SIPO
1 – 0	FISU	------------------------>		
				: stop
		<------------------------	1 – 0	SIOS

TEST DESCRIPTION

1.	SIPO sent from A, stop command given at A, check link enters out of service state.
2.	Repeat test, SIPO sent from B, stop command at B, check link enters out of service state.

TEST NUMBER: 1.31	PAGE: 1 OF 1
REFERENCE: Q.703 §§ 7, 8 STD: Fig. 10	
TITLE: Link State Control – Expected signal units/orders	
SUB TITLE: Deactivation during RPO	
PURPOSE: To test the response to the stop command during RPO	
PRE-TEST CONDITIONS: Link in service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

SP B			SP A	
Link			Link	
1 – 0	FISU	------------------------->		
		<-------------------------	1 – 0	FISU
1 – 0	SIPO	------------------------->		
				: stop
		<-------------------------	1 – 0	SIOS

TEST DESCRIPTION

1.	SIPO received at A, stop command given at A, check link enters out of service state.
2.	Repeat test, SIPO received at B, stop command given at B, check link enters out of service state.

TEST NUMBER: 1.32	PAGE: 1 OF 1
REFERENCE: Q.703 §§ 7, 10.3 STD: Fig. 8; Fig. 9	
TITLE: Link State Control – Expected signal units/orders	
SUB TITLE: Deactivation during the proving period	
PURPOSE: To test the response to the receipt of SIOS during the proving period	
PRE-TEST CONDITIONS: Link out of service	
CONFIGURATION: 1	TYPE OF TEST: VAT, CPT

EXPECTED SIGNAL UNIT SEQUENCE:

SP B Link	SP B		SP A Link	SP A
		<-------------------------	1 – 0	SIOS
1 – 0	SIOS	------------------------->		
				: start
		<-------------------------	1 – 0	SIO
1 – 0	SIO	------------------------->		
		<-------------------------	1 – 0	SIN
1 – 0	SIN	------------------------->		
	: stop			
1 – 0	SIOS	------------------------->		
		<-------------------------	1 – 0	SIOS

TEST DESCRIPTION

1.	Check link enters out of service state when SIOS is received at A during the proving period.
2.	Repeat test, SIOS received at B during proving period.

TEST NUMBER: 1.33	PAGE: 1 OF 1
REFERENCE: Q.703 § 7 STD: Fig. 8	
TITLE: Link State Control – Expected signal units/orders	
SUB TITLE: SIO received instead of FISUs	
PURPOSE: To check the response to the receipt of SIO instead of FISUs in the aligned ready state	
PRE-TEST CONDITIONS: Link out of service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

SP B			SP A	
Link			Link	
		<-------------------------	1 – 0	SIOS
1 – 0	SIOS	------------------------->		
				: start
		<-------------------------	1 – 0	SIO
1 – 0	SIO	------------------------->		
		<-------------------------	1 – 0	SIN
1 – 0	SIN	------------------------->		
		<-------------------------	1 – 0	FISU
1 – 0	SIO	------------------------->		
		<-------------------------	1 – 0	SIOS

TEST DESCRIPTION

1.	Check link enters out of service state when SIO is received at A instead of FISUs in the aligned ready state.

TEST NUMBER: 1.34	PAGE: 1 OF 1
REFERENCE: Q.703 § 7 STD: Fig. 8	
TITLE: Link State Control – Expected signal units/orders	
SUB TITLE: SIOS received instead of FISUs	
PURPOSE: To check the response to the receipt of SIOS instead of FISUs in the aligned ready state	
PRE-TEST CONDITIONS: Link out of service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

SP B			SP A	
Link			Link	
		<------------------------	1 – 0	SIOS
1 – 0	SIOS	------------------------>		
				: start
		<------------------------	1 – 0	SIO
1 – 0	SIO	------------------------>		
		<------------------------	1 – 0	SIN
1 – 0	SIN	------------------------>		
		<------------------------	1 – 0	FISU
	: stop			
1 – 0	SIOS	------------------------>		
		<------------------------	1 – 0	SIOS

TEST DESCRIPTION

1.	Check link enters out of service state when SIOS is received at A instead of FISUs in the aligned ready state.

TEST NUMBER: 1.35	PAGE: 1 OF 1
REFERENCE: Q.703 §§ 7, 8 STD: Fig. 8	
TITLE: Link State Control – Expected signal units/orders	
SUB TITLE: SIPO received instead of FISUs	
PURPOSE: To check the response to the receipt of SIPO instead of FISUs in the aligned ready state	
PRE-TEST CONDITIONS: Link out of service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

SP B			SP A	
Link			Link	
		<-------------------------	1 – 0	SIOS
1 – 0	SIOS	------------------------->		
				: start
		<-------------------------	1 – 0	SIO
1 – 0	SIO	------------------------->		
		<-------------------------	1 – 0	SIN
1 – 0	SIN	------------------------->		
		<-------------------------	1 – 0	FISU
	: set LPO			
1 – 0	SIPO	------------------------->		
		<-------------------------	1 – 0	FISU

TEST DESCRIPTION

1.	Check link enters processor outage state when SIPO received at A instead of FISUs in the aligned ready state.

TEST NUMBER: 2.1	PAGE: 1 OF 1
REFERENCE: Q.703 §§ 7, 11 STD: Fig. 8	
TITLE: Link State Control – Unexpected signal units/orders	
SUB TITLE: Unexpected signal units/orders in "Out of service" state	
PURPOSE: To check that the unexpected signal units/orders are ignored	
PRE-TEST CONDITIONS: Link out of service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

```
          SP   B                                                SP   A

 Link                                              Link

                      <------------------------    1 – 0       SIOS
 1 – 0    SIOS        ------------------------>
          xxx         ------------------------>

                                                               yyy

                                                             : start
                      <------------------------    1 – 0       SIO
 1 – 0    SIO         ------------------------>

                      <------------------------    1 – 0       SIN
 1 – 0    SIN         ------------------------>

                      <------------------------    1 – 0       FISU
 1 – 0    FISU        ------------------------>
```

TEST DESCRIPTION

1.	Check that the unexpected signal units xxx received from B are ignored without impact on the system. xxx are successively SIO, SIN, SIE, SIPO, SIB, aberrant LSSU (non-existing status, one and two octects), FISU and MSU.
2.	Check that the unexpected orders yyy = Stop from level 3 are ignored without impact on system (if applicable).

TEST NUMBER: 2.2	PAGE: 1 OF 1
REFERENCE: Q.703 §§ 7, 11 STD: Fig. 9	
TITLE: Link State Control – Unexpected signal units/orders	
SUB TITLE: Unexpected signal units/orders in "Not aligned" state	
PURPOSE: To check that unexpected signal units/orders are ignored	
PRE-TEST CONDITIONS: Link out of service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

Link	SP B		Link	SP A
		<------------------------	1 – 0	SIOS
1 – 0	SIOS	------------------------>		
				: start
		<------------------------	1 – 0	SIO
	xxx	------------------------>		
				yyy
1 – 0	SIO	------------------------>		
		<------------------------	1 – 0	SIN
1 – 0	SIN	------------------------>		
		<------------------------	1 – 0	FISU
1 – 0	FISU	------------------------>		

TEST DESCRIPTION

1.	Check that the unexpected signal unit xxx received from B are ignored without impact on the system. xxx are successively SIOS, SIPO, SIB, aberrant LSSU, FISU and MSU.
2.	Check that the unexpected orders yyy received from Level 3 are ignored without impact on the system. yyy are successively clear EM and start (if applicable).

TEST NUMBER: 2.3	PAGE: 1 OF 1
REFERENCE: Q.703 §§ 7, 11 STD: Fig. 9	
TITLE: Link State Control – Expected signal units/orders	
SUB TITLE: Unexpected signal units/orders in "Aligned" state	
PURPOSE: To check that unexpected signal units/orders are ignored	
PRE-TEST CONDITIONS: Link out of service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

	SP B			SP A
Link			Link	
		<------------------------	1 – 0	SIOS
1 – 0	SIOS	------------------------>		
				: start
		<------------------------	1 – 0	SIO
1 – 0	SIO	------------------------>		
		<------------------------	1 – 0	SIN
	xxx	------------------------>		
				yyy
1 – 0	SIN	------------------------>		
		<------------------------	1 – 0	FISU
1 – 0	FISU	------------------------>		

TEST DESCRIPTION

1.	Check that the unexpected signal units xxx received from B are ignored without impact on the system. xxx are successively SIO, SIPO, SIB, aberrant LSSU, FISU and MSU.
2.	Check that the unexpected orders yyy received from Level 3 are ignored without impact on the system. yyy are successively clear EM and start (if applicable).

TEST NUMBER: 2.4	PAGE: 1 OF 1
REFERENCE: Q.703 §§ 7, 11 STD: Fig. 9	
TITLE: Link State Control – Unexpected signal units/orders	
SUB TITLE: Unexpected signal units/orders in "Proving" state	
PURPOSE: To check that unexpected signal units/orders are ignored	
PRE-TEST CONDITIONS: Link out of service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

	SP B			SP A
Link			Link	
		<-------------------------	1 – 0	SIOS
1 – 0	SIOS	------------------------->		
				: start
		<-------------------------	1 – 0	SIO
1 – 0	SIO	------------------------->		
		<-------------------------	1 – 0	SIN
1 – 0	SIN	------------------------->		
	xxx	------------------------->		
				yyy
		<-------------------------	1 – 0	FISU
1 – 0	FISU	------------------------->		

TEST DESCRIPTION

1.	Check that the unexpected signal units xxx received from B are ignored without impact on the system. xxx are successively SIPO, SIB, aberrant LSSU, FISU and MSU.
2.	Check that the unexpected orders yyy received from Level 3 are ignored without impact on the system. yyy are successively clear EM and start (if applicable). *Note* – The reception of SIB in "Initial alignment" state may possibly cause link failure after transferring to "In service" state because of the T6 expiration.

TEST NUMBER: 2.5	PAGE: 1 OF 1
REFERENCE: Q.703 §§ 7, 11 STD: Fig. 8	
TITLE: Link State Control – Unexpected signal units/orders	
SUB TITLE: Unexpected signal units/orders in "Aligned ready" state	
PURPOSE: To check that unexpected signal units/orders are ignored	
PRE-TEST CONDITIONS: Link out of service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

SP B			SP A	
Link			Link	
		<-------------------------	1 – 0	SIOS
1 – 0	SIOS	------------------------->		
				: start
		<-------------------------	1 – 0	SIO
1 – 0	SIO	------------------------->		
		<-------------------------	1 – 0	SIN
1 – 0	SIN	------------------------->		
		<-------------------------	1 – 0	FISU
	xxx	------------------------->		
				yyy
1 – 0	FISU	------------------------->		

TEST DESCRIPTION

1. Check that the unexpected signal units xxx received from B are ignored without impact on the system. xxx are successively SIB and aberrant LSSU.

2. Check that the unexpected orders yyy received from level 3 are ignored without impact on the system. yyy are successively set EM, clear EM, clear LPO and Start (if applicable).

   Note – The reception of SIB in "Aligned ready" state may possibly cause link failure after transferring to "In service" state because of the T6 expiration.

TEST NUMBER: 2.6	PAGE: 1 OF 1
REFERENCE: Q.703 §§ 7, 11 STD: Fig. 8	
TITLE: Link State Control – Unexpected signal units/orders	
SUB TITLE: Unexpected signal units/orders in “Aligned not ready” state	
PURPOSE: To check that unexpected signal units/orders are ignored	
PRE-TEST CONDITIONS: Link out of service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

Link	SP B		Link	SP A
		<-------------------------	1 – 0	SIOS
1 – 0	SIOS	------------------------->		
				: set LPO
				: start
		<-------------------------	1 – 0	SIO
1 – 0	SIO	------------------------->		
		<-------------------------	1 – 0	SIN
1 – 0	SIN	------------------------->		
		<-------------------------	1 – 0	SIPO
	xxx	------------------------->		
				yyy
1 – 0	FISU	------------------------->		
		<-------------------------	1 – 0	SIPO

TEST DESCRIPTION

1.	Check that the unexpected signal units xxx received from B are ignored without impact on the system. xxx are successively SIB and aberrant LSSU.
2.	Check that the unexpected orders yyy received from level 3 are ignored without impact on the system. yyy are successively set EM, clear EM, clear LPO and Start (if applicable).

TEST NUMBER: 2.7	PAGE: 1 OF 1
REFERENCE: Q.703 §§ 7, 11 STD: Fig. 8	
TITLE: Link State Control – Unexpected signal units/orders	
SUB TITLE: Unexpected signal units/orders in "In service" state	
PURPOSE: To check unexpected signal units/orders are ignored	
PRE-TEST CONDITIONS: Link in service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

Link	SP B		Link	SP A
		<------------------------	1 – 0	FISU
1 – 0	FISU	------------------------>		
	aberrant LSSU	------------------------>		
				yyy
		<------------------------	1 – 0	FISU
1 – 0	FISU	------------------------>		

TEST DESCRIPTION

1.	Check that an aberrant LSSU received from B is ignored without impact on the system.
2.	Check that the unexpected orders yyy received from level 3 are ignored without impact on the system. yyy are successively set EM, clear EM, clear LPO and Start (if applicable).

TEST NUMBER: 2.8	PAGE: 1 OF 1
REFERENCE: Q.703 §§ 7, 11 STD: Fig. 8	
TITLE: Link State Control – Unexpected signal units/orders	
SUB TITLE: Unexpected signal units/orders in "Processor outage" state	
PURPOSE: To check that the unexpected signal units/orders are ignored	
PRE-TEST CONDITIONS: Link in service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

Link	SP B		Link	SP A
				: set LPO
		<------------------------	1 – 0	SIPO
	xxx	------------------------>		
				yyy
1 – 0	FISU	------------------------>		

TEST DESCRIPTION

1.	Check that the unexpected signal units xxx received from A are ignored without impact on the system. xxx are successively SIB and aberrant LSSU.
2.	Check that the unexpected orders yyy received from level 3 are ignored without impact on the system. yyy are successively set EM, clear EM and Start (if applicable).

TEST NUMBER: 3.1	PAGE: 1 OF 1
REFERENCE: Q.703 §§ 4, 10.2 STD: Fig. 8	
TITLE: Transmission failure	
SUB TITLE: Link aligned ready (Break Tx path)	
PURPOSE: To test the response to a transmission failure – detected by SUERM – when in "Aligned ready" state	
PRE-TEST CONDITIONS: Link out of service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

Link	SP B		Link	SP A
		<-------------------------	1 – 0	SIOS
1 – 0	SIOS	------------------------->		
				: start
		<-------------------------	1 – 0	SIO
1 – 0	SIO	------------------------->		
		<-------------------------	1 – 0	SIN
1 – 0	SIN	------------------------->		
		<-------------------------	1 – 0	FISU
	: break Tx			
		<-------------------------	1 – 0	SIOS

TEST DESCRIPTION

1.	Break Tx path at B when in "Aligned ready" state, check that the SUERM detects the failure and the link is taken out of service.
2.	Repeat test, break Tx at A.

TEST NUMBER: 3.2	PAGE: 1 OF 1
REFERENCE: Q.703 § 5.3 STD: Fig. 8	
TITLE: Transmission failure	
SUB TITLE: Link aligned ready (Corrupt FIBs – Basic)	
PURPOSE: To check the response to a link failure after corruption of two FIBs – detected by reception control – while in Aligned ready State.	
PRE-TEST CONDITIONS: Aligned ready	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

SP B Link			SP A Link	
		<-------------------------	1 – 0	FISU
1 – 0	FISU corrupt FIB (FIB + FSN = 7F)	------------------------->		
1 – 0	FISU corrupt FIB (FIB + FSN = 7F)	------------------------->		
		<-------------------------	1 – 0	SIOS

TEST DESCRIPTION

1.	Check that receipt of two FISUs at A with corrupt FIB's at link aligned ready state causes the link to be taken out of service.

TEST NUMBER: 3.3	PAGE: 1 OF 1
REFERENCE: Q.703 §§ 8, 10.3 STD: Fig. 8	
TITLE: Transmission failure	
SUB TITLE: Link aligned not ready (Break Tx path)	
PURPOSE: To test the response to a break in the transmission path – detected by SUERM – in "Aligned not ready" state	
PRE-TEST CONDITIONS: Link out of service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

```
              SP    B                                                    SP    A

 Link                                                     Link

                            <------------------------     1 – 0      SIOS
 1 – 0        SIOS          ------------------------>
                                                                   : set LPO
                                                                   : start
                            <------------------------     1 – 0      SIO
 1 – 0        SIO           ------------------------>
                            <------------------------     1 – 0      SIN
 1 – 0        SIN           ------------------------>
                            <------------------------     1 – 0      SIPO

            : break Tx
                            <------------------------     1 – 0      SIOS
```

TEST DESCRIPTION

1.	Set LPO at A.
2.	Start link alignment at A.
3.	In link aligned not ready state break Tx at B and check link is taken out of service.
4.	Repeat test for B with break in Tx at A, check link is taken out of service.
5.	The Tx path must be broken before Timer T1 expires.

TEST NUMBER: 3.4	PAGE: 1 OF 1
REFERENCE: Q.703 § 5.3, 8 STD: Fig. 8	
TITLE: Transmission failure	
SUB TITLE: Link aligned not ready (Corrupt FIBs – Basic)	
PURPOSE: To check the response to a link failure after corruption of two FIBs – detected by reception control – while in "Aligned not ready"	
PRE-TEST CONDITIONS: Link out of service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

Link	SP B		Link	SP A
		<-------------------------	1 – 0	SIOS
1 – 0	SIOS	------------------------->		
				: set LPO
				: start
		<-------------------------	1 – 0	SIO
1 – 0	SIO	------------------------->		
		<-------------------------	1 – 0	SIN
1 – 0	SIN	------------------------->		
		<-------------------------	1 – 0	SIPO
1 – 0	FISU corrupt FIB (FIB + FSN = 7F)	------------------------->		
1 – 0	FISU corrupt FIB (FIB + FSN = 7F)	------------------------->		
		<-------------------------	1 – 0	SIOS

TEST DESCRIPTION

1. Set LPO at A.
2. Start link alignment at A.
3. Send two corrupt FISUs (corrupt FIBs) on link aligned not ready.
4. Check link is taken out of service at A.

TEST NUMBER: 3.5	PAGE: 1 OF 1
REFERENCE: Q.703 § 4, 10.2 STD: Fig. 8	
TITLE: Transmission failure	
SUB TITLE: Link in service (Break Tx path)	
PURPOSE: To test the response to a transmission failure when the link is "In service"	
PRE-TEST CONDITIONS: Link in service	
CONFIGURATION: 1	TYPE OF TEST: VAT, CPT

EXPECTED SIGNAL UNIT SEQUENCE:

SP B			SP A	
Link			Link	
		<-------------------------	1 – 0	FISU
1 – 0	FISU	------------------------->		
	: break Tx			
		<-------------------------	SIOS	

TEST DESCRIPTION

1.	Break Tx at B, check SIOS returned from A.
2.	Repeat test, break at A.

TEST NUMBER: 3.6	PAGE: 1 OF 1
REFERENCE: Q.703 § 5.3 STD: Fig. 8	
TITLE: Transmission failure	
SUB TITLE: Link in service (Corrupt FIBs – Basic)	
PURPOSE: To check the response to a link failure after corruption of two FIBS – detected by reception control – while “In service”	
PRE-TEST CONDITIONS: Link in service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

	SP B			SP A
Link			Link	
		<--------------------------	1 – 0	FISU
1 – 0	FISU (FIB + FISN = FF)	-------------------------->		
1 – 0	FISU corrupt FIB (FIB + FSN = 7F)	-------------------------->		
1 – 0	FISU corrupt FIB (FIB + FSN = 7F)	-------------------------->		
		<--------------------------	1 – 0	SIOS

TEST DESCRIPTION

1.	Check that receipt of two FISUs at A with corrupt FIBs at link in service state causes the link to be taken out of service.

TEST NUMBER: 3.7	PAGE: 1 OF 1
REFERENCE: Q.703 § 8, 10.2 STD: Fig. 8	
TITLE: Transmission failure	
SUB TITLE: Link in processor outage (Break Tx path)	
PURPOSE: To test the response to a transmission failure when the link is "Processor outage"	
PRE-TEST CONDITIONS: Link in service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

Link	SP B		Link	SP A
		<------------------------	1 – 0	FISU
1 – 0	FISU	------------------------>		
				: set LPO
		<------------------------	1 – 0	SIPO
	: break Tx			
		<------------------------	1 – 0	SIOS

TEST DESCRIPTION

1.	Break Tx path at B when in "Processor outage" state, check that the SUERM detects the failure and the link is taken out of service.
2.	Repeat test, break TX at A.

TEST NUMBER: 3.8	PAGE: 1 OF 1
REFERENCE: Q.703 § 5.3, 8 STD: Fig. 8	
TITLE: Transmission failure	
SUB TITLE: Link in processor outage (Corrupt FIBs – Basic)	
PURPOSE: To check the response to a link failure after corruption of two FIBs – detected by reception control – while in "Processor outage"	
PRE-TEST CONDITIONS: Link in service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

	SP B			SP A
Link			Link	
		<-------------------------	1 – 0	FISU
1 – 0	FISU	------------------------->		
				: set LPO
		<-------------------------	1 – 0	SIPO
1 – 0	FISU corrupt FIB (FIB + FSN = 7F)	------------------------->		
1 – 0	FISU corrupt FIB (FIB + FSN = 7F)	------------------------->		
		<-------------------------	1 – 0	SIOS

TEST DESCRIPTION

1.	Check that receipt of two FISUs at A with corrupt FIBs on processor outage state causes the link to be taken out of service.

TEST NUMBER: 4.1	PAGE: 1 OF 1
REFERENCE: Q.703 § 8 STD: Fig. 10	
TITLE: Processor outage control	
SUB TITLE: Set and clear LPO while link in service	
PURPOSE: To check the ability to perform correctly when LPO is set and recovered	
PRE-TEST CONDITIONS: Link in service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

SP B Link			SP A Link	
		<-------------------------	1 – 0	FISU
1 – 0	FISU	------------------------->		
				: set LPO
		<-------------------------	1 – 0	SIPO
				: clear LPO
		<-------------------------	1 – 0	FISU
		<-------------------------	1 – 0	MSU (FIB + FSN = 80)

TEST DESCRIPTION

1. Set LPO at A while link in service.
2. Check message is discarded.
3. Clear LPO at A.
4. Check MSU is sent correctly.

TEST NUMBER: 4.2	PAGE: 1 OF 1
REFERENCE: Q.703 § 8 STD: Fig. 10	
TITLE: Processor outage control	
SUB TITLE: RPO during LPO	
PURPOSE: To test the response to RPO is set and cleared when "LPO"	
PRE-TEST CONDITIONS: Link in service. PO set at B	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

Link	SP B		Link	SP A
				: set LPO
		<------------------------	1 – 0	SIPO
1 – 0	SIPO	------------------------>		
		<------------------------	1 – 0	SIPO
	: clear LPO			
1 – 0	FISU	------------------------>		
		<------------------------	1 – 0	SIPO

TEST DESCRIPTION

1. Set LPO at A.
2. Clear LPO at B.
3. Check is SIPO sent from A.

TEST NUMBER: 4.3	PAGE: 1 OF 1
REFERENCE: Q.703 § 8 STD: Fig. 10	
TITLE: Processor outage control	
SUB TITLE: Clear LPO when "Both processor outage"	
PURPOSE: To test the response to LPO, RPO recovered when "Both processor outage"	
PRE-TEST CONDITIONS: PO set at A and B	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

```
          SP    B                                              SP    A

 Link                                                  Link

                        <-------------------------     1 – 0       SIPO
 1 – 0      SIPO        ------------------------->

                                                                 : clear LPO
                        <-------------------------     1 – 0       FISU

          : clear LPO
 1 – 0      FISU        ------------------------->
                        <-------------------------     1 – 0       FISU
```

TEST DESCRIPTION

1.	Clear LPO at A.
2.	Clear LPO at B.
3.	Check is FISU sent from A.

TEST NUMBER: 5.1	PAGE: 1 OF 1
REFERENCE: Q.703 § 4.1 STD: Fig. 11	
TITLE: SU delimitation, alignment, error detection and correction	
SUB TITLE: More than seven '1's between MSU opening and closing flags	
PURPOSE: To test the signal unit delimitation, alignment, and error detection action on receipt of an MSU containing seven or more consecutive '1's	
PRE-TEST CONDITIONS: Link in service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

Link	SP B		Link	SP A
		<-------------------------	1 – 0	FISU
1 – 0	FISU	------------------------->		
1 – 0	corrupt MSU (FIB + FSN = 80) (containing seven consecutive '1's)	------------------------->		
		<-------------------------	1 – 0	FISU (BSN unchanged)
1 – 0	FISU	------------------------->		

TEST DESCRIPTION

1. Send a corrupt MSU at B containing seven consecutive '1's.
2. Check that A discards the signal unit, and goes into octet counting mode.
3. On reception of a correct FISU, check that A leaves the octet counting mode and remains in the "in service" state.

TEST NUMBER: 5.2	PAGE: 1 OF 1
REFERENCE: Q.703 § 4.1 STD: Fig. 11	
TITLE: SU delimitation, alignment, error detection and correction	
SUB TITLE: Greater than maximum signal unit length	
PURPOSE: To test the signal unit delimitation, alignment, error detection action on receipt of signal unit greater than the maximum length	
PRE-TEST CONDITIONS: Link in service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

	SP B			SP A
Link			Link	
		<-------------------------	1 – 0	FISU
1 – 0	FISU	------------------------->		
1 – 0	corrupt MSU (FIB + FSN = 80) (signal unit length > max. allowed)	------------------------->		
		<-------------------------	1 – 0	FISU (BSN unchanged)
1 – 0	FISU	------------------------->		

TEST DESCRIPTION

1.	Send corrupt MSU at B with maximum length plus extra bits and good sumcheck.
2.	Check A discards the signal unit, and goes into octet counting mode.
3.	On reception of a correct FISU, check that A leaves the octet counting mode and remains in the "in service" state.

TEST NUMBER: 5.3	PAGE: 1 OF 1
REFERENCE: Q.703 § 4.1 STD: Fig. 11	
TITLE: SU delimitation, alignment, error detection and correction	
SUB TITLE: Below minimum signal unit length	
PURPOSE: To test the signal unit delimitation, alignment and error detection action on receipt of signal unit less than the minimum length	
PRE-TEST CONDITIONS: Link in service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

Link	SP B		Link	SP A
		<-------------------------	1 – 0	FISU (BIB + BSN = FF)
1 – 0	FISU	------------------------->		
1 – 0	corrupt MSU (FIB + FSN = 80) (signal unit less than 6 octets)	------------------------->		
		<-------------------------	1 – 0	FISU (BSN unchanged)
1 – 0	FISU	------------------------->		

TEST DESCRIPTION

1.	Generate a corrupt MSU at B of less than 6 octets (i.e. less than 5 octets between flags).
2.	Check A discards the signal unit, and goes into octet counting mode.
3.	On reception of a correct FISU, check that A leaves the octet counting mode and remains in the "in service" state.

TEST NUMBER: 5.4	PAGE: 1 OF 1
REFERENCE: Q.703 § 2 STD: Fig. 11	
TITLE: SU delimitation, alignment, error detection and correction	
SUB TITLE: Reception of single and multiple flags between FISUs	
PURPOSE: To check that single and multiple flags between FISUs can be received	
PRE-TEST CONDITIONS: Link in service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

```
           SP   B                                          SP   A

 Link                                              Link

 1 - 0     FISU            ------------------------>

           case 1              FISU F FISU

           case 2             FISU F F FISU                     F: Flag
                                 n(≥2)                     n = number of flags

 1 - 0     FISU            ------------------------>
```

TEST DESCRIPTION

1.	Check that single and n flags, case 1 and case 2 respectively, can be received.

TEST NUMBER: 5.5	PAGE: 1 OF 1
REFERENCE: Q.703 § 2 STD: Fig. 11	
TITLE: SU delimitation, alignment, error detection and correction	
SUB TITLE: Reception of single and multiple flags between MSUs	
PURPOSE: To check that single and multiple flags between MSUs can be received	
PRE-TEST CONDITIONS: Link in service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

	SP B		SP A
Link			Link
1 − 0	FISU	------------------------->	
	case 1	$\boxed{\text{MSU F MSU}}$	
	case 2	$\boxed{\text{MSU F F MSU}}$	F: Flag
		n(⩾2)	n = number of flags
1 − 0	FISU	------------------------->	

TEST DESCRIPTION

1.	Check that single and n flags, case 1 and case 2 respectively, can be received.

TEST NUMBER: 6.1	PAGE: 1 OF 1
REFERENCE: Q.703 § 10.2 STD: Fig. 11, Fig. 18, Fig. 8	
TITLE: SUERM check	
SUB TITLE: Error rate of 1 in 256 – Link remains in service	
PURPOSE: To check the SUERM at a link error rate of 1 in 256 units	
PRE-TEST CONDITIONS: Link in service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

	SP B			SP A
Link			Link	
		<-------------------------	1 – 0	FISU
1 – 0	FISU	------------------------->		
Ct	: corrupt 1 in 256			

TEST DESCRIPTION

1. Check that "In service" state is maintained. The test should run for several minutes.

2. Ct = the count of corrupted FISUs.

   Note – 1)The number *(x)* of corrupt signal units before an SIOS returned is calculated according to the following formula (a = number of correct signal units):

$$x = \frac{1}{1 + a} \left(\frac{256 \text{ x } 64}{\frac{256}{1 + a} - 1} \right) \text{ for } a < 256$$

   2)In this case as $a = 255$, so $x =$ infinity.

TEST NUMBER: 6.2	PAGE: 1 OF 1
REFERENCE: Q.703 § 10.2 STD: Fig. 11, Fig. 18, Fig. 8	
TITLE: SUERM check	
SUB TITLE: Error rate of 1 in 254 – Link out of service	
PURPOSE: To check the SUERM at a link error rate of 1 in 254 units	
PRE-TEST CONDITIONS: Link in service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

SP B			SP A	
Link			Link	
		<-------------------------	1 – 0	FISU
1 – 0	FISU	------------------------->		
Ct	: corrupt 1 in 254			
		<-------------------------	1 – 0	SIOS

TEST DESCRIPTION

1. SIOS should be returned after approx. 8192 corrupt FISUs (eg. CRC error).
2. Ct = the count of corrupted FISUs.

TEST NUMBER: 6.3	PAGE: 1 OF 1
REFERENCE: Q.703 § 10.2 STD: Fig. 11, Fig. 18, Fig. 8	
TITLE: SUERM check	
SUB TITLE: Consecutive corrupted SUs	
PURPOSE: To test the SUERM on consecutive corrupted signal units	
PRE-TEST CONDITIONS: Link in service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

Link	SP B		Link	SP A
		<-------------------------	1 – 0	FISU
1 – 0	FISU	------------------------->		
Ct	: corrupt 1 in 1			
		<-------------------------	1 – 0	SIOS

TEST DESCRIPTION

1.	SIOS should be returned after approx. 64 corrupt FISUs (eg. CRC error).
2.	Ct = the count of corrupted FISUs.

TEST NUMBER: 6.4	PAGE: 1 OF 1
REFERENCE: Q.703 § 10.2 STD: Fig. 11, Fig. 18	
TITLE: SUERM check	
SUB TITLE: Time controlled break of the link	
PURPOSE: To check response to a range of time controlled breaks of Tx or Rx	
PRE-TEST CONDITIONS: Link in service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

```
                SP   B                                                   SP   A

   Link                                                        Link

                              <-------------------------       1 - 0     FISU
   1 - 0        FISU          ------------------------->
                : break Tx

                : restore Tx
                FISU          ------------------------->
                              <-------------------------       1 - 0     FISU
```

TEST DESCRIPTION

1.	Break the transmission link, and restore before level 2 goes out of service. (Break time is less than approx. 128ms for 64 kbit/s).
2.	Check that A enters and leaves the octet counting mode on reception of an FISU.

TEST NUMBER: 7.1	PAGE: 1 OF 1
REFERENCE: Q.703 § 10.3 STD: Fig. 9, Fig. 11, Fig. 17	
TITLE: AERM check	
SUB TITLE: Error rate below the normal threshold	
PURPOSE: To test the AERM on error rates below the normal threshold	
PRE-TEST CONDITIONS: Link out of service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

```
              SP    B                                                   SP    A

  Link                                                   Link

                          <-------------------------     1 - 0      SIOS
  1 - 0       SIOS        ------------------------->

                                                                    : start
                          <-------------------------     1 - 0      SIO
  1 - 0       SIO         ------------------------->
                          <-------------------------     1 - 0      SIN
  1 - 0       SIN         ------------------------->                  |
  1 - 0       corrupt LSSUs ----------------------->                  |  T4
                                                                      |
  1 - 0       SIN         ------------------------->                FISU
                          <-------------------------     1 - 0
```

TEST DESCRIPTION

1.	Start link at A.
2.	Generate x number of corrupt LSSUs (e.g. CRC error) at B.(x < Tin).
3.	Check that the proving period continues and the link aligns successfully.

TEST NUMBER: 7.2	PAGE: 1 OF 1
REFERENCE: Q.703 § 10.3 STD: Fig. 9, Fig. 11, Fig. 17	
TITLE: AERM check	
SUB TITLE: Error rate at the normal threshold	
PURPOSE: To test the AERM at an error rate equal to the normal threshold	
PRE-TEST CONDITIONS: Link out of service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

SP B Link			SP A Link	
		<-------------------------	1 – 0	SIOS
1 – 0	SIOS	------------------------->		
				: start
		<-------------------------	1 – 0	SIO
1 – 0	SIO	------------------------->		
		<-------------------------	1 – 0	SIN
1 – 0	SIN	------------------------->		
1 – 0	corrupt LSSUs	------------------------->		
	SIN	------------------------->		T4
		<-------------------------	1 – 0	FISU

TEST DESCRIPTION

1. Start link at A.
2. Generate x number of corrupt LSSUs (e.g. CRC error) at B.(x ⩾ Tin).
3. Check that the proving period is aborted, then restarted and link aligns successfully.

TEST NUMBER: 7.3	PAGE: 1 OF 1
REFERENCE: Q.703 § 10.3 STD: Fig. 9, Fig. 11, Fig. 17	
TITLE: AERM check	
SUB TITLE: Error rate above the normal threshold	
PURPOSE: To test the AERM at an error rate above the threshold over five proving periods	
PRE-TEST CONDITIONS: Link out of service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

Link	SP B		Link	SP A
		<-------------------------	1 – 0	SIOS
1 – 0	SIOS	------------------------->		
				: start
		<-------------------------	1 – 0	SIO
1 – 0	SIO	------------------------->		
		<-------------------------	1 – 0	SIN
1 – 0	SIN	------------------------->		
1 – 0	corrupt LSSUs	------------------------->		
		<-------------------------	1 – 0	SIN
1 – 0	SIN	------------------------->		
1 – 0	corrupt LSSUs	------------------------->		
		<-------------------------	1 – 0	SIN
1 – 0	SIN	------------------------->		
1 – 0	corrupt LSSUs	------------------------->		
		<-------------------------	1 – 0	SIN
1 – 0	SIN	------------------------->		
1 – 0	corrupt LSSUs	------------------------->		
		<-------------------------	1 – 0	SIN
1 – 0	SIN	------------------------->		
1 – 0	corrupt LSSUs	------------------------->		
		<-------------------------	1 – 0	SIOS

TEST DESCRIPTION

1.	Start link at A.
2.	Generate x number of corrupt LSSUs (e.g. CRC error) at B.(x $\geqslant$ Tin).
3.	Observe that 5 proving period attempts are made before link out of service state.

TEST NUMBER: 7.4	PAGE: 1 OF 1
REFERENCE: Q.703 § 10.3 STD: Fig. 9, Fig. 11, Fig. 17	
TITLE: AERM check	
SUB TITLE: Error rate at the emergency threshold	
PURPOSE: To test the AERM at the emergency threshold	
PRE-TEST CONDITIONS: Link out of service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

Link	SP B		Link	SP A
		<-------------------------	1 – 0	SIOS
1 – 0	SIOS	------------------------->		
				: start
		<-------------------------	1 – 0	SIO
1 – 0	SIO	------------------------->		
		<-------------------------	1 – 0	SIN
1 – 0	SIE	------------------------->		
1 – 0	corrupt LSSU	------------------------->		
1 – 0	SIE	------------------------->		
T4 (Pe)		<-------------------------	1 – 0	SIN
		<-------------------------	1 – 0	FISU

TEST DESCRIPTION

1. Start link at A, check emergency proving started from B.
2. Generate x number of corrupt LSSUs (e.g. CRC error) at B. (5 > x ⩾ Tie).
3. Check that link aligns successfully.

TEST NUMBER: 8.1	PAGE: 1 OF 1
REFERENCE: Q.703 § 5.2 STD: Fig. 13, Fig. 14	
TITLE: Transmission and reception control (Basic)	
SUB TITLE: MSU transmission and reception	
PURPOSE: To check basic MSU transmission and reception	
PRE-TEST CONDITIONS: Link in service	
CONFIGURATION: 1	TYPE OF TEST: VAT, CPT

EXPECTED SIGNAL UNIT SEQUENCE:

Link	SP B		Link	SP A
		<------------------------	1 – 0	FISU
1 – 0	FISU	------------------------>		
1 – 0	MSU (FIB + FSN = 80) (BIB + BSN = FF)	------------------------>		
		<------------------------	1 – 0	FISU (FIB + FSN = FF) (BIB + BSN = 80)
1 – 0	FISU (FIB + FSN = 80) (BIB + BSN = FF)	------------------------>		
		<------------------------	1 – 0	MSU (FIB + FSN = 80) (BIB + BSN = 80)
1 – 0	FISU (FIB + FSN = 80) (BIB + BSN = 80)	------------------------>		
		<------------------------	1 – 0	FISU (FIB + FSN = 80) (BIB + BSN = 80)

TEST DESCRIPTION

1.	Generate an MSU at B.
2.	Check that A receives the MSU correctly, and returns a positive acknowledgement.
3.	Generate an MSU at A.
4.	Check that B receives the MSU correctly, and returns a positive acknowledgement.

TEST NUMBER: 8.2	PAGE: 1 OF 1
REFERENCE: Q.703 § 5.3 STD: Fig. 13	
TITLE: Transmission and reception control (Basic)	
SUB TITLE: Negative acknowledgement of an MSU	
PURPOSE: To test the response to a negatively acknowledged MSU	
PRE-TEST CONDITIONS: Link in service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

Link	SP B		Link	SP A
		<------------------------	1 – 0	FISU
1 – 0	FISU	------------------------>		
		<------------------------	1 – 0	MSU (FIB + FSN = 80)
		<------------------------	1 – 0	MSU (FIB + FSN = 81)
1 – 0	FISU (BIB + BSN = 7F)	------------------------>		
		<------------------------	1 – 0	MSU (FIB + FSN = 00)
		<------------------------	1 – 0	MSU (FIB + FSN = 01)

TEST DESCRIPTION

1.	Send MSU from A.
2.	Reply with negative acknowledgement from B.
3.	Check that A retransmits the MSU.

TEST NUMBER: 8.3	PAGE: 1 OF 1
REFERENCE: Q.703 § 5.3 STD: Fig. 13	
TITLE: Transmission and reception control (Basic)	
SUB TITLE: Check RTB full	
PURPOSE: To check that MSUs are buffered when no acknowledgements are received	
PRE-TEST CONDITIONS: Link in service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

Link	SP B		Link	SP A
		<-------------------------	1 – 0	FISU
1 – 0	FISU (BIB + BSN = FF)	------------------------->		
		<-------------------------	1 – 0	MSU (FIB + FSN = 80) ● ●
		<-------------------------	1 – 0	MSU (FIB + FSN = FE)
		<-------------------------	1 – 0	FISU (FIB + FSN = FE)
1 – 0	FISU (BIB + BSN = 7F)	------------------------->		
		<-------------------------	1 – 0	MSU (FIB + FSN = 00) ● ●
		<-------------------------	1 – 0	MSU (FIB + FSN = 7E)

TEST DESCRIPTION

1.	Generate MSUs at A, at a rate of 100 per second, in order to fill the RTB before the EDA timer T7 expires.
2.	No acknowledgements are sent from B until the last message is received, then send negative acknowledgement to the first message received.
3.	Check that the complete contents of the RTB are retransmitted.

TEST NUMBER: 8.4	PAGE: 1 OF 1
REFERENCE: Q.703 § 5.2 STD: Fig. 14	
TITLE: Transmission and reception control (Basic)	
SUB TITLE: Single MSU with erroneous FIB	
PURPOSE: To ensure correct performance when an MSU with erroneous FIB is received	
PRE-TEST CONDITIONS: Link in service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

Link	SP B		Link	SP A
		<-------------------------	1 – 0	FISU (BIB + BSN = 7F)
1 – 0	FISU (FIB + FSN = 7F)	------------------------->		
1 – 0	MSU (FIB + FSN = 80)	------------------------->		
		<-------------------------	1 – 0	FISU (BIB + BSN = 7F)
1 – 0	FISU (FIB + FSN = 00)	------------------------->		
1 – 0	FISU (FIB + FSN = 00)	------------------------->		
		<-------------------------	1 – 0	FISU (BIB + BSN = FF)
1 – 0	MSU (FIB + FSN = 80)	------------------------->		
		<-------------------------	1 – 0	FISU (BIB + BSN = 80)

TEST DESCRIPTION

1.	Generate an MSU at B with FIB inverted.
2.	Check A discards the MSU.
3.	Generate 2 FISUs at B with correct FIB.
4.	Check A discards the FISU and negative acknowledgement returned.
5.	Check that B retransmits the MSU correctly, and positive acknowledgement returned.

TEST NUMBER: 8.5	PAGE: 1 OF 1
REFERENCE: Q.703 § 5.2 STD: Fig. 14	
TITLE: Transmission and reception control (Basic)	
SUB TITLE: Duplicated FSN	
PURPOSE: To test the reception control response to duplicated FSNs	
PRE-TEST CONDITIONS: Link in service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

Link	SP B		Link	SP A
		<------------------------	1 – 0	FISU
1 – 0	FISU	------------------------>		
1 – 0	MSU (FIB + FSN = 80)	------------------------>		
		<------------------------	1 – 0	FISU (BIB + BSN = 80)
1 – 0	MSU (FIB + FSN = 80)	------------------------>		
1 – 0	FISU (FIB + FSN = 81)	------------------------>		
		<------------------------	1 – 0	FISU (BIB + BSN = 00)
1 – 0	MSU (FIB + FSN = 01)	------------------------>		
		<------------------------	1 – 0	FISU (BIB + BSN = 01)

TEST DESCRIPTION

1.	Generate an MSU at B, check A receives the MSU correctly and returns a positive acknowledgement.
2.	Duplicate the FSN at B, check that A responds with a negative acknowledgement.
3.	Retransmit the MSU with correct FSN, check that A replies with a positive acknowledgement.

TEST NUMBER: 8.6	PAGE: 1 OF 1
REFERENCE: Q.703 § 5.2 STD: Fig. 14	
TITLE: Transmission and reception control (Basic)	
SUB TITLE: Erroneous retransmission – Single MSU	
PURPOSE: To test the reception control response to retransmission of a single MSU	
PRE-TEST CONDITIONS: Link in service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

Link	SP B		Link	SP A
		<-------------------------	1 – 0	FISU (BIB + BSN = FF)
1 – 0	FISU (FIB + FSN = FF)	------------------------->		
1 – 0	MSU (FIB + FSN = 00)	------------------------->		
1 – 0	FISU (FIB + FSN = 80)	------------------------->		
1 – 0	FISU (FIB + FSN = 80)	------------------------->		
		<-------------------------	1 – 0	FISU (BIB + BSN = 7F)
1 – 0	MSU (FIB + FSN = 00)	------------------------->		
		<-------------------------	1 – 0	FISU (BIB + BSN = 00)

TEST DESCRIPTION

1. A single MSU with FIB inverted in error is sent to A, followed by FISUs with correct FIBs.
2. Check that A returns a negative acknowledgement for the MSU.
3. Retransmit the MSU correctly.
4. Check that A receives the MSU correctly and returns a positive acknowledgement.

TEST NUMBER: 8.7	PAGE: 1 OF 1
REFERENCE: Q.703 § 5.3 STD: Fig. 14	
TITLE: Transmission and reception control (Basic)	
SUB TITLE: Erroneous retransmission – Multiple FISUs	
PURPOSE: To test reception control response to retransmissions of multiple FISUs	
PRE-TEST CONDITIONS: Link in service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

SP B			SP A	
Link			Link	
		<-------------------------	1 – 0	FISU
1 – 0	FISU (FIB+FSN=FF)	------------------------->		
1 – 0	FISU (FIB+FSN=7F)	------------------------->		
1 – 0	FISU (FIB+FSN=FF)	------------------------->		
1 – 0	FISU (FIB+FSN=7F)	------------------------->		
		<-------------------------	1 – 0	SIOS

TEST DESCRIPTION

1. Generate FISUs with the FIB inverted at B.
2. Check that A responds with link out of service.

TEST NUMBER: 8.8	PAGE: 1 OF 1
REFERENCE: Q.703 § 5.3 STD: Fig. 14	
TITLE: Transmission and reception control (Basic)	
SUB TITLE: Single FISU with corrupt FIB	
PURPOSE: To test the response to receive an FISU with a corrupt FIB	
PRE-TEST CONDITIONS: Link in service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

SP B			SP A	
Link			Link	
		<-------------------------	1 – 0	FISU
1 – 0	FISU (FIB+FSN=FF)	------------------------->		
1 – 0	FISU (FIB+FSN=7F)	------------------------->		
		<-------------------------	1 – 0	FISU
1 – 0	FISU (FIB+FSN=FF)	------------------------->		
		<-------------------------	1 – 0	FISU

TEST DESCRIPTION

1.	Generate one FISU with a corrupt FIB at B, and check that the link status remains in service.

TEST NUMBER: 8.9	PAGE: 1 OF 1
REFERENCE: Q.703 § 5.2 STD: Fig. 10, Fig. 14	
TITLE: Transmission and reception control (Basic)	
SUB TITLE: Single FISU prior to RPO being set	
PURPOSE: To test the response to RPO while in the abnormal FIB state	
PRE-TEST CONDITIONS: Link in service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

Link	SP B		Link	SP A
		<-------------------------	1 – 0	FISU
1 – 0	FISU	------------------------->		
1 – 0	FISU (one only) (FIB + FSN = 7F)	------------------------->		
1 – 0	SIPO	------------------------->		
1 – 0	MSU (FIB + FSN = 80)	------------------------->		
1 – 0	FISU (FIB + FSN = 80)	-------------------------> [a]		
1 – 0	FISU (FIB + FSN = 80)	------------------------->		
		<-------------------------	1 – 0	FISU (BIB + BSN = 7F)
1 – 0	MSU (FIB + FSN = 00)	------------------------->		
		<-------------------------	1 – 0	FISU (BIB + BSN = 00)

[a] RPO at A has recovered, but this FISU is discarded.

TEST DESCRIPTION

1.	Generate one FISU at B with abnormal FIB.
2.	Send SIPO from B, followed by an MSU.
3.	Check A responds correctly with negative acknowledgement and a retransmission is received corrrectly.

TEST NUMBER: 8.10	PAGE: 1 OF 1
REFERENCE: Q.703 § 5.3 STD: Fig. 14	
TITLE: Transmission and reception control (Basic)	
SUB TITLE: Abnormal BSN – single MSU	
PURPOSE: To test the response to an abnormal BSN	
PRE-TEST CONDITIONS: Link in service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

Link	SP B		Link	SP A
		<-------------------------	1 – 0	FISU
1 – 0	FISU (FIB + FSN = FF) (BIB + BSN = FF)	------------------------->		
1 – 0	MSU (FIB + FSN = 80) (BIB + BSN = BF)	------------------------->		
1 – 0	FISU (FIB + FSN = 80) (BIB + BSN = FF)	-------------------------> [a]		
1 – 0	FISU (FIB + FSN = 80) (BIB + BSN = FF)	------------------------->		
		<-------------------------	1 – 0	FISU (BIB + BSN = 7F)
1 – 0	MSU (FIB + FSN = 00) (BIB + BSN = FF)	------------------------->		
		<-------------------------	1 – 0	FISU (BIB + BSN = 00)

[a] Though UNB: = 1, abnormal BSNR is not canceled.

TEST DESCRIPTION

1.	Generate a single MSU with abnormal BSN at B, followed by FISUs with correct BSN.
2.	Check that A responds with a negative acknowledgement.
3.	Retransmit the MSU correctly at B.
4.	Check that the MSU is received correctly and positive acknowledgement is given.

TEST NUMBER: 8.11	PAGE: 1 OF 1
REFERENCE: Q.703 § 5.3 STD: Fig. 14	
TITLE: Transmission and reception control (Basic)	
SUB TITLE: Abnormal BSN – two consecutive FISUs	
PURPOSE: To test the response to abnormal BSNs in two consecutive FISUs	
PRE-TEST CONDITIONS: Link in service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

Link	SP B		Link	SP A
		<-------------------------	1 – 0	FISU
1 – 0	FISU (BIB + BSN = FF)	------------------------->		
1 – 0	FISU (BIB + BSN = BF)	------------------------->		
1 – 0	FISU (BIB + BSN = BF)	------------------------->		
1 – 0	FISU (BIB + BSN = FF)	------------------------->		
		<-------------------------	1 – 0	SIOS

TEST DESCRIPTION

1.	Generate two consecutive FISUs at B with abnormal BSNs.
2.	Check that A responds by taking the link out of service.

TEST NUMBER: 8.12	PAGE: 1 OF 1
REFERENCE: Q.703 § 5.3 STD: Fig. 14	
TITLE: Transmission and reception control (Basic)	
SUB TITLE: Excesssive delay of acknowledgement	
PURPOSE: To test the transmission control response to the expiration of EDA timer T7	
PRE-TEST CONDITIONS: Link in service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

SP B Link			SP A Link		
		<------------------------	1 – 0		FISU
1 – 0	FISU (BIB + BSN = FF)	------------------------>			
		<------------------------	1 – 0	T7	MSU (FIB + FSN = 80)
		<------------------------	1 – 0		SIOS

TEST DESCRIPTION

1. Generate an MSU at A.
2. Discard the received MSU at B and send no acknowledgement to A for more than T7 period.
3. Check that the link is taken out of service by SIOS generated at A after T7 has expired.
4. Timer T7 shall be in the range 0.5 secs to 2.0 secs.

TEST NUMBER: 8.13	PAGE: 1 OF 1
REFERENCE: Q.703 § 7 STD: Fig. 14	
TITLE: Transmission and reception control (Basic)	
SUB TITLE: Level 3 Stop command	
PURPOSE: To test the response to a Stop command	
PRE-TEST CONDITIONS: Link in service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

SP B			SP A	
Link			Link	
		<-------------------------	1 – 0	FISU
1 – 0	FISU	------------------------->		
				: stop
		<-------------------------	1 – 0	SIOS

TEST DESCRIPTION

1. Give Stop command at A.
2. Check that A responds with link out of service.

TEST NUMBER: 9.1	PAGE: 1 OF 1
REFERENCE: Q.703 § 6.2 STD: Fig. 15, Fig. 16	
TITLE: Transmission and reception control (PCR)	
SUB TITLE: MSU transmission and reception	
PURPOSE: To check basic MSU transmission and reception	
PRE-TEST CONDITIONS: Link in service	
CONFIGURATION: 1	TYPE OF TEST: VAT, CPT

EXPECTED SIGNAL UNIT SEQUENCE:

SP B Link			SP A Link	
		<-------------------------	1 – 0	FISU (FSN=7F, BSN=7F)
1 – 0	FISU (FSN=7F, BSN=7F)	------------------------->		
		<-------------------------	1 – 0	MSU (FSN=0, BSN=7F)
		<-------------------------	1 – 0	MSU (FSN=0, BSN=7F) ● ●
1 – 0	FISU (FSN=7F, BSN=0)	------------------------->		
		<-------------------------	1 – 0	FISU (FSN=0, BSN=7F)
1 – 0	MSU (FSN=0, BSN=0)	------------------------->		
		<-------------------------	1 – 0	FISU (FSN=0, BSN=0)

TEST DESCRIPTION

1. Generate an MSU at A.
2. Check that B receives the MSU correctly.
3. Check that A sends FISUs after receiving an FISU with a positive acknowledgement.
4. Generate an MSU at B.
5. Check that A receives the MSU correctly and returns a positive acknowledgement.

TEST NUMBER: 9.2	PAGE: 1 OF 1
REFERENCE: Q.703 § 6.3 STD: Fig. 15, Fig. 16	
TITLE: Transmission and reception control (PCR)	
SUB TITLE: Priority control	
PURPOSE: To check the preventive retransmission procedure	
PRE-TEST CONDITIONS: Link in service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

Link	SP B		Link	SP A
		<------------------------	1 – 0	FISU (FSN = 7F, BSN = 7F)
1 – 0	FISU (FSN = 7F, BSN = 7F)	------------------------>		
		<------------------------	1 – 0	MSU (FSN = 0, BSN = 7F)
		<------------------------	1 – 0	MSU (FSN = 1, BSN = 7F)
				●
				●
		<------------------------	1 – 0	MSU (FSN = 2, BSN = 7F)
				●
				●
		<------------------------	1 – 0	MSU (FSN = 0, BSN = 7F)
		<------------------------	1 – 0	MSU (FSN = 1, BSN = 7F)
		<------------------------	1 – 0	MSU (FSN = 2, BSN = 7F)
				●
				●
1 – 0	FISU (FSN = 7F, BSN = 0)	------------------------>		
1 – 0	FISU (FSN = 7F, BSN = 1)	------------------------>		
1 – 0	FISU (FSN = 7F, BSN = 2)	------------------------>		
		<------------------------	1 – 0	FISU (FSN = 2, BSN = 7F)

TEST DESCRIPTION

1. Generate two MSUs at A.
2. No positive acknowledgement is sent from B.
3. Check that MSUs are retransmitted at A.
4. Generate another MSU at A.
5. Check that B receives MSUs correctly.
6. Reply with positive acknowledgements at B.
7. Check that A stops retransmission after receiving the positive acknowledgement for the last MSU in RTB and sends FISU.

TEST NUMBER: 9.3	PAGE: 1 OF 1
REFERENCE: Q.703 § 6.4 STD: Fig. 15	
TITLE: Transmission and reception control (PCR)	
SUB TITLE: Forced retransmission with the value N_1	
PURPOSE: To check that "RTB full" is detected by N_1 and forced retransmission occurs	
PRE-TEST CONDITIONS: Link in service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

Link	SP B		Link	SP A
		<------------------------	1 – 0	FISU (FSN = 7F, BSN = 7F)
1 – 0	FISU (FSN = 7F, BSN = 7F)	------------------------>		
		<------------------------	1 – 0	MSU (FSN = 0, BSN = 7F) ● ●
		<------------------------	1 – 0	MSU (FSN = 7E, BSN = 7F)
		<------------------------	1 – 0	MSU (FSN = 0, BSN = 7F) ● ●
		<------------------------	1 – 0	MSU (FSN = X, BSN = 7F)
1 – 0	FISU (FSN = 7F, BSN = 0)	------------------------>		
		<------------------------	1 – 0	MSU (FSN = X + 1, BSN = 7F) ● ●
		<------------------------	1 – 0	MSU (FSN = 7F, BSN = 7F)

TEST DESCRIPTION

1. Generate 128 MSUs at A, at a rate of 100 per second, in order to fill the RTB before the EDA timer T7 expires.
2. No positive acknowledgement is sent from B until a forced retransmission starts at A.
3. Reply with a positive acknowledgement with BSN = 0 before T7 expires at A.
4. Check that the forced retransmission is canceled after the transmission of the last MSU in RTB.

Note – N_1 is the maximum number of MSUs which are available for retransmission.
(The value of N_1 is normally 127).

TEST NUMBER: 9.4	PAGE: 1 OF 1
REFERENCE: Q.703 § 6.4 STD: Fig. 15	
TITLE: Transmission and reception control (PCR)	
SUB TITLE: Forced retransmission with the value N_2	
PURPOSE: To check that "RTB full" is detected by N_2 and forced retransmission starts	
PRE-TEST CONDITIONS: Link in service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

Link	SP B		Link	SP A
		<-------------------------	1 – 0	FISU (FSN = 7F, BSN = 7F)
1 – 0	FISU (FSN = 7F, BSN = 7F)	------------------------->		
		<-------------------------	1 – 0	MSU (FSN = 0, BSN = 7F) ● ●
		<-------------------------	1 – 0	MSU (FSN = N – 1, BSN = 7F)
		<-------------------------	1 – 0	MSU (FSN = 0, BSN = 7F) ● ●
		<-------------------------	1 – 0	MSU (FSN = X, BSN = 7F)
1 – 0	FISU (FSN = 7F, BSN = a – 1)	------------------------->		
		<-------------------------	1 – 0	MSU (FSN = a, BSN = 7F)
		<-------------------------	1 – 0	MSU (FSN = N, BSN = 7F) (a > X)

TEST DESCRIPTION

1. Generate N + 1 MSUs at A, (the octet count of N MSUs is larger than N_2).
2. Send no positive acknowledgement at B until a forced retransmission starts at A.
3. Check that B receives the MSUs with FSN = 0 up to FSN = N – 1 but does not receive the MSU with FSN = N.
4. Reply with a positive acknowledgement with BSN = a – 1 at B.
5. Check that the retransmission restarts from the next value of FSN which is acknowledged by B when the retransmission is interrupted.
6. Check that B receives the MSU with FSN = N.

Note – N_2 is the maximum number of octets which are available for retransmission.

TEST NUMBER: 9.5	PAGE: 1 OF 1
REFERENCE: Q.703 § 6.4 STD: Fig. 15	
TITLE: Transmission and reception control (PCR)	
SUB TITLE: Forced retransmission cancel	
PURPOSE: To check that the forced retransmission is canceled when BSN equal to FSNL is received	
PRE-TEST CONDITIONS: Link in service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

Link	SP B		Link	SP A
		<-------------------------	1 – 0	FISU (FSN = 7F, BSN = 7F)
1 – 0	FISU (FSN = 7F, BSN = 7F)	------------------------>		
		<-------------------------	1 – 0	MSU (FSN = 0, BSN = 7F) ● ●
		<-------------------------	1 – 0	MSU (FSN = 7E, BSN = 7F)
		<-------------------------	1 – 0	MSU (FSN = 0, BSN = 7F) ● ●
		<-------------------------	1 – 0	MSU (FSN = X, BSN = 7F)
1 – 0	FISU (FSN = 7F, BSN = 7E)	------------------------>		
		<-------------------------	1 – 0	MSU (FSN = 7F, BSN = 7F)

TEST DESCRIPTION

1. Generate $N_1 + 1$ MSUs at A, (e.g. 128).
2. Send no positive acknowledgement at B until a retransmission occurs at A.
3. Reply with a positive acknowledgement with BSN = 7E at B.
4. Check that a forced retransmission is canceled and the MSU with FSN = 7F is sent at A.

Note 1 – FSNL is the FSN of the last MSU in RTB.

Note 2 – Alternatively, the number of octets threshold (N_2), instead of the number of MSUs threshold (N_1), could be used to start forced retransmission.

TEST NUMBER: 9.6	PAGE: 1 OF 1
REFERENCE: Q.703 § 6.4 STD: Fig. 15	
TITLE: Transmission and reception control (PCR)	
SUB TITLE: Repetition of forced retransmission	
PURPOSE: To check that the forced retransmission repeats when "RTB full" is still detected after finishing a forced retransmission	
PRE-TEST CONDITIONS: Link in service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

Link	SP B		Link	SP A
		<-------------------------	1 – 0	FISU (FSN = 7F, BSN = 7F)
1 – 0	FISU (FSN = 7F, BSN = 7F)	------------------------->		
		<-------------------------	1 – 0	MSU (FSN = 0, BSN = 7F) ● ●
		<-------------------------	1 – 0	MSU (FSN = 7E, BSN = 7F)
		<-------------------------	1 – 0	MSU (FSN = 0, BSN = 7F) ● ●
		<-------------------------	1 – 0	MSU (FSN = 7E, BSN = 7F)
		<-------------------------	1 – 0	MSU (FSN = 0, BSN = 7F) ●

TEST DESCRIPTION

1.	Generate MSUs at A at a rate of N per second, in order to make A repeat a forced retransmission. ($N \geqslant 127 \div T$, where T = lower limit of T7)
2.	No acknowledgement is sent from B.
3.	Check that A repeats a forced retransmission.

TEST NUMBER: 9.7	PAGE: 1 OF 1
REFERENCE: Q.703 § 6.2 STD: Fig. 15	
TITLE: Transmission and reception control (PCR)	
SUB TITLE: MSU transmission while RPO set	
PURPOSE: To ensure correct performance while RPO is set	
PRE-TEST CONDITIONS: Link in service	
CONFIGURATION:. 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

Link	SP B		Link	SP A
		<-------------------------	1 – 0	FISU (FSN = 7F, BSN = 7F)
1 – 0	FISU (FSN = 7F, BSN = 7F)	------------------------->		
		<-------------------------	1 – 0	MSU (FSN = 0, BSN = 7F) ● ●
1 – 0	: set LPO SIPO (FSN = 7F, BSN = 7F)	------------------------->		
		<-------------------------	1 – 0	FISU (FSN = 0, BSN = 7F) ● ●
1 – 0	: clear LPO MSU (FSN = 0, BSN = 7F)	------------------------->		
		<-------------------------	1 – 0	MSU (FSN = 0, BSN = 7F)
1 – 0	MSU (FSN = 0, BSN = 0)	------------------------->		
		<-------------------------	1 – 0	FISU (FSN = 0, BSN = 0)

TEST DESCRIPTION

1.	Generate an MSU at A.
2.	Instead of sending positive acknowledgement, set and keep PO at B.
3.	Check A stops a retransmission of the MSU and sends FISUs, and not detect link failure by the expiration of T7.
4.	Cease PO and send an MSU with no positive acknowledgement at B.
5.	Check A starts a retransmission of the MSU.
6.	Generate an MSU with a positive acknowledgement at B.
7.	Check A receives the MSU and responds correctly.

TEST NUMBER: 9.8	PAGE: 1 OF 1
REFERENCE: Q.703 § 6.3 STD: Fig. 16	
TITLE: Transmission and reception control (PCR)	
SUB TITLE: Abnormal BSN – Single MSU	
PURPOSE: To test the response to an abnormal BSN	
PRE-TEST CONDITIONS: Link in service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

Link	SP B		Link	SP A
		<-------------------------	1 – 0	FISU (FSN = 7F, BSN = 7F)
1 – 0	FISU (FSN = 7F, BSN = 7F)	------------------------>		
1 – 0	MSU (FSN = 0, BSN = 0)	------------------------>		
1 – 0	MSU (FSN = 0, BSN = 7F)	------------------------>		
1 – 0	MSU (FSN = 0, BSN = 7F)	------------------------>		
		<-------------------------	1 – 0	FISU (FSN = 7F, BSN = 0)

TEST DESCRIPTION

1.	Generate a single MSU at B with abnormal BSN followed by retransmission of that MSU with normal BSN.
2.	Check that A responds with a positive acknowledgement and not detect link failure.

TEST NUMBER: 9.9	PAGE: 1 OF 1
REFERENCE: Q.703 § 6.3 STD: Fig. 16	
TITLE: Transmission and reception control (PCR)	
SUB TITLE: Abnormal BSN – Two MSUs	
PURPOSE: To test the response to two consecutive MSUs with an MSU having normal BSN between them	
PRE-TEST CONDITIONS: Link in service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

Link	SP B		Link	SP A
		<-------------------------	1 – 0	FISU (FSN=7F, BSN=7F)
1 – 0	FISU (FSN=7F, BSN=7F)	------------------------->		
1 – 0	MSU (FSN=0, BSN=7E)	------------------------->		
1 – 0	MSU (FSN=0, BSN=7F)	------------------------->		
1 – 0	MSU (FSN=0, BSN=7E)	------------------------->		
		<-------------------------	1 – 0	SIOS (FSN=7F, BSN=7F)

TEST DESCRIPTION

1.	Generate two consecutive MSUs at B with abnormal BSN with an MSU having normal BSN between them.
2.	Check that all MSUs are discarded at A.
3.	Check that A responds by taking the link out of service.

TEST NUMBER: 9.10	PAGE: 1 OF 1
REFERENCE: Q.703 § 6.2 STD: Fig. 16	
TITLE: Transmission and reception control (PCR)	
SUB TITLE: Unexpected FSN	
PURPOSE: To check the reception control response to an MSU with unexpected FSN	
PRE-TEST CONDITIONS: Link in service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

Link	SP B		Link	SP A
		<------------------------	1 – 0	FISU (FSN = 7F, BSN = 7F)
1 – 0	FISU (FSN = 7F, BSN = 7F)	------------------------>		
1 – 0	MSU (FSN = 0, BSN = 7F)	------------------------>		
1 – 0	MSU (FSN = 2, BSN = 7F)	------------------------>		
		<------------------------	1 – 0	FISU (FSN = 7F, BSN = 0)

TEST DESCRIPTION

1.	Generate an MSU with unexpected FSN at B.
2.	Check A discards the MSU with unexpected FSN and not sends acknowledgement for that MSU.

TEST NUMBER: 9.11	PAGE: 1 OF 1
REFERENCE: Q.703 § 6.3 STD: Fig. 15	
TITLE: Transmission and reception control (PCR)	
SUB TITLE: Excessive delay of acknowledgement	
PURPOSE: To test the transmission control response to the expiration of EDA timer T7	
PRE-TEST CONDITIONS: Link in service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

SP B			SP A	
Link			Link	
		<------------------------	1 – 0	FISU (FSN=7F, BSN=7F)
1 – 0	FISU (FSN=7F, BSN=7F)	------------------------>		
		<------------------------	1 – 0	MSU (FSN=0, BSN=7F)
				T7 ● ● ●
		<------------------------	1 – 0	SIOS (FSN=0, BSN=7F)

TEST DESCRIPTION

1.	Generate an MSU at A.
2.	Suspend sending positive acknowledgement at B for more than T7 period.
3.	Check that A sends SIOSs instead of retransmission of MSU after T7 expires.
4.	Timer T7 shall be in the range 0.5 secs to 2.0 secs.

TEST NUMBER: 9.12	PAGE: 1 OF 1
REFERENCE: Q.703 § 6.2 STD: Fig. 16	
TITLE: Transmission and reception control (PCR)	
SUB TITLE: FISU with FSN expected for MSU	
PURPOSE: To check that the received FISU having FSN expected for MSU is discarded	
PRE-TEST CONDITIONS: Link in service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

SP B Link			SP A Link	
1 – 0	FISU (FSN = 7F, BSN = 7F)	------------------------>		
		<------------------------	1 – 0	FISU (FSN = 7F, BSN = 7F)
1 – 0	FISU (FSN = 0, BSN = 7F)	------------------------>		
		<------------------------	1 – 0	FISU (FSN = 7F, BSN = 7F)

TEST DESCRIPTION

1. Generate an FISU with FSN expected for MSU at B.
2. Check that A discards the FISU and responds with an FISU with correct BSN.

TEST NUMBER: 9.13	PAGE: 1 OF 1
REFERENCE: Q.703 § 7 STD: Fig. 16	
TITLE: Transmission and reception control (PCR)	
SUB TITLE: Level 3 Stop command	
PURPOSE: To test the response to a Stop command	
PRE-TEST CONDITIONS: Link in service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

	SP B			SP A
Link			Link	
		<-------------------------	1 – 0	FISU
1 – 0	FISU	------------------------>		
				: stop
		<-------------------------	1 – 0	SIOS

TEST DESCRIPTION

1.	Give Stop command at A.
2.	Check that A responds with link out of service.

TEST NUMBER: 10.1	PAGE: 1 OF 1
REFERENCE: Q.703 § 9 STD: Fig. 19	
TITLE: Congestion Control	
SUB TITLE: Congestion abatement	
PURPOSE: To check the congestion abatement procedure	
PRE-TEST CONDITIONS: Link in service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

```
            SP   B                                    SP   A

Link                                         Link

                                                      : make congestion
                                                        state
                  <------------------------   1 – 0   SIB
                                                  T5 |
                  <------------------------   1 – 0   SIB
                                                       ●
                                                       ●
                                                      : clear congestion
                                                        state
                  <------------------------   1 – 0   FISU
```

TEST DESCRIPTION

1.	Make congestion state at A and check A sends SIB. (Implementation of congestion control is not specified.)
2.	Check B receives SIBs at the interval of T5.
3.	Clear congestion state at A and check A stops sending SIBs.
4.	Timer T5 shall be in the range 80 ms to 120 ms.

TEST NUMBER: 10.2	PAGE: 1 OF 1
REFERENCE: Q.703 § 9.2 STD: Fig. 19	
TITLE: Congestion Control	
SUB TITLE: Timer T7	
PURPOSE: To check timer T7 is restarted at the reception of SIB (without expiring of T6)	
PRE-TEST CONDITIONS: Link in service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

Link	SP B			Link	SP A	
			<------------------------	1 – 0	MSU	
1 – 0	SIB	Ct	------------------------>			T6
1 – 0	SIB		------------------------>			
	●					
	●					
1 – 0	SIB	Bt	------------------------>			
1 – 0	FISU		------------------------>			

TEST DESCRIPTION

1. Generate an MSU at A.
2. Generate SIBs at B with the time intervals of T5 for Ct, instead of positive acknowledgement.
3. Check that link remains in service during Ct.
4. Send FISU with positive acknowledgement from B after Bt expires.
5. Check that link remains in service.
6. Ct = more than T7 and less than T6.
7. Bt = less than T7.
8. (Ct + Bt) is less than T6.

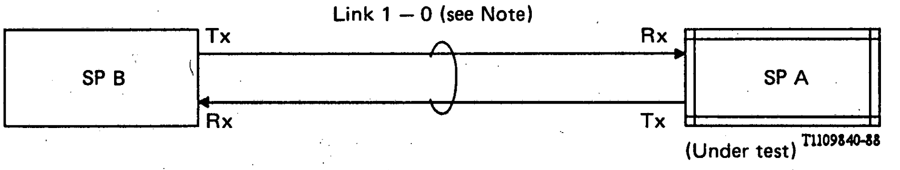
TEST NUMBER: 10.3	PAGE: 1 OF 1
REFERENCE: Q.703 § 9.3 STD: Fig. 19	
TITLE: Congestion Control	
SUB TITLE: Timer T6	
PURPOSE: To check “Remote Congestion” Timer T6	
PRE-TEST CONDITIONS: Link in service	
CONFIGURATION: 1	TYPE OF TEST: VAT

EXPECTED SIGNAL UNIT SEQUENCE:

Link	SP B		Link	SP A
1 – 0	SIB	------------------------->		
1 – 0	SIB	------------------------->		
	●			
	●			T6
1 – 0	SIB	------------------------->		
	●			
	●			
1 – 0	SIB	------------------------->		
		<-------------------------	1 – 0	SIOS

TEST DESCRIPTION

1. Generate SIB at B until Timer T6 expires.
2. Check link becomes out of service.
3. Timer T6 shall be in the range 3 secs to 6 secs (8 to 12 secs for 4.8 kbit/s).



Note — First digit: linkset number.
Second digit: link number.

FIGURE 1/Q.781

Test configuration of MTP level 2 test
Configuration 1

Recommendation Q.782

MTP LEVEL 3 TEST SPECIFICATION

1 Introduction

This Recommendation contains a set of detailed tests of signalling system No. 7 MTP level 3 protocol. These tests intend to validate the protocol specified in Q.704 and Q.707 Recommendations. The level 3 performance aspects specified in Q.706 Recommendation are also partly checked whenever possible. This Recommendation conforms to the Q.780 Recommendation. However, in addition to the objectives and guidelines of the latter Recommendation, other general principles specific to level 3 tests are presented below.

2 General principles of level 3 tests

2.1 *Presentation of test descriptions*

Each test description mentions the type of SP involved in the test. Three cases are possible:

- test applicable to an SP having no STP function: SP
- test applicable to an SP having STP function: STP
- test applicable to all types of SPs: ALL

Each test description includes the environment in which the point under test must be inserted in order to pass the test. Four test configurations are necessary (named A, B, C and D); they are presented in § 3.

Each test is precisely described. Nevertheless, some events not directly concerning the point under test, or without direct link with the test nature, are not explicitely described. This is, for example, the case of TFPs propagation when a point becomes isolated, or of the changeover procedure in a test concerning transfer allowed procedure.

In order to preserve the test description implementation independence, a certain flexibility has been left in the test descriptions. This is particularly the case when it is necessary to deactivate a link (where it is only mentioned "Deactivate" with no more precision). The operator will choose, according to the implementation particularities and the events expected in the test description, the appropriate deactivation means (MML, provoked failure, etc.).

In the test descriptions, the signalling links are identified as follows: "number of linkset" – "number of link in the linkset" (e.g. 1 – 1 means link 1 of the linkset 1). This identification is independent of SLC attributed to these links. When the number of the link is X, that means that the concerned message can use any link of the linkset. When the field "number of link in the linkset" is, for example, "1, 2, ...", that means that the traffic uses all indicated links. Finally, when the links are identified by the mention ALL, that means that the traffic will use all available links of the point.

The orders "Start traffic", "Wait" and "Stop traffic" apply to the test configuration. They are placed at the beginning of the line.

2.2 *Presentation of the test list*

These tests, as a whole, aim at a complete validation of the level 3 protocol without redundancies.

The test list is presented in § 4. The national options and the various signalling link management "policies" are not included in this Recommendation.

The first set of tests in the list checks that, before some more precise tests, the point under test can perform the basic functions, i.e. can connect itself to the external environment and exchange signalling messages.

The second set basically validates the signalling message handling function of the point under test. A main point of this part concerns the validation of load sharing procedures. If an implementation does not use the load sharing between linksets, some tests would not be applicable, and other should be adapted.

The third and fourth sets check changeover and changeback procedures. They include tests like changeover and changeback to/from two linksets which will be performed only if the point under tests allows this possibility.

Rerouting procedures are checked using the tests in parts 5 and 6.

Part 7 concerns tests to check inhibition and uninhibition procedures. To limit the test numbers, it was not considered that the messages used in these procedures can be transferred via STPs.

Part 8 concerns tests to check transfer controlled procedure and MTP user flow control for the international signalling network.

Part 9 concerns tests to check signalling route management functions in a point having an STP function. To limit the test numbers and to avoid to complicate the test configuration, it was not considered that TFPs and TFAs can be transferred via STPs.

Part 10 concerns tests for the point restart procedure.

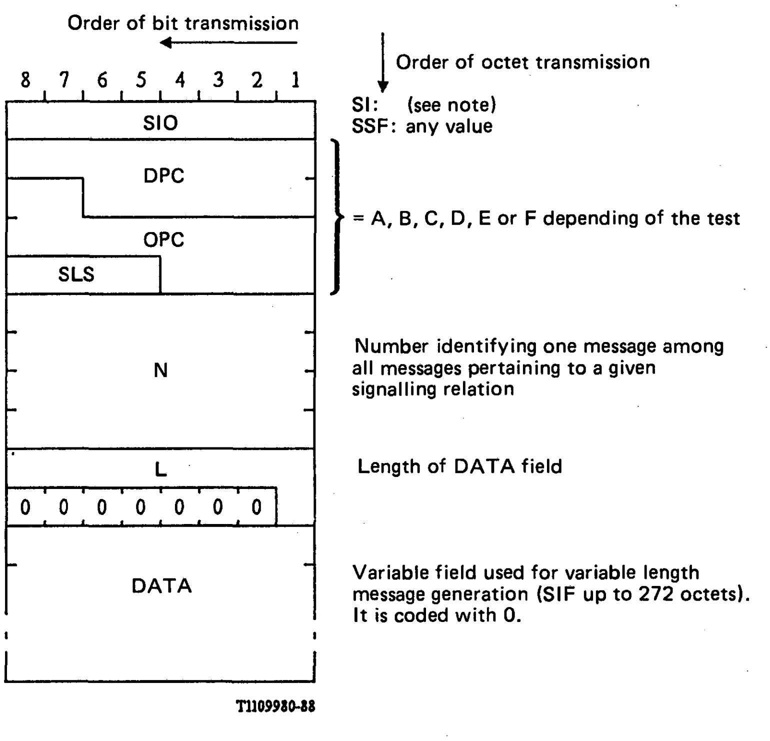
Part 11 deals with STP traffic test.

Part 12 checks the signalling link test procedure.

Finally, part 13 contains solely validation tests and aims at checking the actions of the tested system on reception of invalid level 3 messages.

2.3 *Test traffic*

Running the tests described in this Recommendation requires the exchange of traffic between the point under test and its environment. The traffic used is a test traffic especially generated for the test of the system. It uses variable length messages, structured as described below:



The mechanisms of generation and reception of this test traffic may be internal to the point under test or external (using a simulator for example). The tests presented here do not impose the choice of one of these mechanisms except for the tests of the STP function itself (tests 2.7, 8.2, 10 and 11) where the test traffic is necessarily generated outside the STP. The test traffic should be recorded and analysed subsequently for each described test.

Note – For compatibility testing (CPT), use SI value for MTP testing user part, for validation testing (VAT) value is to be chosen as required.

3 Test configurations

3.1 *Definition*

The set of tests described in this Recommendation assumes that the point under test is inserted in a test environment called "test configuration". A **test configuration** is defined as being:

a) the set of points, real or simulated, linked between them by signalling linksets, real or simulated, and of which some are connected to the point under test by one or several signalling linksets,

b) the set of routing rules applied in different points and also in point under test,

c) the flows of test traffic generated and received by:

d) a set of generation and reception means (see § 2.3),

e) the means (program, operator interface, etc.) to run the described tests; notably the possibilities of storage and analysis of test traffic and level 3 messages, and, in the case of validation tests, the possibility to send at any stage of a test, any messages (level 3 or test) valid or not.

3.2 *Presentation of test configurations*

3.2.1 *General*

The set of tests described in this Recommendation requires 4 different configurations named A, B, C and D. For each test, only the three first aspects of the above definition are precisely defined (set of points, set of routing rules and test traffic flows, see § 3.1).

3.2.2 *Configuration A*

This simple configuration is adapted to the validation of all procedures concerning only one or more signalling links belonging to one linkset. It is used for the tests:

- of activation and deactivation of links;
- of changeover and changeback procedures;
- of inhibition and uninhibition of links;
- invalid messages.

Configuration A is shown in Figure 1/Q.782.

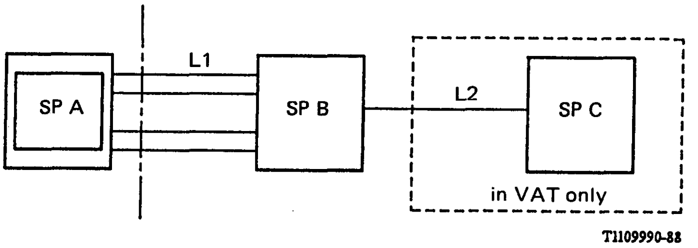


FIGURE 1/Q.782

Configuration A

Configuration A makes use of a point C in all validation tests in order to check the impact of the procedures on various traffic flows. Point C is not used in configuration A in the case of compatibility tests.

Linkset 1 has four signalling links in order to check, for example, changeover procedure to several links within a linkset (test 3.15).

In real networks, the procedures checked with this configuration act on the traffic carried in both directions of a link. Consequently, the flows of test traffic used are, regarding the routing label of messages:

- OPC = A, DPC = B and OPC = B, DPC = A
- OPC = A, DPC = C and OPC = C, DPC = A (in validation test only).

TABLE 1/Q.782

Routing rules in configuration A

→	A	B	C
A	–	L1	L1
B	L1	–	L2
C	L2	L2	–

3.2.3 *Configuration B*

Configuration B is adapted to the validation of all procedures concerning several signalling linksets. It is used for the tests:

- of signalling message handling;
- of changeover and changeback;
- of forced and controlled rerouting.

Configuration B is shown in Figure 2/Q.782.

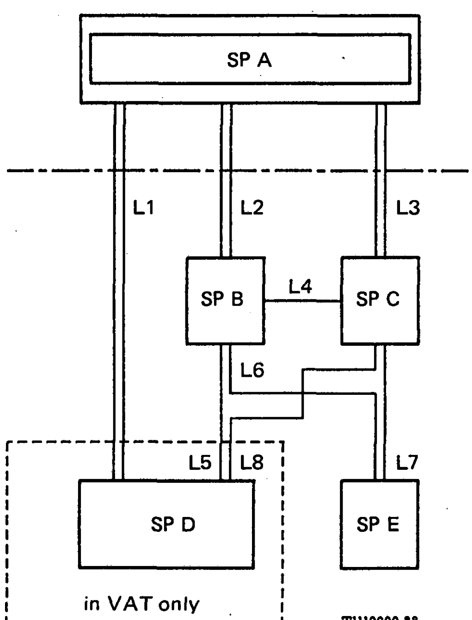


FIGURE 2/Q.782

Configuration B

In configuration B, Table 2/Q.782, the point under test A is linked to the external world with 3 signalling linksets. This is the minimum required number of linksets in order to check:

– load sharing between three linksets;
– changeover and changeback from/to two linksets (Recommendation Q.704, § 5.3.1).

When the SP A is an SP having no STP function, this configuration is also the minimum to run the tests in a network situation where associated mode and quasi-associated mode are used (Recommendation Q.701, § 3.1.2).

This configuration comprises point D in all validation tests in order to check the impact of the procedures on various traffic flows (relations A-D and A-E). The point D is not used in configuration B in case of compatibility tests.

In a real network, some procedures (changeover, changeback) checked with this configuration act on the traffic in both directions on the concerned linksets. Consequently, the test traffic flows used are, regarding the routing label of messages:

– OPC = A, DPC = E and OPC = E, DPC = A
– OPC = A, DPC = D and OPC = D, DPC = A (in validation test only).

TABLE 2/Q.782

Routing rules in configuration B

→	A	B	C	D	E
A	–	L2,L3	L3,L2	L1-L2-L3	L2-L3
B	L2,L4	–	L4	L5,L4	L6,L4
C	L3,L4	L4	–	L8,L4	L7,L4
D	L1,L5,L8	L5,L8	L8,L5	–	Any
E	L7,L6	L6,L7	L7,L6	Any	–

Li,Lj: Li normal linkset and Lj alternative linkset

Li-Lj: load sharing between Li and Lj

3.2.4 *Configuration C*

This configuration is adapted to the validation of some functions specific to an STP like:

– message transfer function;
– sending of TFC;
– traffic test.

Configuration C is shown in Figure 3/Q.782.

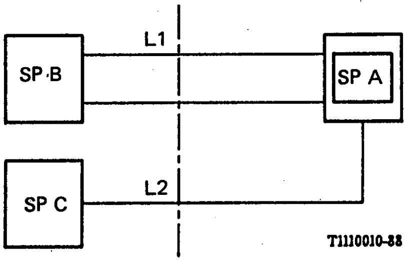


FIGURE 3/Q.782

Configuration C

In configuration C, Table 3/Q.782, the point under test A carries the test traffic from B to C and from C to B. The linkset 1 has two links, this a minimum to create an overload situation to trigger the sending of TFC independently of the implementation of the flow control procedure.

The tests performed with this configuration require that the traffic crosses the STP under test in both directions. Consequently the test traffic flows are, regarding the routing label of messages:

– OPC = B, DPC = C and OPC = C, DPC = B

TABLE 3/Q.782

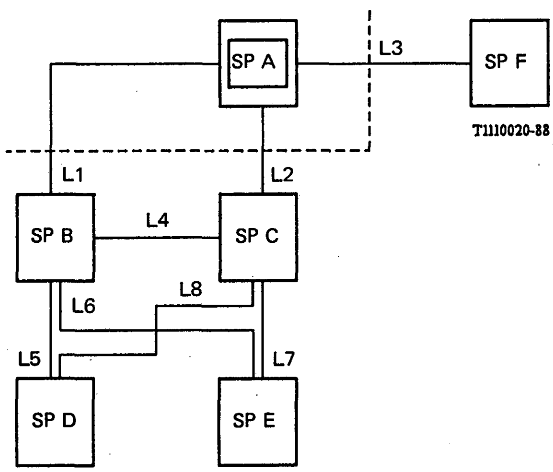
Routing rules in configuration C

	A	B	C
A	–	L1	L2
B	L1	–	L1
C	L2	L2	–

3.2.5 *Configuration D*

This configuration is adapted to the validation of all procedures concerning exclusively the points having an STP function. It is used to check the signalling route management procedures.

Configuration D is shown in Figure 4/Q.782.



Note – The SPs E, D and F have not STP function.

FIGURE 4/Q.782

Configuration D

Configuration D, Table 4/Q.782, is used only to check the signalling route management: transfer prohibited and transfer allowed procedures. Consequently, all linksets of this configuration have only one signalling link.

The STP under test is linked to the external world with three linksets: one terminal linkset (to an SP without STP function) and two inter STP linksets. This structure is minimal to check the various aspects of the broadcasting of TFPs and TFAs:

- TFPs or TFAs concerning several destinations;
- TFPs or TFAs to several destinations.

This configuration includes points D and E. This is necessary in order to check the sending of TFP on an alternative linkset: in A the routing rules are such that the linksets 1 and 2 are used to reach D using normal/alternative routing and to reach E using load sharing routing (sending of TFP in the first case and not in the second).

The tests performed with this configuration, which check the signalling route procedures, require that the test traffic uses the concerned signalling routes. The test traffic flows used in this Recommendation are, regarding the routing label messages:

- OPC = F, DPC = D   OPC = D, DPC = F
- OPC = F, DPC = E   OPC = E, DPC = F
- OPC = A, DPC = D   OPC = A, DPC = E   OPC = A, DPC = F

TABLE 4/Q.782

Routing rules in configuration D

→	A	B	C	D	E	F
A	–	L1,L2	L2,L1	L1,L2	L1,L2	L3
B	L1,L4	–	L4	L5,L4	L6,L4	L1
C	L2,L4	L4	–	L8,L4	L7,L4	L2
D	Any			–	Any	
E	Any				–	Any
F	L3	L3	L3	L3	L3	–

4 Test list

All tests with the indication "*" are validation and compatibility tests. The tests without asterisk are validation test only.

1 *Signalling link management*

* 1.1 First signalling link activation

* 1.2 Signalling linkset deactivation

* 1.3 Signalling linkset activation

2 *Signalling message handling*

2.1 Message received with an invalid SSF (discrimination function)

2.2 Message received with an invalid DPC (discrimination function)

2.3 Message received with an invalid SI (distribution function)

2.4 Load sharing within a linkset

* 2.4.1 All links available

2.4.2 With one link unavailable

2.5 Load sharing between linksets

* 2.5.1 Between two linksets
2.5.2 Between three linksets
2.5.3 Between three linksets and one route unavailable
2.5.4 Between three linksets and one linkset unavailable

2.6 Inaccessible destination

2.6.1 Due to a linkset failure
2.6.2 Due to a route failure
2.6.3 Due to a linkset and route failures

* 2.7 Message transfer function

3 *Changeover*

3.1 Changeover initiated at one side of a linkset (COO < – > COA)

3.2 Changeover initiated at the both ends at the same time (COO < – > COO)

3.3 Changeover on expiration of timer T2 (COO or ECO – > –)

3.4 Unreasonable FSN in COO/COA

3.5 Reception of a changeover acknowledgement without sending a changeover order (– < – COA or ECA)

3.6 Reception of an additional changeover order (– < – COO or ECO)

3.7 Emergency changeover at one side of a linkset (COO < – > ECA)

3.8 Emergency changeover at one side of a linkset (COO < – > ECO)

3.9 Emergency changeover at one side of a linkset (ECO < – > COA)

3.10 Emergency changeover at one side of a linkset (ECO < – > ECA)

3.11 Emergency changeover at one side of a linkset (ECO < – > COO)

3.12 Emergency changeover initiated at the both ends at the same time (ECO < – > ECO)

3.13 Reactivation of a link during a changeover procedure

3.14 Simultaneous changeover

3.15 Changeover to several alternative links within a linkset

* 3.16 Changeover to another linkset with the adjacent SP accessible

* 3.17 Changeover to another linkset with the adjacent SP inaccessible

3.18 Changeover to two linksets

3.19 Changeover due to various reasons

3.20 Changeover as compatibility test

3.21 Reception of a changeover order on an available link

4 *Changeback*

* 4.1 Changeback within a linkset

4.2 Additional CBA

4.3 Additional CBD

4.4 No acknowledgement to first CBD

4.5 No acknowledgement of repeat changeback declaration

4.6 Simultaneous changeback

4.7 Changeback from several alternative links within a linkset

* 4.8 Changeback from another linkset

4.9 Changeback from two linksets

4.10 Changeback due to various reasons

* 4.11 Time controlled diversion procedure

* 5 *Forced rerouting*

* 6 *Controlled rerouting*

7 *Management inhibiting*

7.1 Inhibition of a link

* 7.1.1 Available link
* 7.1.2 Unavailable link

7.2 Inhibition not permitted

* 7.2.1 Local reject on an available link
* 7.2.2 Local reject on an unavailable link

7.2.3 Sending of LID
7.2.4 Reception of LID

7.3 Expiration of T14

7.3.1 On an available link
7.3.2 On an unavailable link

7.4 Additional inhibition messages (LIA, LID, LIN)

7.5 Inhibition asked by the both ends

7.6 Manual uninhibition of a link

* 7.6.1 With changeback
* 7.6.2 Without changeback

7.7 Expiration of T12

* 7.8 Not possible uninhibition

7.9 Automatic uninhibition of a link

7.10 Forced uninhibition of a link

7.10.1 Sending of LFU
7.10.2 Reception of LFU

7.11 Expiration of T13

7.12 Additional uninhibition messages (LUA, LUN, LFU)

7.13 Uninhibition at one side after test 7.5

7.14 Automatic uninhibition after test 7.5

7.15 Automatic uninhibition when two links are inhibited

7.16 Reception of traffic on an inhibited link

7.17 Management inhibiting test

* 7.17.1 Normal procedure

7.17.2 Reception of an LLT or LRT on an uninhibited link
7.17.3 Reception of an LLT on a link locally inhibited
7.17.4 Reception of an LRT on a link remotely inhibited

8 *Signalling traffic flow control*

8.1 Reception of a TFC

8.2 Sending of TFCs

8.3 Reception of an UPU

8.4 Sending of an UPU

9 *Signalling route management*

9.1 Sending of a TFP on an alternative route

* 9.1.1 Failure of normal linkset
* 9.1.2 On reception of a TFP

9.2 Broadcast of TFPs

* 9.2.1 On one linkset failure
* 9.2.2 On multiple failures

9.3 Reception of a message for an unaccessible destination

9.4 Sending of a TFA on an alternative route

* 9.4.1 Recovery of normal linkset
* 9.4.2 On reception of a TFA

9.5 Broadcast of TFAs

* 9.5.1 On one linkset recovery
* 9.5.2 Various reasons

9.6 Periodic sending of signallint-route-set-test messages

9.7 Reception of signalling-route-set-test messages

10 *Signalling point restart*

10.1 Recovery of a linkset (SP A has not the STP function)

* 10.1.1 With use of point restart procedure
10.1.2 Without use of point restart procedure

10.2 Recovery of a linkset (SP A has the STP function)

* 10.2.1 With use of point restart procedure
10.2.2 Without use of point restart procedure

10.3 An adjacent signalling point becomes accessible via another signalling point (SP A has not STP function)

10.4 An adjacent signalling point becomes accessible via another signalling point (SP A has STP function)

* 10.5 Restart of an SP having no STP function

* 10.6 Restart of an SP having STP function

10.7 Reception of an unexpected TRA

10.7.1 In an SP having no STP function
10.7.2 In an SP having STP function

11 *Traffic test*

12 *Signalling link test*

* 12.1 After activation of a link

12.2 No acknowledgement to first SLTM

12.3 No acknowledgement to second SLTM

12.4 Unreasonable field in an SLTA

12.5 Reception of an SLTM in an attempt state

* 12.6 Additional SLTA, SLTM

13 *Invalid messages*

13.1 Invalid H0.H1 in a signalling network management message

13.2 Invalid changeover messages

13.3 Invalid changeback messages

13.4 Invalid changeback code

13.5 Invalid inhibition messages

13.6 Invalid transfer control messages

13.7 Invalid signalling route management messages

13.8 Invalid Signalling-Route-Set-Test messages

13.9 Invalid traffic restart allowed message

13.10 Invalid H0-H1 in a signalling network testing and maintenance message

13.11 Invalid signalling link test messages

13.12 Invalid user part unavailable messages

TEST NUMBER: 1.1	PAGE: 1 of 1
REFERENCE: Q.704 § 3 Fig. 7, Fig. 36, Fig. 37, Fig. 38	
TITLE: Signalling link management	
SUBTITLE: First signalling link activation	
PURPOSE: To put into service a signalling linkset with 1 signalling link	
PRE-TEST CONDITIONS: Signalling links deactivated	

CONFIGURATION: A	TYPE OF TEST: VAT, CPT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

	SP A			SP B
Link			Link	
			1 – 1	:Activate
1 – 1	:Activate			
		<---------------	1 – 1	SLTM
1 – 1	SLTA	--------------->		
1 – 1	SLTM	--------------->		
		<---------------	1 – 1	SLTA
:Start traffic				
1 – 1	TRAFFIC	--------------->		
		<---------------	1 – 1	TRAFFIC
:Wait				
:Stop traffic				

TEST DESCRIPTION

1.	Check that the signalling link becomes available.
2.	Check the reception and sending of variable length messages on the activated linkset from/to the SP at the other end of this linkset (and, in case of VAT, from/to other SP crossing the SP at the other end of this linkset).
3.	Check that, after the alignment, the level 2 does not send any message received before or during the deactivation.
4.	Check that all messages are correctly received (no loss of messages, no duplication and no missequencing).
5.	Stop traffic.
6.	Repeat the test with different SLC values.

TEST NUMBER: 1.2		PAGE: 1 of 1
REFERENCE: Q.704 § 3 Fig. 7, Fig. 36, Fig. 37, Fig. 38		
TITLE: Signalling link management		
SUBTITLE: Signalling linkset deactivation		
PURPOSE: To remove from service a signalling linkset with 1 signalling link		
PRE-TEST CONDITIONS: One signalling link (1-1) activated		
CONFIGURATION: A	TYPE OF TEST: VAT, CPT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

	SP A		SP B
Link		Link	
1 – 1	:Deactivate		

TEST DESCRIPTION

1.	Check that the signalling linkset becomes unavailable.

TEST NUMBER: 1.3		PAGE: 1 of 1
REFERENCE: Q.704 § 3, 12.2.4.1 Fig. 7, Fig. 36, Fig. 37, Fig. 38		
TITLE: Signalling link management		
SUBTITLE: Signalling linkset activation		
PURPOSE: To put into service a signalling linkset with 4 signalling links		
PRE-TEST CONDITIONS: Signalling links deactivated		
CONFIGURATION: A	TYPE OF TEST: VAT, CPT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

Link	SP A		Link	SP B
			1 – 1	:Activate
1 – 1	:Activate			
			1 – 2	:Activate
1 – 2	:Activate			
			1 – 3	:Activate
1 – 3	:Activate			
			1 – 4	:Activate
1 – 4	:Activate			
:Start traffic				
1 – 1	TRAFFIC	--------------->		
		<---------------	1 – 1	TRAFFIC
1 – 2	TRAFFIC	--------------->		
		<---------------	1 – 2	TRAFFIC
1 – 3	TRAFFIC	--------------->		
		<---------------	1 – 3	TRAFFIC
1 – 4	TRAFFIC	--------------->		
		<---------------	1 – 4	TRAFFIC
:Wait				
:Stop traffic				

Note – This test describes the activation of a linkset. The signalling link activation order is given simultaneously to all signalling links of the signalling linkset (Q.704 § 12.2.4.1). However, depending on in which order the links are getting aligned, changeback procedures will be performed. This test does not describe the transitory states (changeback procedure is checked in other tests).

TEST DESCRIPTION

1.	Check that the signalling links become available and start traffic between A and B (and A and C in VAT).
2.	Check the reception and sending of variable length messages on the activated linkset from/to the SP at the other end of this linkset (and, in case of VAT, from/to other SP crossing the SP at the other end of this linkset).
3.	Check that, after the alignment, the level 2 does not send any message received before or during the deactivation.
4.	Check that all messages are correctly received (no loss of messages, no duplication and no missequencing).
5.	Stop traffic.

TEST NUMBER: 2.1		PAGE: 1 of 1
REFERENCE: Q.704 § 3 Fig. 24 § 2.4		
TITLE: Signalling message handling		
SUBTITLE: Message received with an invalid SSF (discrimination function)		
PURPOSE: To check the response to a message with an invalid SSF		
PRE-TEST CONDITIONS: Signalling linkset activated		
CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

SP A			SP B
Link		Link	
	<---------------	1 – 1	:Invalid SLTM (invalid SSF)

TEST DESCRIPTION

1.	Send an SLTM with an erroneous SSF.
2.	Check that no response is received.

TEST NUMBER: 2.2		PAGE: 1 of 1
REFERENCE: Q.704 § 2 Fig. 24, Fig. 26		
TITLE: Signalling message handling		
SUBTITLE: Message received with an invalid DPC		
PURPOSE: To check the response to a message with an invalid DPC		
PRE-TEST CONDITIONS: Signalling linkset activated		
CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

SP A			SP B	
Link			Link	
		<---------------	1 – 1	:Invalid ECO (erroneous DPC)
1 – 1	TFP	--------------->		(only if the tested point A has an STP function)

TEST DESCRIPTION

1. Send a ECO message with an erroneous DPC.
2. Check that no response is received if the tested point has not STP function. If the tested point has the STP function, check that a TFP is received.

TEST NUMBER: 2.3		PAGE: 1 of 1
REFERENCE: Q.704 § 2.4 Fig. 24, Fig. 25		
TITLE: Signalling message handling		
SUBTITLE: Message received with an erroneous SI (distribution function)		
PURPOSE: To check the response to a message received with an erroneous SI		
PRE-TEST CONDITIONS: Signalling linkset activated		
CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

SP A		SP B	
Link		Link	
	<---------------	1 – 1	:invalid SLTM (invalid SI)

TEST DESCRIPTION

1.	Send an SLTM message with an invalid SI.
2.	Check that no response is received.

TEST NUMBER: 2.4.1		PAGE: 1 of 1
REFERENCE: Q.704 Fig. 26; §2.3 Q.705 § 4.4		
TITLE: Signalling message handling		
SUBTITLE: Load sharing within a linkset – all links available		
PURPOSE: To check the load sharing within a linkset with all the links available		
PRE-TEST CONDITIONS: Signalling linkset activated		
CONFIGURATION: A	TYPE OF TEST: VAT, CPT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

SP A			SP B	
Link			Link	
:Start traffic				
1 – 1	TRAFFIC	--------------->		
		<---------------	1 – 1	TRAFFIC
1 – 2	TRAFFIC	--------------->		
		<---------------	1 – 2	TRAFFIC
1 – 3	TRAFFIC	--------------->		
		<---------------	1 – 3	TRAFFIC
1 – 4	TRAFFIC	--------------->		
		<---------------	1 – 4	TRAFFIC
:Wait				
:Stop traffic				

TEST DESCRIPTION

1. Start traffic to B (and C in VAT) for all SLS.
2. Stop traffic, check that the messages have been transmitted on the correct link in accordance with the SLS field.
3. Check that there was no loss of messages, no duplication and no missequencing.

TEST NUMBER: 2.4.2	PAGE: 1 of 1
REFERENCE: Q.704 Fig. 26; § 2.3 Q.705 § 4.4	
TITLE: Signalling message handling	
SUBTITLE: Load sharing within a linkset – one link unavailable	
PURPOSE: To check the load sharing within a linkset when one link is unavailable	
PRE-TEST CONDITIONS: Signalling link 1 – 3 deactivated	

CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

SP A			SP B	
Link			Link	
:Start traffic				
1 – 1	TRAFFIC	--------------->		
		<---------------	1 – 1	TRAFFIC
1 – 2	TRAFFIC	--------------->		
		<---------------	1 – 2	TRAFFIC
1 – 4	TRAFFIC	--------------->		
		<---------------	1 – 4	TRAFFIC
:Wait				
:Stop traffic				

TEST DESCRIPTION

1.	Start the traffic to B and C for all SLS, wait and stop.
2.	Check that the messages have been transmitted on the correct link in accordance with the SLS field on the remaining links.

TEST NUMBER: 2.5.1		PAGE: 1 of 1
REFERENCE: Q.704 Fig. 26; § 2.3 Q.705 § 4.4		
TITLE: Signalling message handling		
SUBTITLE: Load sharing between linksets – between two linksets		
PURPOSE: To check the load sharing between two linksets under normal conditions		
PRE-TEST CONDITIONS: All linksets and routes available		
CONFIGURATION: B	TYPE OF TEST: VAT, CPT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

```
     SP   A                    SP   B                 SP   C                SP   E

 Link                          Link          Link                   Link

:Start traffic
 3 – 1     TRAFFIC   ----------------------------->  7 – 1  ----------->
                     <-----------------------------  3 – 1  <-----------  7 – 1    TRAFFIC
 3 – 2     TRAFFIC   ----------------------------->  7 – 1  ----------->
                     <-----------------------------  3 – 2  <-----------  7 – 1    TRAFFIC
 2 – 1     TRAFFIC   -------->  6 – 1  -------------------------------->
 2 – 2     TRAFFIC   -------->  6 – 1  -------------------------------->
:Wait
:Stop traffic
```

TEST DESCRIPTION

1.	Start the traffic to E for all SLS.
2.	Stop the traffic and check that the messages have been transmitted on the correct linkset in accordance with the SLS and DPC.
3.	Check that there was no loss of messages, no duplication and no missequencing.

TEST NUMBER: 2.5.2		PAGE: 1 of 1
REFERENCE: Q.704 Fig. 26; § 2.3 Q.705 § 4.4		
TITLE: Signalling message handling		
SUBTITLE: Load sharing between linksets – between three linksets		
PURPOSE: To check the load sharing between three linksets under normal conditions		
PRE-TEST CONDITIONS: All linksets and routes available		
CONFIGURATION: B	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

```
      SP  A                  SP  B            SP  C               SP  D

  Link                      Link            Link                Link
:Start traffic
 1 – 1    TRAFFIC   ------------------------------------------------------->
                    <--------------------------------------------------------  1 – 1    TRAFFIC
 1 – 2    TRAFFIC   ------------------------------------------------------->
                    <--------------------------------------------------------  1 – 2    TRAFFIC
 3 – 1    TRAFFIC   ------------------------------>  8 – 1   ------------>
 3 – 2    TRAFFIC   ------------------------------>  8 – 1   ------------>
 2 – 1    TRAFFIC   -------->  5 – 1  ---------------------------------->
 2 – 2    TRAFFIC   -------->  5 – 1  ---------------------------------->
:Wait
:Stop traffic
```

TEST DESCRIPTION

1.	Start the traffic to D for all SLS.
2.	Stop the traffic and check that the messages have been transmitted on the correct linkset and on the correct link in accordance with the SLS.
3.	Check that there was no loss of messages, no duplication and no missequencing.

TEST NUMBER: 2.5.3	PAGE: 1 of 1

REFERENCE: Q.704 Fig. 26; § 2.3 Q.705 § 4.4

TITLE: Signalling message handling

SUBTITLE: Load sharing between linksets – between three linksets and one route unavailable

PURPOSE: To check the load sharing between three linksets when one route is unavailable

PRE-TEST CONDITIONS: Linksets 4 and 8 unavailable (TFP, PC = D from C to A)

CONFIGURATION: B	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

```
     SP  A                  SP  B               SP  C              SP  D

 Link                        Link          Link               Link
:Start traffic
 1 – 1    TRAFFIC  ------------------------------------------------------->
                   <-------------------------------------------------------  1 – 1   TRAFFIC
 1 – 2    TRAFFIC  ------------------------------------------------------->
                   <-------------------------------------------------------  1 – 2   TRAFFIC
 2 – 1    TRAFFIC  -------->  5 – 1  ---------------------------------->
 2 – 2    TRAFFIC  -------->  5 – 1  ---------------------------------->
:Wait
:Stop traffic
```

TEST DESCRIPTION

1.	Start the traffic for all SLS, wait and stop.
2.	Check that the traffic to D via C has been shared on the remaining linksets.

TEST NUMBER: 2.5.4	PAGE: 1 of 1
REFERENCE: Q.704 Fig. 26; § 2.3 Q.705 § 4.4	
TITLE: Signalling message handling	
SUBTITLE: Load sharing between linksets – between three linksets and one linkset unavailable	
PURPOSE: To check the load sharing between two linksets after the unavailability of the third linkset	
PRE-TEST CONDITIONS: Linkset 1 deactivated	

CONFIGURATION: B	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

```
SP    A                          SP    B                    SP    C                 SP    D

Link                             Link                 Link                    Link
:Start traffic
3 – 1     TRAFFIC  ------------------------------>   8 – 1   ------------>
3 – 2     TRAFFIC  ------------------------------>   8 – 1   ------------>
2 – 1     TRAFFIC  -------->   5 – 1   ----------------------------------->
                   <--------   2 – 1   <-----------------------------------   5 – 1    TRAFFIC
2 – 2     TRAFFIC  -------->   5 – 1   ----------------------------------->
                   <--------   2 – 2   <-----------------------------------   5 – 1    TRAFFIC
:Wait
:Stop traffic
```

TEST DESCRIPTION

1.	Start the traffic for all SLS to D, wait and stop.
2.	Check that the traffic has been shared on the remaining linksets.

TEST NUMBER: 2.6.1	PAGE: 1 of 1
REFERENCE: Q.704 Fig. 26	
TITLE: Signalling message handling	
SUBTITLE: Inaccessible destination – due to a linkset failure	
PURPOSE: To check the signalling message handling when a destination becomes inaccessible due to a linkset failure	
PRE-TEST CONDITIONS: Signalling linkset with one link available	

CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

SP A			SP B	
Link			Link	
:Start traffic				
1 – 1	TRAFFIC	--------------->		
		<---------------	1 – 1	TRAFFIC
1 – 1	:Deactivate			

TEST DESCRIPTION

1.	Start the traffic for all SLS to B and C.
2.	Deactivate the last link 1 – 1 and check that the linkset becomes unavailable.
3.	Check that the SPs B and C become inaccessible.
4.	Check that all messages stored or received after the unavailability of the linkset are discarded.

TEST NUMBER: 2.6.2	PAGE: 1 of 1
REFERENCE: Q.704 Fig. 26	
TITLE: Signalling message handling	
SUBTITLE: Inaccessible destination – due to a route failure	
PURPOSE: To check the signalling message handling when a destination becomes inaccessible on reception of a TFP.	
PRE-TEST CONDITIONS: All links and routes available	

CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

SP A			SP B	
Link			Link	
:Start traffic				
1 – 1	TRAFFIC	--------------->		
		<---------------	1 – 1	TRAFFIC
1 – 2	TRAFFIC	--------------->		
		<---------------	1 – 2	TRAFFIC
1 – 3	TRAFFIC	--------------->		
		<---------------	1 – 3	TRAFFIC
1 – 4	TRAFFIC	--------------->		
		<---------------	1 – 4	TRAFFIC
		<---------------	1 – X	TFP, PC=C

TEST DESCRIPTION

1.	Start the traffic to B and C for all SLS.
2.	Provoke the sending of a TFP (PC=C) from SP B to SP A.
3.	Check that the SP C becomes inaccessible.
4.	Stop traffic.
5.	Check that all messages stored or received after the inaccessibility have been discarded.
6.	Check that traffic to B has not been disturbed.

TEST NUMBER: 2.6.3	PAGE: 1 of 1

REFERENCE: Q.704 Fig. 26

TITLE: Signalling message handling

SUBITLE: Inaccessible destination – due to a linkset and a route failure

PURPOSE: To check the signalling message handling when a destination becomes inaccessible due to a linkset and a route failure

PRE-TEST CONDITIONS: Linkset 4 unavailable

CONFIGURATION: B	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

```
                       SP   A                          SP   B            SP   C
     Link                                        Link               Link
:Start traffic
     1 – 1, 2    TRAFFIC        <-------------------------------------------------> SP  D
       3 – 1     TRAFFIC        ---------------------------------->  To D and E
                                <----------------------------------   3 – 1  TRAFFIC (from E)
       3 – 2     TRAFFIC        ---------------------------------->  To D and E
                                <----------------------------------   3 – 2  TRAFFIC (from E)
       2 – 1     TRAFFIC        -------------->      To D and E
       2 – 2     TRAFFIC        -------------->      To D and E
                                                                      7 – 1        :Deactivate
                                <----------------------------------   3 – X  TFP, PC=E
       2 – 1     TRAFFIC        -------------->  To D and E
                                <--------------  2 – 1 TRAFFIC
                                                 (from E)
       2 – 2     TRAFFIC        -------------->  To D and E
                                <--------------  2 – 2 TRAFFIC
                                                 (from E)
       2 – 1          :Deactivate
       2 – 2          :Deactivate
     1 – 1, 2    TRAFFIC        <-------------------------------------------------> SP  D
:Wait
:Stop traffic
```

Note – The transitory states (signalling network management procedures) are not described in this test which checks only the signalling message handling.

TEST DESCRIPTION

1.	Start the traffic to the SPs D and E for all SLS.
2.	Initiate the sending of a TFP (DPC = E) from SP C to SP A, check that the traffic to E is routed via B and check that the traffic to D is not disturbed.
3.	Deactivate the linkset 2 and check that the destination E becomes inaccessible. Stop traffic.
4.	Check that all messages stored or received during the inaccessibility have been discarded.

TEST NUMBER: 2.7	PAGE: 1 of 1

REFERENCE: Q.704 § 2 Fig. 26

TITLE: Signalling message handling

SUBTITLE: Message transfer function

PURPOSE: To test the transfer function in an STP

PRE-TEST CONDITIONS: All links available

CONFIGURATION: C	TYPE OF TEST: VAT, CPT	TYPE OF SP: STP

MESSAGE SEQUENCE:

		SP B		SP A		SP C
Link				Link		Link
:Start traffic						
1 – 1, 2	TRAFFIC		----------->	2 – 1	----------->	
			<-----------	1 – 1, 2	<-----------	TRAFFIC
:Wait						
:Stop traffic						

Note – The traffic used in this test is in conformance with the traffic model presented in Recommendation Q.706.

TEST DESCRIPTION

1. Start traffic between B and C in both directions via A.
2. Check that transfer function is correctly performed.
3. Stop traffic and check that there were no loss of messages, no duplication and no missequencing. Check that the information field of these messages has not been corrupted.

TEST NUMBER: 3.1	PAGE: 1 of 1

REFERENCE: Q.704 § 5 Fig. 28, Fig. 29, Fig. 30

TITLE: Changeover

SUBTITLE: Changeover initiated at one side of a linkset (COO <-> COA)

PURPOSE: To check the normal changeover procedure

PRE-TEST CONDITIONS: Linkset with two available links

CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

	SP A			SP B
Link			Link	
:Start traffic				
1 – 1	TRAFFIC	--------------->		
		<---------------	1 – 1	TRAFFIC
1 – 2	TRAFFIC	--------------->		
		<---------------	1 – 2	TRAFFIC
1 – 1	:Deactivate (MML command or failure)			
1 – 2	COO, SLC 1 – 1	--------------->		
		<---------------	1 – 2	COA, SLC 1 – 1
1 – 2	TRAFFIC (from 1 – 1)	--------------->		
		<---------------	1 – 2	TRAFFIC (from 1 – 1)
:Wait				
:Stop traffic				

TEST DESCRIPTION

1.	Start traffic to B and C on all the links.
2.	Deactivate link 1 – 1, check that a COO is sent (from A) for 1 – 1 on 1 – 2 and respond with a COA within T2.
3.	Check that the time between the deactivation and the sending of the COO is inside the specified value (see Q.706).
4.	Check that the traffic from link 1 – 1 is changed over to 1 – 2 and check that the traffic normally carried by 1 – 2 is passed over to 1 – 2.
5.	Stop traffic and check it has been received correctly (no lost messages no duplication and no missequencing).
6.	Repeat the test by sending the COO from B (instead of A). In addition, check that the time between the reception of the COO and the sending of the COA is inside the specified value (see Q.706).

TEST NUMBER: 3.2		PAGE: 1 of 1
REFERENCE: Q.704 § 5 Fig. 28, Fig. 29, Fig. 30		
TITLE: Changeover		
SUBTITLE: Changeover initiated at both ends at the same time (COO <-> COO)		
PURPOSE: To check the changeover procedure when the changeover is initiated at the both ends simultaneously		
PRE-TEST CONDITIONS: Linkset with two available links		
CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

```
              SP   A                                                SP   B

     Link                                           Link
:Start traffic
     1 - 1    TRAFFIC           ---------------->
                                <----------------   1 - 1    TRAFFIC
     1 - 2    TRAFFIC           ---------------->
                                <----------------   1 - 2    TRAFFIC
     1 - 1     :Deactivate (MML command or failure)
     1 - 2    COO (SLC 1 - 1)   ---------------->
                                <----------------   1 - 2    COO (SLC 1 - 1)
     1 - 2    COA (SLC 1 - 1)   ---------------->
                                <----------------   1 - 2    COA (SLC 1 - 1)
     1 - 2    TRAFFIC           ---------------->
              (from 1 - 1)
                                <----------------   1 - 2    TRAFFIC
                                                             (from 1 - 1)
:Wait
:Stop traffic
```

TEST DESCRIPTION

1.	Start the traffic to B and C on all the links.
2.	Deactivate the link 1 – 1, check that the COOs and COAs for 1 – 1 are received on link 1 – 2.
3.	Check that the traffic from link 1 – 1 changed over to 1 – 2 and stop traffic.
4.	Repeat the test without sending of COA from SP B to SP A

TEST NUMBER: 3.3		PAGE: 1 of 1
REFERENCE: Q.704 § 5 Fig. 28, Fig. 29, Fig. 30		
TITLE: Changeover		
SUBTITLE: Changeover on expiration of timer T2 (COO or ECO -> -)		
PURPOSE: To check the changeover procedure when no COA is received in response of a COO previously sent		
PRE-TEST CONDITIONS: Linkset with two available links		
CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

SP A			SP B	
Link			Link	
:Start traffic				
1 – 1	TRAFFIC	--------------->		
		<---------------	1 – 1	TRAFFIC
1 – 2	TRAFFIC	--------------->		
		<---------------	1 – 2	TRAFFIC
1 – 1	:Deactivate (MML command or failure)			
1 – 2	COO, SLC 1 – 1	--------------->		
	T2			
1 – 2	TRAFFIC (from 1 – 1)	--------------->		
		<---------------	1 – 2	TRAFFIC (from 1 – 1)
:Wait				
:Stop traffic				

TEST DESCRIPTION

1.	Start traffic to B and C on all the links.
2.	Deactivate link 1 – 1, check that a COO is received for 1 – 1 on link 1 – 2.
3.	After the expiration of T2, check that the changeover procedure is performed.
4.	Check that the duration of T2 is inside the specified range.
5.	Stop traffic and check that there was no duplication and no missequencing, some messages may be lost as the system should not perform retreival.
6.	Repeat the test but replacing COO by ECO.

TEST NUMBER: 3.4	PAGE: 1 of 1
REFERENCE: Q.704 § 5 Fig. 28, Fig. 29, Fig. 30	
TITLE: Changeover	
SUBTITLE: Unreasonable FSN in COO/COA	
PURPOSE: To check the changeover procedure on reception of a COO/COA containing an unreasonable FSN	
PRE-TEST CONDITIONS: Linkset with two available links	

CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

	SP A			SP B
Link			Link	
:Start traffic				
1 – 1	TRAFFIC	--------------->		
		<---------------	1 – 1	TRAFFIC
1 – 2	TRAFFIC	--------------->		
		<---------------	1 – 2	TRAFFIC
1 – 1	:Deactivate (MML command or failure)			
1 – 2	COO, SLC 1 – 1	--------------->		
		<---------------	1 – 2	COA, SLC 1 – 1 (unreasonable FSN)
1 – 2	TRAFFIC (from 1 – 1)	--------------->		
		<---------------	1 – 2	TRAFFIC (from 1 – 1)
:Wait				
:Stop traffic				

TEST DESCRIPTION

1.	Start traffic to B and C on all the links.
2.	Deactivate link 1 – 1, check that a COO is received for 1 – 1 on link 1 – 2 and respond within T2 with a COA containing an unreasonable FSN.
3.	Stop traffic, check that the changeover procedure has been performed.
4.	Check that there was no duplication and no missequencing. Some messages may be lost as the system should not perform retreival.
5.	Check that an indication is given by the system.
6.	Repeat the test with a COO sent from B (instead COA) containing an unreasonable FSN.

TEST NUMBER: 3.5	PAGE: 1 of 1

REFERENCE: Q.704 § 5 Fig. 28, Fig. 29, Fig. 30

TITLE: changeover

SUBTITLE: Reception of a changeover acknowledgement without sending a changeover order (- <- COA or ECA)

PURPOSE: To check the changeover procedure on reception of an unexpected changeover acknowledgement

PRE-TEST CONDITIONS: Linkset with two available links

CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

SP A			SP B	
Link			Link	
:Start traffic				
1 – 1	TRAFFIC	---------------->		
		<----------------	1 – 1	TRAFFIC
1 – 2	TRAFFIC	---------------->		
		<----------------	1 – 2	TRAFFIC
		<----------------	1 – 2	COA, SLC 1 – 1
1 – 1	TRAFFIC	---------------->		
		<----------------	1 – 1	TRAFFIC
1 – 2	TRAFFIC	---------------->		
		<----------------	1 – 2	TRAFFIC
:Wait				
:Stop traffic				

TEST DESCRIPTION

1.	Start traffic to B and C on all the links.
2.	Send a COA for 1 – 1 on link 1 – 2, check that this message is ignored.
3.	Stop traffic and check that it has been received correctly.
4.	Repeat the test with an ECA instead of a COA.

TEST NUMBER: 3.6	PAGE: 1 of 1

REFERENCE: Q.704 § 5 Fig. 28, Fig. 29, Fig. 30

TITLE: Changeover

SUBTITLE: Reception of an additional changeover order (- <- COO or ECO)

PURPOSE: To check the action of the system when a changeover order relating to a particular link is received after completion of changeover

PRE-TEST CONDITIONS: Linkset with the link 1 - 2 available

CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

SP A Link			SP B Link	
:Start traffic				
1 - 2	TRAFFIC	--------------->		
		<---------------	1 - 2	TRAFFIC
		<---------------	1 - 2	COO, SLC 1 - 1
1 - 2	ECA, SLC 1 - 1	--------------->		
1 - 2	TRAFFIC	--------------->		
		<---------------	1 - 2	TRAFFIC
:Wait				
:Stop traffic				

TEST DESCRIPTION

1.	Start traffic to B and C on link 1 - 2.
2.	Send a COO for 1 - 1 on link 1 - 2 and check that an ECA is received in T2.
3.	Stop traffic and check that it has been received correctly.
4.	Check that an indication is given by the system.
5.	Repeat the test with an ECO instead of a COO.

TEST NUMBER: 3.7	PAGE: 1 of 1

REFERENCE: Q.704 § 5 Fig. 28, Fig. 29, Fig. 30

TITLE: Changeover

SUBTITLE: Emergency changeover at one side of a linkset (COO <-> ECA)

PURPOSE: To check the emergency changeover procedure when a COO is acknowledged by an ECA

PRE-TEST CONDITIONS: Linkset with two available links

CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

Link	SP A		Link	SP B
:Start traffic				
1 – 1	TRAFFIC	--------------->		
		<---------------	1 – 1	TRAFFIC
1 – 2	TRAFFIC	--------------->		
		<---------------	1 – 2	TRAFFIC
1 – 1	:Deactivate (MML command or failure)			
1 – 2	COO, SLC 1 – 1	--------------->		
		<---------------	1 – 2	ECA, SLC 1 – 1
		<---------------	1 – 2	TRAFFIC (from 1 – 1)
1 – 2	TRAFFIC (from 1 – 1)	--------------->		
:Wait				
:Stop traffic				

TEST DESCRIPTION

1. Start traffic to B and C on all links.
2. Check the sending of a COO (from A) for 1 – 1 on 1 – 2 and check that an ECA is sent inside T2.
3. Check that the traffic is changed over from 1 – 1 to 1 – 2.
4. Stop traffic and check that it has been received correctly; no duplication and no missequencing. Some messages may be lost as the system should not perform retreival.
5. Repeat the test by sending COO from B (instead of A).

TEST NUMBER: 3.8		PAGE: 1 of 1
REFERENCE: Q.704 § 5 Fig. 28, Fig. 29, Fig. 30		
TITLE: Changeover		
SUBTITLE: Emergency changeover at one side of a linkset (COO <-> ECO)		
PURPOSE: To check the emergency changeover procedure when a COO is acknowledged by an ECO		
PRE-TEST CONDITIONS: Linkset with two available links.		
CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

	SP A			SP B
Link			Link	
:Start traffic				
1 – 1	TRAFFIC	--------------->		
		<---------------	1 – 1	TRAFFIC
1 – 2	TRAFFIC	--------------->		
		<---------------	1 – 2	TRAFFIC
1 – 1	:Deactivate (MML command or failure)			
1 – 2	COO, SLC 1 – 1	--------------->		
		<---------------	1 – 2	ECO, SLC 1 – 1
1 – 2	COA, SLC 1 – 1	--------------->		
1 – 2	TRAFFIC (from 1 – 1)	--------------->		
		<---------------	1 – 2	TRAFFIC (from 1 – 1)
:Wait				
:Stop traffic				

TEST DESCRIPTION

1.	Start traffic to B and C on all links.
2.	Check the sending of a COO (from A) for 1 – 1 on 1 – 2 and check that an ECO is sent (before T2 expires) and a COA is received.
3.	Check that the traffic is changed over from 1 – 1 to 1 – 2.
4.	Stop traffic and check that it has been received correctly; no duplication and no missequencing. Some messages may be lost as the system should not perform retreival.
5.	Repeat the test but send COO from B (instead of A).

TEST NUMBER: 3.9		PAGE: 1 of 1
REFERENCE: Q.704 § 5 Fig. 28, Fig. 29, Fig. 30		
TITLE: Changeover		
SUBTITLE: Emergency changeover at one side of a linkset (ECO <-> COA)		
PURPOSE: To check the emergency changeover procedure when an ECO is acknowledged by a COA		
PRE-TEST CONDITIONS: Linkset with two available links		
CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

Link	SP A		Link	SP B
:Start traffic				
1 – 1	TRAFFIC	--------------->		
		<---------------	1 – 1	TRAFFIC
1 – 2	TRAFFIC	--------------->		
		<---------------	1 – 2	TRAFFIC
1 – 1	:Deactivate (failure)			
1 – 2	ECO, SLC 1 – 1	--------------->		
		<---------------	1 – 2	COA, SLC 1 – 1
		<---------------	1 – 2	TRAFFIC (from 1 – 1)
1 – 2	TRAFFIC (from 1 – 1)	--------------->		
:Wait				
:Stop traffic				

TEST DESCRIPTION

1. Start traffic to B and C on all links.
2. Check that an ECO is received for 1 – 1 on 1 – 2 and that a COA is sent before T2 expires.
3. Check that traffic is changed over from 1 – 1 to 1 – 2.
4. Stop traffic and check that it has been received correctly; no duplication and no missequencing, some messages may be lost as the system should not perform retreival.
5. Repeat the test but send ECO from B (instead of A).

TEST NUMBER: 3.10	PAGE: 1 of 1
REFERENCE: Q.704 § 5 Fig. 28, Fig. 29, Fig. 30	
TITLE: Changeover	
SUBTITLE: Emergency changeover at one side of a linkset (ECO <-> ECA)	
PURPOSE: To check the emergency changeover procedure when an ECO is acknowledged by an ECA	
PRE-TEST CONDITIONS: Linkset with two available links	

CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

SP A Link			SP B Link	
:Start traffic				
1 – 1	TRAFFIC	--------------->		
		<---------------	1 – 1	TRAFFIC
1 – 2	TRAFFIC	--------------->		
		<---------------	1 – 2	TRAFFIC
1 – 1	:Deactivate (failure)			
1 – 2	ECO, SLC 1 – 1	--------------->		
		<---------------	1 – 2	ECA, SLC 1 – 1
		<---------------	1 – 2	TRAFFIC (from 1 – 1)
1 – 2	TRAFFIC (from 1 – 1)	--------------->		
:Wait				
:Stop traffic				

TEST DESCRIPTION

1.	Start traffic to B and C on all links.
2.	Check that an ECO is received for 1 – 1 on 1 – 2 and that an ECA is sent before T2 expires.
3.	Check that traffic is changed over from 1 – 1 to 1 – 2.
4.	Stop traffic and check that it has been received correctly; no duplication and no missequencing. Some messages may be lost as the system should not perform retreival.
5.	Repeat the test but send ECO from B (instead of A).

TEST NUMBER: 3.11	PAGE: 1 of 1

REFERENCE: Q.704 § 5 Fig. 28, Fig. 29, Fig. 30

TITLE: Changeover

SUBTITLE: Emergency changeover at one side of a linkset (ECO <-> COO)

PURPOSE: To check the emergency changeover procedure when a COO is received in response to an ECO

PRE-TEST CONDITIONS: Linkset with two available links

CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

SP A			SP B	
Link			Link	
:Start traffic				
1 – 1	TRAFFIC	--------------->		
		<---------------	1 – 1	TRAFFIC
1 – 2	TRAFFIC	--------------->		
		<---------------	1 – 2	TRAFFIC
1 – 1	:Deactivate (failure)			
1 – 2	ECO, SLC 1 – 1	--------------->		
		<---------------	1 – 2	COO, SLC 1 – 1
1 – 2	ECA, SLC 1 – 1	--------------->		
1 – 2	TRAFFIC (from 1 – 1)	--------------->		
		<---------------	1 – 2	TRAFFIC (from 1 – 1)
:Wait				
:Stop traffic				

TEST DESCRIPTION

1. Start traffic to B and C on all links.
2. Check that an ECO is received for 1 – 1 on 1 – 2 and that a COO is sent before T2 expires and acknowledged with an ECA.
3. Check that traffic is changed over from 1 – 1 to 1 – 2.
4. Stop traffic and check that it has been received correctly; no duplication and no missequencing. Some messages may be lost as the system should not perform retrieval.
5. Repeat the test but sent ECO from B (instead of A).

TEST NUMBER: 3.12	PAGE: 1 of 1

REFERENCE: Q.704 § 5 Fig. 28, Fig. 29, Fig. 30

TITLE: Changeover

SUBTITLE: Emergency changeover initiated at both ends at the same time (ECO <-> ECO)

PURPOSE: To check the emergency changeover procedure when it is initiated at the both ends simultaneously

PRE-TEST CONDITIONS: Linkset with two available links

CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

SP A			SP B	
Link			Link	
:Start traffic				
1 – 1	TRAFFIC	--------------->		
		<---------------	1 – 1	TRAFFIC
1 – 2	TRAFFIC	--------------->		
		<---------------	1 – 2	TRAFFIC
1 – 1	:Deactivate (failure)			
1 – 2	ECO, SLC 1 – 1	--------------->		
		<---------------	1 – 2	ECO, SLC 1 – 1
1 – 2	ECA, SLC 1 – 1	--------------->		
		<---------------	1 – 2	ECA, SLC 1 – 1
1 – 2	TRAFFIC (from 1 – 1)	--------------->		
		<---------------	1 – 2	TRAFFIC (from 1 – 1)
:Wait				
:Stop traffic				

TEST DESCRIPTION

1.	Start traffic to B and C on all links.
2.	Check that an ECO is received for 1 – 1 on 1 – 2 and that an ECO is sent before T2 expires and acknowledged with ECA.
3.	Check that traffic is changed over from 1 – 1 to 1 – 2.
4.	Stop traffic and check that it has been received correctly; no duplication and no missequencing. Some messages may be lost as the system should not perform retrieval.
5.	Repeat the test without sending ECA from SP B to SP A.

TEST NUMBER: 3.13		PAGE: 1 of 1
REFERENCE: Q.704 § 5 Fig. 28, Fig. 29, Fig. 30		
TITLE: Changeover		
SUBTITLE: Reactivation of a link during a changeover procedure		
PURPOSE: To check the changeover procedure when the link failure causing the changeover is removed during the procedure.		
PRE-TEST CONDITIONS: Linkset with two available links		
CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

SP A			SP B	
Link			Link	
:Start traffic				
1 – 1	TRAFFIC	--------------->		
		<---------------	1 – 1	TRAFFIC
1 – 2	TRAFFIC	--------------->		
		<---------------	1 – 2	TRAFFIC
1 – 1	:Deactivate (failure)			
1 – 1	:Activate (end of failure)			
:Wait				
:Stop traffic				

Note – This test will be performed if applicable (some systems may terminate the changeover procedure, then perform the changeback).

TEST DESCRIPTION

1.	Start traffic to B and C on all links.
2.	Deactivate the link 1 – 1 and reactivate this link immediately.
3.	Stop traffic and check that the changeover procedure has not been performed. Depending the time between the deactivation and the reactivation, a COO may be sent or not.
4.	Check that the traffic used the links 1 – 1 and 1 – 2 normally.

TEST NUMBER: 3.14		PAGE: 1 of 1
REFERENCE: Q.704 § 5 Fig. 28, Fig. 29, Fig. 30		
TITLE: Changeover		
SUBTITLE: Simultaneous changeover		
PURPOSE: To check that the system can correctly handle simultaneous failures of several links		
PRE-TEST CONDITIONS: Linkset with three available links		
CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

Link	SP A		Link	SP B
:Start traffic				
1 – 1	TRAFFIC	--------------->		
		<---------------	1 – 1	TRAFFIC
1 – 2	TRAFFIC	--------------->		
		<---------------	1 – 2	TRAFFIC
1 – 3	TRAFFIC	--------------->		
		<---------------	1 – 3	TRAFFIC
1 – 1, 1 – 2	:Deactivate (MML command or failure)			
1 – 3	COO, SLC 1 – 1	--------------->		
1 – 3	COO, SLC 1 – 2	--------------->		
		<---------------	1 – 3	COA, SLC 1 – 1
		<---------------	1 – 3	COA, SLC 1 – 2
1 – 3	TRAFFIC (from 1 – 1 and 1 – 2)	--------------->		
		<---------------	1 – 3	TRAFFIC (from 1 – 1 and 1 – 2)
:Wait				
:Stop traffic				

TEST DESCRIPTION

1.	Start traffic to B and C on all links.
2.	Deactivate the links 1 – 1 and 1 – 2 simultaneously.
3.	Check that COOs are received on 1 – 3 for 1 – 1 and 1 – 2, and respond with COAs inside T2s. Check that traffic is changed over from 1 – 1 and 1 – 2 to 1 – 3.
4.	Stop traffic and check that it has been received correctly (no lost messages, no duplication and no missequencing).

TEST NUMBER: 3.15	PAGE: 1 of 1
REFERENCE: Q.704 § 5 Fig. 28, Fig. 29, Fig. 30	
TITLE: Changeover	
SUBTITLE: Changeover to several alternative links within a linkset	
PURPOSE: To check the changeover porcedure when there are several alternative links	
PRE-TEST CONDITIONS: Linkset with all links available	

CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

SP A			SP B	
Link			Link	
:Start traffic				
1 – 1	TRAFFIC	--------------->		
		<---------------	1 – 1	TRAFFIC
1 – 2	TRAFFIC	--------------->		
		<---------------	1 – 2	TRAFFIC
1 – 3	TRAFFIC	--------------->		
		<---------------	1 – 3	TRAFFIC
1 – 4	TRAFFIC	--------------->		
		<---------------	1 – 4	TRAFFIC
1 – 1	:Deactivate (MML command or failure)			
1 – 2, 3 or 4	COO, SLC 1 – 1	--------------->		
		<---------------	1 – 2, 3 or 4	COA, SLC 1 – 1
1 – 2	TRAFFIC (from 1 – 1)	--------------->		
		<---------------	1 – 2	TRAFFIC (from 1 – 1)
1 – 3	TRAFFIC (from 1 – 1)	--------------->		
		<---------------	1 – 3	TRAFFIC (from 1 – 1)
1 – 4	TRAFFIC (from 1 – 1)	--------------->		
		<---------------	1 – 4	TRAFFIC (from 1 – 1)
:Wait				
:Stop traffic				

TEST DESCRIPTION

1.	Start traffic to B and C on all links.
2.	Deactivate the link 1 – 1 and check that the changeover is performed to links 1 – 2, 1 – 3 and 1 – 4.
3.	Stop traffic and check that it has been shared on the alternative links according to the load sharing policy of this linkset.
4.	Check that, for each destination and for each SLS, there was no lost messages, no duplication and no missequencing.

TEST NUMBER: 3.16	PAGE: 1 of 1

REFERENCE: Q.704 § 5 Fig. 28, Fig. 29, Fig. 30

TITLE: Changeover

SUBTITLE: Changeover to another linkset with adjacent SP accessible

PURPOSE: To check that the system performs changeover to an alternative route when the last link of a linkset becomes unavailable

PRE-TEST CONDITIONS: Linkset 1 and link 3 – 1 unavailable

CONFIGURATION: B	TYPE OF TEST: VAT, CPT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

```
        SP   A                    SP   B                  SP   C               SP   ●

 Link                             Link             Link                 Link
:Start traffic
 3 - 2     TRAFFIC    ------------------------------>  7 - 1  ------------>                SP  E
                                                       8 - 1  <------------                SP  D
                      <------------------------------  3 - 2  <------------   7 - 1        SP  E
 2 - 1, 2  TRAFFIC    -------->  6 - 1   ---------------------------------->               SP  E
                                 5 - 1   ---------------------------------->               SP  D
                      <--------  2 - 1, 2 <----------------------------------  5 - 1       SP  D
 3 - 2     :Deactivate (MML command or failure)
 2 - X     COO, SLC   -------->  4 - 1   -------->
           3 - 2
                      <--------  2 - X   <--------4 - 1 COA, SLC 3 - 2
 2 - 1, 2  TRAFFIC    -------->  6 - 1   ---------------------------------->               SP  E
           (from 3 - 2)          5 - 1   ---------------------------------->               SP  D
                      <--------  2 - 1, 2 <----------------------------------  5 - 1       SP  D
                      <--------  2 - 1, 2 <----------------------------------  6 - 1       SP  E
:Wait
:Stop traffic
```

TEST DESCRIPTION

1.	Start traffic to E (and D in VAT).
2.	Deactivate link 3 – 2 and check that a COO (for 3 – 2) is sent from A to C via B and that a COA (from 3 – 2) is sent from C to A via B within T2.
3.	Stop traffic and check that it has been shared on the alternative links 2 – 1 and 2 – 2 according to the load sharing rules of linkset 2.
4.	Check that, for each SLS, there was no lost messages, no duplication and no missequencing.
5.	Repeat the test but replace COO with ECO (some messages may have been lost).

TEST NUMBER: 3.17		PAGE: 1 of 1
REFERENCE: Q.704 § 5 Fig. 28, Fig. 29, Fig. 30		
TITLE: Changeover		
SUBTITLE: Changeover to another linkset with adjacent SP inaccessible		
PURPOSE: To check that the system responds correctly when there is no path between the ends of an unavailable link.		
PRE-TEST CONDITIONS: Linkset 4 unavailable		
CONFIGURATION: B	TYPE OF TEST: VAT, CPT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

```
     SP    A                    SP   B                   SP    C                SP    E

 Link                       Link               Link                  Link

:Start traffic

 2 - 1   TRAFFIC      -------->  6 - 1  --------------------------------->
 2 - 2   TRAFFIC      -------->  6 - 1  --------------------------------->
 3 - 1   TRAFFIC      ----------------------------->  7 - 1   ----------->
                      <-----------------------------  3 - 1   <-----------   7 - 1    TRAFFIC
 3 - 2   TRAFFIC      ----------------------------->  7 - 1   ----------->
                      <-----------------------------  3 - 2   <-----------   7 - 1    TRAFFIC

 2 - 1   :Deactivate (MML command or failure)
 2 - 2   :Deactivate (MML command or failure)
         |
         |  T1
         |
 3 - 1   TRAFFIC      ----------------------------->  7 - 1   ----------->
         (from 2 - 1, 2)
                      <-----------------------------  3 - 1   <-----------   7 - 1    TRAFFIC
 3 - 2   TRAFFIC      ----------------------------->  7 - 1   ----------->
         (from 2 - 1, 2)
                      <-----------------------------  3 - 2   <-----------   7 - 1    TRAFFIC
:Wait
:Stop traffic
```

TEST DESCRIPTION

1.	Start traffic to E on linkset 2 and 3.
2.	Deactivate the linkset 2.
3.	Check that traffic continues on linkset 3 at the expiration of T1.
4.	Stop traffic and check that it has been shared on links 3 – 1 and 3 – 2 according to the load sharing rules of the linkset 3.
5.	Check that the traffic has been received correctly. Some messages may have been lost but none should be missequenced or duplicated..
6.	Check that the duration of T1 is inside the specified range.

TEST NUMBER: 3.18	PAGE: 1 of 1
REFERENCE: Q.704 § 5 Fig. 28, Fig. 29, Fig. 30	
TITLE: Changeover	
SUBTITLE: Changeover to two linksets	
PURPOSE: To check the changeover procedure when it is performed to several links pertaining to two linksets	
PRE-TEST CONDITIONS: Link 1 – 1 unavailable, all other available	

CONFIGURATION: B	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

```
      SP   A                       SP   B                  SP   C                SP   D

 Link                          Link              Link                   Link

:Start traffic
 1 - 2   TRAFFIC    ----------------------------------------------------->
                    <-----------------------------------------------------  1 - 2     TRAFFIC
 1 - 2   :Deactivate (MML command or failure)
 2 - X   COO,       -------->  5 - 1   --------------------------------->
         SLC 1 - 2
or 3 - X            ------------------------------>  8 - 1   ------------>
                    <--------  2 - X   <---------------------------------  5 - 1   COA,
                                                                                   SLC 1 - 2
 2 - 1   TRAFIC     -------->  5 - 1   --------------------------------->
         (from 1 - 2)
                    <--------  2 - X   <---------------------------------  5 - 1   TRAFIC
                                                                                   (from 1 - 2)
 2 - 2   TRAFIC     -------->  5 - 1   --------------------------------->
         (from 1 - 2)
 3 - 1   TRAFFIC    ------------------------------>  8 - 1   ------------>
         (from 1 - 2)
 3 - 2   TRAFFIC    ------------------------------>  8 - 1   ------------>
         (from 1 - 2)
:Wait
:Stop traffic
```

TEST DESCRIPTION

1.	Start traffic to D.
2.	Deactivate the link 1 – 2 and check that a COO for 1 – 2 is sent to D via B or C and that a COA is sent from D to A via B or C inside T2.
3.	Stop traffic and check that it has been shared on the alternative links 2 – 1, 2 – 2, 3 – 1 and 3 – 2 according to the load sharing rules in A.
4.	Check that, for each SLS, there were no lost messages, no duplication and no missequencing.
5.	Repeat the test but replace COO with ECO (some messages may have been lost).

TEST NUMBER: 3.19		PAGE: 1 of 1
REFERENCE: Q.704 § 5 ; 3.2.2		
TITLE: Changeover		
SUBTITLE: Changeover due to various reasons		
PURPOSE: To check the interface L2-L3		
PRE-TEST CONDITIONS: Linkset with two available links		
CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

```
                SP   A                                            SP   B

    Link                                          Link

:Start traffic

   1 - 1        TRAFFIC        --------------->
                               <---------------   1 - 1      TRAFFIC
   1 - 2        TRAFFIC        --------------->
                               <---------------   1 - 2      TRAFFIC

   1 - 1          :Deactivation due to various reasons (see Note)

                CHANGEOVER

   1 - 2        TRAFFIC        --------------->
                (from 1 - 1)
                               <---------------   1 - 2      TRAFFIC (from 1 - 1)

:Wait

:Stop traffic
```

Note – The object of this test is to check the interface L2-L3 by invoking a changeover by the different means listed in Q.704 (§ 3.2.2). These reasons are: high error rate, expiration of timer T1, T2, T6 and T7 of L2, equipement failure, erroneous BSN or FIB, reception of SIOS, SIN, SIE, SIO and SIPO of L2, and management request. The goal of this test is not to check the changeover procedure itself, but only that the COO is generated for each of these reasons.

TEST DESCRIPTION

1.	Start traffic to B and C on all links.
2.	Invoke the deactivation of the link 1 – 1 (see Note above).
3.	Check that traffic is changed over from 1 – 1 to 1 – 2.
4.	Stop traffic and check that it has been received correctly.
5.	Repeat the test for each reason.

TEST NUMBER: 3.20		PAGE: 1 of 1
REFERENCE: Q.704 § 5, Fig. 28, Fig. 29, Fig. 30		
TITLE: Changeover		
SUB TITLE: Changeover as compatibility test		
PURPOSE: To check the changeover procedure as compatibility test		
PRE-TEST CONDITIONS: Linkset with two available links		
CONFIGURATION: A	TYPE OF TEST: CPT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

```
                SP    A                                              SP    B

          Link                                                 Link

:Start traffic

       1 - 1    TRAFFIC                -------------------------->
                                       <--------------------------    1 - 1    TRAFFIC
       1 - 2    TRAFFIC                -------------------------->
                                       <--------------------------    1 - 2    TRAFFIC

       1 - 1    :Deactivate (MML command or failure)

                CHANGEOVER

       1 - 2    TRAFFIC (from 1 - 1)   -------------------------->
                                       <--------------------------    1 - 2    TRAFFIC (from 1 - 1)

:Wait

:Stop traffic
```

Note – In a compatibility test it is impossible to describe precisely the exchanges of changeover messages because the description depends of the type of deactivation of the link and of the time necessary to detect the deactivation.

TEST DESCRIPTION

1.	Start traffic to B on links 1 – 1 and 1 – 2.
2.	Deactivate link 1 – 1 and check that the changeover is performed.
3.	Check that the sequence of changeover messages conforms to one of the descriptions 3.1 to 3.12. Stop traffic.
4.	Repeat the test by invoking the different reasons listed in the note in test 3.19.

TEST NUMBER: 3.21	PAGE: 1 of 1

REFERENCE: Q.704 § 5, Fig. 28, Fig. 29, Fig. 30

TITLE: Changeover

SUB TITLE: Reception of a changeover order on an available link

PURPOSE: To check the changeover procedure on reception of a COO or ECO for a link in service

PRE-TEST CONDITIONS: Linkset with two available links

CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

SP A			SP B	
Link			Link	
:Start traffic				
1 – 1	TRAFFIC	------------------------->		
		<-------------------------	1 – 1	TRAFFIC
1 – 2	TRAFFIC	------------------------->		
		<-------------------------	1 – 2	TRAFFIC
		<-------------------------	1 – 2	COO, SLC 1 – 1 (FSN corresponding to the last received message)
1 – 2	COA, SLC 1 – 1	------------------------->		
1 – 2	TRAFFIC (from 1 – 1)	------------------------->		
		<-------------------------	1 – 2	TRAFFIC (from 1 – 1)
:Wait				
:Stop traffic				

TEST DESCRIPTION

1. Start traffic to B and C on all the links.
2. Send a COO from B to A for 1 – 1 on link 1 – 2 and check that the COA is received.
3. Check that the link 1 – 1 becomes unavailable.
4. Stop traffic and check that the changeover procedure has been performed.
5. Check that there was no loss of messages, no duplication and no missequencing.
6. Repeat the test but send an ECO (instead of a COO) and check that an ECA is received (instead of a COA). Some messages may be lost.

TEST NUMBER: 4.1	PAGE: 1 of 1

REFERENCE: Q.704 § 6, Fig. 28, Fig. 29, Fig. 31

TITLE: Changeback

SUB TITLE: Changeback within a linkset

PURPOSE: To check that the changeback procedure is correctly performed on restoration of a link in a linkset

PRE-TEST CONDITIONS: Linkset with one available link (end of test 3.1)

CONFIGURATION: A	TYPE OF TEST: VAT, CPT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

SP A Link			SP B Link	
:Start traffic				
1 – 2	TRAFFIC	------------------------->		
		<-------------------------	1 – 2	TRAFFIC
1 – 1	:Activate (depending of the deactivation mean previously used)			
1 – 2	CBD, SLC 1 – 1	------------------------->		
		<-------------------------	1 – X	CBA, SLC 1 – 1
1 – 1	TRAFFIC (from 1 – 2)	------------------------->		
		<-------------------------	1 – 2	CBD, SLC 1 – 1
1 – X	CBA, SLC 1 – 1	------------------------->		
		<-------------------------	1 – 1	TRAFFIC (from 1 – 2)
1 – 2	TRAFFIC	------------------------->		
		<-------------------------	1 – 2	TRAFFIC
:Wait				
:Stop traffic				

TEST DESCRIPTION

1.	Start traffic to B (and C in VAT) on link 1 – 2.
2.	Activate the link 1 – 1 and check that it enters the correct in service state.
3.	Check that a CBD for SLC 1 – 1 is received and that traffic for link 1 – 1 is switched back after a CBA is sent.
4.	Stop traffic and check that it has been received correctly, no lost messages, no duplication and no missequencing.
5.	Continue the test by activating the link 1 – 3, then 1 – 4.
6.	As a compatibility test, repeat the test for several reasons chosen among those listed in test 4.10.

TEST NUMBER: 4.2	PAGE: 1 of 1
REFERENCE: Q.704 § 6, Fig. 28, Fig. 29, Fig. 31	
TITLE: Changeback	
SUB TITLE: Additional CBA	
PURPOSE: To check the actions of the system on reception of an additional CBA	
PRE-TEST CONDITIONS: Linkset with all links available	

CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

SP A			SP B	
Link			Link	
:Start traffic				
ALL	TRAFFIC	------------------------->		
		<-------------------------	ALL	TRAFFIC
		<-------------------------	1 – X	CBA, SLC 1 – X
ALL	TRAFFIC	------------------------->		
		<-------------------------	ALL	TRAFFIC
:Wait				
:Stop traffic				

TEST DESCRIPTION

1.	Start traffic to B and C on all links.
2.	Send an unexpected CBA to A and check that this message is discarded without action on the traffic.
3.	Stop traffic.

TEST NUMBER: 4.3	PAGE: 1 of 1

REFERENCE: Q.704 § 6, Fig. 28, Fig. 29, Fig. 31

TITLE: Changeback

SUB TITLE: Additional CBD

PURPOSE: To check the action of the system on reception of an additional CBD

PRE-TEST CONDITIONS: Linkset with all links available

CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

SP A			SP B	
Link			Link	
:Start traffic				
ALL	TRAFFIC	------------------------->		
		<-------------------------	ALL	TRAFFIC
		<-------------------------	1 – X	CBD, SLC 1 – X
1 – X	CBA, SLC 1 – X	------------------------->		
ALL	TRAFFIC	------------------------->		
		<-------------------------	ALL	TRAFFIC
:Wait				
:Stop traffic				

TEST DESCRIPTION

1.	Start traffic to B and C on all links.
2.	Send an unexpected CBD to A and check that a CBA is send back in response without impact on the traffic.
3.	Stop traffic and check that it has been received correctly.

TEST NUMBER: : 4.4	PAGE: 1 of 1
REFERENCE: Q.704 § 6, Fig. 28, Fig. 29, Fig. 31	
TITLE: Changeback	
SUB TITLE: No acknowledgement to first CBD	
PURPOSE: To check that a second CBD is sent if the first is not acknowledged	
PRE-TEST CONDITIONS: Linkset with one available link	

CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

```
                SP   A                                              SP   B

        Link                                               Link

:Start traffic

        1 - 2   TRAFFIC              ------------------------>
                                     <------------------------   1 - 2   TRAFFIC
        1 - 1   :Activate
        1 - 2   CBD, SLC 1 - 1       ------------------------>
                |
                | T4
                |
        1 - 2   CBD, SLC 1 - 1       ------------------------>
                                     <------------------------   1 - X   CBA, SLC 1 - 1
        1 - 1   TRAFFIC (from 1 - 2) ------------------------>
                                     <------------------------   1 - 1   TRAFFIC (from 1 - 2,
                                                                         see note)
        1 - 2   TRAFFIC              ------------------------>
                                     <------------------------   1 - 2   TRAFFIC
:Wait
:Stop traffic
```

Note – B may perform a changeback or not.

TEST DESCRIPTION

1.	Start traffic to B and C on link 1 – 2.
2.	Activate link 1 – 1 and check that a CBD is received (no CBA in response).
3.	Check that after T4 a second CBD is received and CBA is sent in response before T5 expires.
4.	Check that the traffic is changed back on link 1 – 1.
5.	Stop traffic and check that there were no lost messages, no duplication and no missequencing.
6.	Check that the duration of T4 is inside the specified range.

TEST NUMBER: 4.5		PAGE: 1 of 1
REFERENCE: Q.704 § 6, Fig. 28, Fig. 29, Fig. 31		
TITLE: Changeback		
SUB TITLE: No acknowledgement of repeat changeback declaration		
PURPOSE: To check that traffic is changed back after a repeat changeback declaration is not acknowledged		
PRE-TEST CONDITIONS: Linkset with one available link		
CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

SP A Link			SP B Link	
:Start traffic				
1 – 2	TRAFFIC	------------------------->		
		<-------------------------	1 – 2	TRAFFIC
1 – 1	:Activate			
1 – 2	CBD, SLC 1 – 1	------------------------->		
	T4			
1 – 2	CBD, SLC 1 – 1	------------------------->		
	T5			
1 – 1	TRAFFIC (from 1 – 2)	------------------------->		
		<-------------------------	1 – 1	TRAFFIC (from 1 – 2, see note)
1 – 2	TRAFFIC	------------------------->		
		<-------------------------	1 – 2	TRAFFIC
:Wait				
:Stop traffic				

Note – B may perform a changeback or not.

TEST DESCRIPTION

1.	Start traffic to B and C on link 1 – 2.
2.	Check that a CBD is received and not acknowledged.
3.	Check that after T4, a CBD is repeated and not acknowledged by a CBA.
4.	Check that after T5, the traffic is changed back on link 1 – 1.
5.	Stop traffic and check that there were no lost messages, no duplication and no missequencing.
6.	Check that an indication was given by the system (§ 6.2.3, Q. 704).
7.	Check that the duration of T5 is inside the specified range.

TEST NUMBER: 4.6	PAGE: 1 of 1

REFERENCE: Q.704 § 6, Fig. 28, Fig. 29, Fig. 31

TITLE: Changeback

SUB TITLE: Simultaneous changeback

PURPOSE: To check simultaneous changebacks of traffic onto two links

PRE-TEST CONDITIONS: Linkset with one available link (end of test 3.14)

CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

SP A Link			SP B Link	
:Start traffic				
1 – 3	TRAFFIC	------------------------->		
		<-------------------------	1 – 3	TRAFFIC
1 – 1	:Activate (depending of the deactivation mean			
1 – 2	:Activate previously used)			
1 – 3	CBD, SLC 1 – 1	------------------------->		
1 – 3	CBD, SLC 1 – 2	------------------------->		
		<-------------------------	1 – X	CBA, SLC 1 – 1
		<-------------------------	1 – X	CBA, SLC 1 – 2
1 – 1	TRAFFIC (from 1 – 3)	------------------------->		
		<-------------------------	1 – 1	TRAFFIC (from 1 – 3, see note)
1 – 2	TRAFFIC (from 1 – 3)	------------------------->		
		<-------------------------	1 – 2	TRAFFIC (from 1 – 3, see note)
1 – 3	TRAFFIC	------------------------->		
		<-------------------------	1 – 3	TRAFFIC
:Wait				
:Stop traffic				

Note 1 – B may perform changebacks or not.

Note 2 – Changeback procedures may be performed in sequence. The traffic sequence presented here, after the changebacks, is the final situation.

TEST DESCRIPTION

1.	Start traffic to B and C on link 1 – 3.
2.	Simultaneously activate links 1 – 1 and 1 – 2.
3.	Check that CBDs are received and CBAs are sent (within T4) for 1 – 1 and 1 – 2 and that the traffic is changed back on links 1 – 1 and 1 – 2.
4.	Stop traffic and check that there were no lost messages, no duplication and no missequencing.

TEST NUMBER: 4.7	PAGE: 1 of 1
REFERENCE: Q.704 § 6, Fig. 28, Fig. 29, Fig. 31	
TITLE: Changeback	
SUB TITLE: Changeback from several alternative links within a linkset	
PURPOSE: To check the changeback procedure when it is performed to several links in a same linkset	
PRE-TEST CONDITIONS: Linkset with one unavailable link (end of test 3.15)	

CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

Link	SP A		Link	SP B
:Start traffic				
1 – 2, 3, 4	TRAFFIC	------------------------->		
		<-------------------------	1 – 2, 3, 4	TRAFFIC
1 – 1	:Activate (depending of the deactivation mean previously used)			
1 – 2	CBD, SLC 1 – 1	------------------------->		
1 – 3	CBD, SLC 1 – 1	------------------------->		
1 – 4	CBD, SLC 1 – 1	------------------------->		
		<-------------------------	1 – X	CBA, SLC 1 – 1
		<-------------------------	1 – X	CBA, SLC 1 – 1
		<-------------------------	1 – X	CBA, SLC 1 – 1
1 – 1	TRAFFIC (from 1 – 2, 3, 4)	------------------------->		
		<-------------------------	1 – 1	TRAFFIC (from 1 – 2, 3, 4, see note)
1 – 2, 3, 4	TRAFFIC	------------------------->		
		<-------------------------	1 – 2, 3, 4	TRAFFIC

:Wait

:Stop traffic

Note – B may perform changebacks or not.

TEST DESCRIPTION

1.	Start traffic to B and C on links 1 – 2, 1 – 3 and 1 – 4.
2.	Activate link 1 – 1 and check that a CBD is sent on links 1 – 2, 1 – 3 and 1 – 4. Check that each CBD contains a different changeback code.
3.	Check that the traffic is changed back on link 1 – 1.
4.	Stop traffic and check that there were no lost messages, no duplication and no missequencing.

TEST NUMBER: 4.8	PAGE: 1 of 1

REFERENCE: Q.704 § 6, Fig. 28, Fig. 29, Fig. 31

TITLE: Changeback

SUB TITLE: Changeback from another linkset

PURPOSE: To check the changeback procedure when it is performed from another linkset

PRE-TEST CONDITIONS: Linksets 1 and 3 unavailable (end of test 3.16)

CONFIGURATION: B	TYPE OF TEST: VAT, CPT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

```
          SP   A                          SP   B        SP   C            SP  ●
  Link                                  Link        Link             Link
:Start traffic
  2 - 1, 2   TRAFFIC    ----------->  5 - 1     -------------------------->           SP   D
                                      6 - 1     -------------------------->           SP   E
                        <-----------  2 - 1, 2  <--------------------------   5 - 1   SP   D
                        <-----------  2 - 1, 2  <--------------------------   6 - 1   SP   E
  3 - 2      :Activate  (depending of the deactivation mean previously used)
  2 - 1      CBD, SLC 3 - 2  ----------->  4 - 1  ----------->
  2 - 2      CBD, SLC 3 - 2  ----------->  4 - 1  ----------->
                        <------------------------------  3 - 2   CBA, SLC 3 - 2
                        <------------------------------  3 - 2   CBA, SLC 3 - 2
                                                         CHANGEBACK
  2 - 1, 2   TRAFFIC    ----------->  5 - 1     -------------------------->           SP   D
                                      6 - 1     -------------------------->           SP   E
                        <-----------  2 - 1, 2  <--------------------------   5 - 1   SP   D
  3 - 2      TRAFFIC    ------------------------------>  8 - 1  --------->            SP   D
             (from 2 - X)                                7 - 1  --------->            SP   E
:Wait
:Stop traffic
```

Note – After activation of link 3 – 2, CBDs are sent from C to A via B and acknowledged by A. These messages are not presented to simplify the test description.

TEST DESCRIPTION

1.	Start traffic to E (and D in VAT).
2.	Activate link 3 – 2 and check that CBDs are received and that CBAs are sent before T4 expires in A.
3.	Check that the traffic is changed back on linkset 3 in accordance with the load sharing rules in A.
4.	Stop traffic and check that there were no lost messages, no duplication and no missequencing.

TEST NUMBER: 4.9		PAGE: 1 of 1
REFERENCE: Q.704 § 6, Fig. 28, Fig. 29, Fig. 31		
TITLE: Changeback		
SUB TITLE: Changeback from two linksets		
PURPOSE: To check the changeback procedure when it is performed from two linksets		
PRE-TEST CONDITIONS: Linkset 1 unavailable (end of test 3.18)		
CONFIGURATION: B	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

```
            SP   A                              SP   B          SP   C              SP   D
 Link                                     Link            Link                 Link
:Start traffic
 2 – 1    TRAFFIC         ----------->  5 – 1  ---------------------------------->
                          <-----------  2 – 1  <----------------------------------  5 – 1   TRAFFIC
 2 – 2    TRAFFIC         ----------->  5 – 1  ---------------------------------->
                          <-----------  2 – 2  <----------------------------------  5 – 1   TRAFFIC
 3 – 1    TRAFFIC         -------------------------------->  8 – 1  ------------->
 3 – 2    TRAFFIC         -------------------------------->  8 – 1  ------------->
 1 – 2    :Activate   (depending of the deactivation mean previously used)
 2 – 1    CBD, SLC 1 – 2  ----------->  5 – 1  ---------------------------------->
 2 – 2    CBD, SLC 1 – 2  ----------->  5 – 1  ---------------------------------->
 3 – 1    CBD, SLC 1 – 2  -------------------------------->  8 – 1  ------------->
 3 – 2    CBD, SLC 1 – 2  -------------------------------->  8 – 1  ------------->          CBAs
                          <-----------  2 – X  <----------------------------------  5 – 1   SLC 1 – 2
                          <-----------  2 – X  <----------------------------------  5 – 1   SLC 1 – 2
                          <-----------  2 – X  <----------------------------------  5 – 1   SLC 1 – 2
                          <-----------  2 – X  <----------------------------------  5 – 1   SLC 1 – 2
 1 – 2    TRAFFIC     (from linksets 2 and 3)  --------------------------------------->
                          <-------------------------------------------------------  1 – 2   TRAFFIC
                                                                                            (from linksets 5,
                                                                                            see note)
 2 – 1, 2 TRAFFIC         ----------->  5 – 1  ---------------------------------->
 3 – 1, 2 TRAFFIC         -------------------------------->  8 – 1  ------------->
:Wait
:Stop traffic
```

Note – D may perform changebacks or not.

TEST DESCRIPTION

1.	Start traffic on linksets 2 and 3 to D.
2.	Activate the link 1 – 2 and check that CBDs are received and that CBAs are sent before T4 expires in A. Check that each CBD has a different changeback code.
3.	Check that the traffic is changed back to link 1 – 2 in accordance with the load sharing rules in A.
4.	Stop traffic and check that there were no lost messages, no duplication and no missequencing.

TEST NUMBER: 4.10	PAGE: 1 of 1

REFERENCE: Q.704 § 6, Fig. 28, Fig. 29, Fig. 31

TITLE: Changeback

SUB TITLE: Changeback due to various reasons

PURPOSE: To check the interface L2-L3

PRE-TEST CONDITIONS: Linkset with one available link (end of 3.19)

CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

SP A			SP B	
Link			Link	
:Start traffic				
1 – 2	TRAFFIC	------------------------->		
		<-------------------------	1 – 2	TRAFFIC
1 – 1	:Activation due to various reasons (see Note)			
1 – 2	CBD, SLC 1 – 1	------------------------->		
		<-------------------------	1 – 2	CBA, SLC 1 – 1
1 – 1	TRAFFIC (from 1 – 2)	------------------------->		
		<-------------------------	1 – 2	CBD, SLC 1 – 1
1 – X	CBA, SLC 1 – 1	------------------------->		
		<-------------------------	1 – 1	TRAFFIC (from 1 – 2)
1 – 2	TRAFFIC	------------------------->		
		<-------------------------	1 – 2	TRAFFIC

:Wait

:Stop traffic

Note – The object of this test is to check the interface L2-L3 by provoking a changeback by different means listed in § 3 (Q.704). These reasons are: initial alignment procedure completed with success, processor outage condition has ceased at the remote signalling terminal and management request.

TEST DESCRIPTION

1.	Start traffic to B and C on link 1 – 2.
2.	Provoke the activation of the link 1 – 1 (see Note above).
3.	Check that the traffic is changed back to 1 – 1.
4.	Stop traffic and check that it has been received correctly.
5.	Repeat the test for each reason.

TEST NUMBER: 4.11	PAGE: 1 of 1

REFERENCE: Q.704 § 6.4, Fig. 28, Fig. 29, Fig. 31

TITLE: Changeback

SUB TITLE: Time controlled diversion procedure

PURPOSE: To check the correct operation of the time controlled diversion procedure

PRE-TEST CONDITIONS: Linksets 1, 2 and 4 unavailable

CONFIGURATION: B	TYPE OF TEST: VAT, CPT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

```
                 SP   A                                SP   B                          SP   C
     Link                          Link                              Link
:Start traffic
        3 - 1    TRAFFIC            ------------------------------>
                 (to D and E)
                                    <------------------------------  3 - 1         TRAFFIC
                                                                                   (from D and E)
        3 - 2    TRAFFIC            ------------------------------>
                 (to D and E)
                                    <------------------------------  3 - 2         TRAFFIC
                                                                                   (from D and E)
        2 - 1     :Activate (depending of the deactivation mean previously used)
                  |
                  | T21
                  |
                  ⊥                 <------  2 - 1    TRA (see note 1)
        3 - 1, 2  TRAFFIC STOPPED
                  |
                  | T3
                  |
        2 - 1    TRAFFIC            --------->
                 (from 3 - 1, 2)
                                    <------  2 - 1    TRAFFIC (from D, see note 2)
        3 - 1, 2 TRAFFIC            ------------------------------>
                                    <------------------------------  3 - 1, 2      TRAFFIC (from E)
:Wait
:Stop traffic
```

Note 1 – If SP A is an STP, a TRA message is also sent from A to B after activation of link 2 – 1.

Note 2 – B performs the point restart procedure and D on reception of a TFA for A reroutes its traffic to A. These procedures are not presented to simplify the test description.

TEST DESCRIPTION

1.	Start traffic to E (and D in VAT) on linkset 3.
2.	Activate link 2 – 1.
3.	Check that T21 is started in A, and is stopped on reception of TRA from SP B (see notes).
4.	Check that traffic on linkset 3 ceased in A and that after expiration T3 traffic diverts to link 2 – 1 in accordance with the load sharing rules in A.
5.	Stop traffic and check that there were no lost messages, no duplication and no missequencing.
6.	Check that the duration of T3 is inside the specified range.
7.	Repeat the test (in VAT) without sending TRA from B to A and check that the time controlled diversion is performed when T21 expires.

TEST NUMBER: 5	PAGE: 1 of 1
REFERENCE: Q.704 § 7, Fig. 29, Fig. 32	
TITLE: Forced rerouting	
SUB TITLE:	
PURPOSE: To check that the system can perform forced rerouting	
PRE-TEST CONDITIONS: Linksets 1 and 4 unavailable	

CONFIGURATION: B	TYPE OF TEST: VAT, CPT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

```
                SP   A                         SP   B                   SP   C

   Link                     Link                              Link

:Start traffic
   2 – 1, 2   TRAFFIC       -----> to D and E
                            <----- 2 – 1, 2   TRAFFIC (from D)
   3 – 1, 2   TRAFFIC       ------------------------------>   to D and E
                            <------------------------------   3 – 1, 2   TRAFFIC (from E)

                                   6 – 1      :Deactivate
                            <----- 2 – X      TFP, PC = E

   3 – 1, 2   TRAFFIC       ------------------------------>
   (to D and from 2 – 1, 2 to E)
                            <------------------------------   3 – 1, 2   TRAFFIC (from E)
   2 – 1, 2   TRAFFIC       -----> to D
                            <----- 2 – 1, 2   TRAFFIC (from D)
:Wait

:Stop traffic
```

TEST DESCRIPTION

1.	Start traffic on linksets 2 and 3 to E (and D in VAT).
2.	Deactivate the linkset 6 and check the sending of a TFP concerning E from B to A.
3.	Stop traffic and check that the forced rerouting has been performed correctly, messages may have been lost but not missequenced or duplicated.
4.	Check that the traffic to D carried by the linksets 2 and 3 has not been disturbed (no lost messages, no duplication and no missequencing).
5.	Check that an indication was given by the system.

TEST NUMBER: 6	PAGE: 1 of 1
REFERENCE: Q.704 § 8, Fig. 29, Fig. 33	
TITLE: Controlled rerouting	
SUB TITLE:	
PURPOSE: To check that the system can perform controlled rerouting	
PRE-TEST CONDITIONS: Linksets 1, 4 and 6 unavailable (end of test 5)	

CONFIGURATION: B	TYPE OF TEST: VAT, CPT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

```
                SP    A                        SP    B                   SP    C

      Link                       Link                         Link

:Start traffic
      3 - 1, 2    TRAFFIC        ------------------------------>   to D and E
                                 <------------------------------   3 - 1, 2     TRAFFIC (from E)
      2 - 1, 2    TRAFFIC        ----->  to D
                                 <-----  2 - 1, 2   TRAFFIC (from D)
                                         6 - 1      :Activate
                                 <-----  2 - X      TFA, PC = E
                 |
                 | T6
                 |
      2 - 1, 2    TRAFFIC        ----->
      (to D and from 3 - 1, 2 to E)
                                 <-----  3 - 1, 2   TRAFFIC (from D)
      3 - 1, 2    TRAFFIC        ------------------------------>
                                 <------------------------------   3 - 1, 2     TRAFFIC (from E)

:Wait

:Stop traffic
```

TEST DESCRIPTION

1.	Start traffic to E (and D in VAT).
2.	Activate the linkset 6 and check the sending of a TFA concerning E from B to A.
3.	Stop traffic and check that the controlled rerouting has been performed correctly (for all traffic flows, no lost messages, no duplication and no missequencing).
4.	Check that the duration of T6 is inside the specified range.

TEST NUMBER: 7.1.1		PAGE: 1 of 1
REFERENCE: Q.704 § 10, Fig. 28		
TITLE: Management inhibiting		
SUB TITLE: Inhibition of a link – available link		
PURPOSE: To check for the correct response when link inhibition is requested for an available link		
PRE-TEST CONDITIONS: Linkset with two available links		
CONFIGURATION: A	TYPE OF TEST: VAT, CPT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

SP A			SP B	
Link			Link	
:Start traffic				
1 – 1	TRAFFIC	------------------------->		
		<-------------------------	1 – 1	TRAFFIC
1 – 2	TRAFFIC	------------------------->		
		<-------------------------	1 – 2	TRAFFIC
1 – 1	:Request inhibition			
1 – X	LIN, SLC 1 – 1	------------------------->		
		<-------------------------	1 – X	LIA, SLC 1 – 1
	TIME – CONTROLLED CHANGEOVER (see note)			
1 – 2	TRAFFIC (from 1 – 1)	------------------------->		
		<-------------------------	1 – 2	TRAFFIC (from 1 – 1)
:Wait				
:Stop traffic				

Note – A changeover is performed after the inhibition of link 1 – 1 but it is not described in this test which checks only the inhibition procedure.

TEST DESCRIPTION

1.	Start traffic to B (and C in VAT) on links 1 – 1 and 1 – 2.
2.	Initiate inhibition of link 1 – 1 and check that LIN is received and an LIA is received in A within T14.
3.	Check that the traffic normally carried by link 1 – 1 is transferred to link 1 – 2.
4.	Check that the link 1 – 1 enters in the "Local inhibiting" state.
5.	Repeat test in the reverse direction.

TEST NUMBER: 7.1.2	PAGE: 1 of 1

REFERENCE: Q.704 § 10, Fig. 28

TITLE: Management inhibiting

SUB TITLE: Inhibition of a link - unavailable link

PURPOSE: To check for the correct response when link inhibition is requested for an unavailable link

PRE-TEST CONDITIONS: Linkset with one available link

CONFIGURATION: A	TYPE OF TEST: VAT, CPT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

```
                SP    A                                                 SP    B

          Link                                                   Link

:Start traffic

          1 – 1    TRAFFIC              ------------------------->
                                        <-------------------------    1 – 1    TRAFFIC

          1 – 2    :Request inhibition

          1 – 1    LIN, SLC 1 – 2       ------------------------->
                                        <-------------------------    1 – 1    LIA, SLC 1 – 2

          1 – 2    :Activate (depending of the deactivation mean previously used)

          1 – 1    TRAFFIC              ------------------------->
                                        <-------------------------    1 – 1    TRAFFIC

:Wait

:Stop traffic
```

TEST DESCRIPTION

1.	Start traffic to B (and C in VAT) on link 1 – 1.
2.	Request inhibition of link 1 – 2, check the reception of LIN at B and send LIA in response within T14.
3.	Check that the inhibition was performed.
4.	Activate link 1 – 2 and check that it stays in inhibited state.
5.	Stop traffic and check that it was not disturbed.
6.	Repeat test in reverse direction.

TEST NUMBER: 7.2.1	PAGE: 1 of 1

REFERENCE: Q.704 § 10, Fig. 28

TITLE: Management inhibiting

SUB TITLE: Inhibition not permitted – local reject on available link

PURPOSE: To check the inhibition procedure in case of local reject on an available link

PRE-TEST CONDITIONS: Linkset with one available link

CONFIGURATION: A	TYPE OF TEST: VAT, CPT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

SP A			SP B
Link			Link
:Start traffic			
1 – 1	TRAFFIC	------------------------>	
		<------------------------	1 – 1 TRAFFIC
1 – 1	:Request inhibition		
1 – 1	TRAFFIC	------------------------>	
		<------------------------	1 – 1 TRAFFIC
:Wait			
:Stop traffic			

TEST DESCRIPTION

1. Start traffic to B (and C in VAT) on link 1 – 1.
2. Request inhibition of link 1 – 1 and check that this request is not permitted.
3. Stop traffic and check that it has not been disturbed.
4. Repeat the test but modify pre-test conditions as follows: link 1 – 1 available and link 1 – 2 inhibited by B.

TEST NUMBER: 7.2.2		PAGE: 1 of 1
REFERENCE: Q.704 § 10, Fig. 28		
TITLE: Management inhibiting		
SUB TITLE: Inhibition not permitted – local reject on unavailable link		
PURPOSE: To check the inhibition procedure in case of local reject on an unavailable link		
PRE-TEST CONDITIONS: All links unavailable		
CONFIGURATION: A	TYPE OF TEST: VAT, CPT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

SP A		SP B
Link		Link
1 – 1	:Request inhibition	

TEST DESCRIPTION

1.	Request inhibition of link 1 – 1 and check that it is rejected.

TEST NUMBER: 7.2.3	PAGE: 1 of 1
REFERENCE: Q.704 § 10, Fig. 28	
TITLE: Management inhibiting	
SUB TITLE: Inhibition not permitted – sending of LID	
PURPOSE: To check the reject of an inhibition asked on reception of an LIN	
PRE-TEST CONDITIONS: Linkset with one available link	

CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

SP A			SP B	
Link			Link	
:Start traffic				
1 – 1	TRAFFIC	------------------------->		
		<-------------------------	1 – 1	TRAFFIC
		<-------------------------	1 – 1	LIN, SLC 1 – 1
1 – 1	LID, SLC 1 – 1	------------------------->		
1 – 1	TRAFFIC	------------------------->		
		<-------------------------	1 – 1	TRAFFIC
:Wait				
:Stop traffic				

TEST DESCRIPTION

1.	Start traffic to B and C on link 1 – 1.
2.	Send an LIN, SLC 1 – 1 from B to A and check the reception of an LID.
3.	Check that the inhibition is not performed.
4.	Stop traffic and check that it has not been disturbed.

TEST NUMBER: 7.2.4		PAGE: 1 of 1
REFERENCE: Q.704 § 10, Fig. 28		
TITLE: Management inhibiting		
SUB TITLE: Inhibition not permitted – reception of LID		
PURPOSE: To check the reject of an inhibition asked on sending of an LIN		
PRE-TEST CONDITIONS: Linkset with two available links		
CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

SP A			SP B	
Link			Link	
:Start traffic				
1 – 1, 2	TRAFFIC	------------------------->		
		<-------------------------	1 – 1, 2	TRAFFIC
1 – 1	:Request inhibition			
1 – X	LIN, SLC 1 – 1	------------------------->		
		<-------------------------	1 – X	LID, SLC 1 – 1
1 – 1, 2	TRAFFIC	------------------------->		
		<-------------------------	1 – 1, 2	TRAFFIC
:Wait				
:Stop traffic				

TEST DESCRIPTION

1.	Start traffic to B and C on links 1 – 1 and 1 – 2.
2.	Request the inhibition of link 1 – 1 and check the reception of LIN and response with an LID before T14 expires in A.
3.	Check that the inhibition is not performed.
4.	Stop traffic and check that it was not disturbed.

TEST NUMBER: 7.3.1	PAGE: 1 of 1
REFERENCE: Q.704 § 10, Fig. 28	
TITLE: Management inhibiting	
SUB TITLE: Expiration of T14 – available link	
PURPOSE: To check that the inhibition procedure asked for an available link is restarted when T14 expires	
PRE-TEST CONDITIONS: Linkset with two available links	

CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

Link	SP A		Link	SP B
:Start traffic				
1 – 1	TRAFFIC	------------------------->		
		<-------------------------	1 – 1	TRAFFIC
1 – 2	TRAFFIC	------------------------->		
		<-------------------------	1 – 2	TRAFFIC
1 – 1	:Request inhibition			
1 – X	LIN, SLC 1 – 1	------------------------->		
	T14			
1 – X	LIN, SLC 1 – 1	------------------------->		
		<-------------------------	1 – 1	LIA, SLC 1 – 1
	TIME–CONTROLLED CHANGEOVER (see note)			
1 – 2	TRAFFIC (from 1 – 1)	------------------------->		
		<-------------------------	1 – 2	TRAFFIC (from 1 – 1)

:Wait

:Stop traffic

Note – A changeover is performed after the inhibition of link 1 – 1 but it is not described in this inhibition test.

TEST DESCRIPTION

1.	Start traffic to B and C on links 1 – 1 and 1 – 2.
2.	Request the inhibition of link 1 – 1, check that an LIN is received without response. Check that a new LIN is received after T14 expires and that an LIA is sent in response.
3.	Check that the inhibition is performed. Stop traffic and check that it was not disturbed.
4.	Repeat the test but without sending of an LIA. Check that after the second expiration of T14 the procedure is stopped.
5.	Check that the duration of T14 is inside the specified range.

TEST NUMBER: 7.3.2	PAGE: 1 of 1

REFERENCE: Q.704 § 10, Fig. 28

TITLE: Management inhibiting

SUB TITLE: Expiration of T14 – unavailable link

PURPOSE: To check that the inhibition procedure asked for an unavailable link is restarted when T14 expires

PRE-TEST CONDITIONS: Linkset with one available link

CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

SP A			SP B	
Link			Link	
:Start traffic				
1 – 1	TRAFFIC	------------------------->		
		<-------------------------	1 – 1	TRAFFIC
1 – 2	:Request inhibition			
1 – 1	LIN, SLC 1 – 2	------------------------->		
	T14			
1 – 1	LIN, SLC 1 – 2	------------------------->		
		<-------------------------	1 – 1	LIA, SLC 1 – 2
1 – 2	:Activate			
1 – 1	TRAFFIC	------------------------->		
		<-------------------------	1 – 1	TRAFFIC
:Wait				
:Stop traffic				

TEST DESCRIPTION

1.	Start traffic to B and C on link 1 – 1.
2.	Request inhibition of link 1 – 2, check that an LIN is received without response. Check that a new LIN is received after T14 expires and that an LIA is sent in response.
3.	Check that the inhibition is performed.
4.	Activate link 1 – 2 and check that it stays unavailable.
5.	Stop traffic and check that it was not disturbed.
6.	Repeat the test but without sending of an LIA. Check that after the second expiration of T14 the procedure is stopped.

TEST NUMBER: 7.4		PAGE: 1 of 1
REFERENCE: Q.704 § 10, Fig. 28		
TITLE: Management inhibiting		
SUB TITLE: Additionnal inhibition messages (LIA, LID, LIN)		
PURPOSE: To check the action of the system on reception of an additionnal LIA, LID or LIN		
PRE-TEST CONDITIONS: End of test 7.1.1		
CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

SP A Link			SP B Link	
:Start traffic				
1 – 2	TRAFFIC	------------------------->		
		<-------------------------	1 – 2	TRAFFIC
		<-------------------------	1 – 2	LIA, SLC 1 – 1
		<-------------------------	1 – 2	LID, SLC 1 – 1
1 – 2	TRAFFIC	------------------------->		
		<-------------------------	1 – 2	TRAFFIC
		<-------------------------	1 – 2	LIN, SLC 1 – 1
1 – 1	LIA, SLC 1 – 1	------------------------->		
1 – 2	TRAFFIC	------------------------->		
		<-------------------------	1 – 2	TRAFFIC
:Wait				
:Stop traffic				

TEST DESCRIPTION

1.	Start traffic to B and C on link 1 – 2.
2.	Send an additionnal LIA and LID on link 1 – 2.
3.	Check that these messages are ignored without impact on the traffic.
4.	Send an additionnal LIN on link 1 – 2.
5.	Check that an LIA is received in response without impact on the traffic and that the link 1 – 1 enters in the "Local and remote inhibiting" state.
6.	Stop traffic.

TEST NUMBER: 7.5	PAGE: 1 of 1

REFERENCE: Q.704 § 10, Fig. 28

TITLE: Management inhibiting

SUB TITLE: Inhibition asked by the both ends of a link

PURPOSE: To check the action of the system on reception of an LIN after sending of an LIN

PRE-TEST CONDITIONS: Linkset with two available links

CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

Link	SP A		Link	SP B
:Start traffic				
1 – 1, 2	TRAFFIC	------------------------->		
		<-------------------------	1 – 1, 2	TRAFFIC
1 – 1	:Request inhibition			
1 – X	LIN, SLC 1 – 1	------------------------->		
		<-------------------------	1 – X	LIN, SLC 1 – 1
1 – 1	LIA, SLC 1 – 1	------------------------->		
		<-------------------------	1 – X	LIA, SLC 1 – 1
	TIME-CONTROLLED CHANGEOVER (see note)			
1 – 2	TRAFFIC (from 1 – 1)	------------------------->		
		<-------------------------	1 – 2	TRAFFIC (from 1 – 1)
:Wait				
:Stop traffic				

Note – A changeover procedure is performed but not described in this inhibition test.

TEST DESCRIPTION

1.	Start traffic to B and C on link 1 – 1 and 1 – 2.
2.	Request inhibition of link 1 – 1. Check the reception of LIN and response with an LIN.
3.	Check the reception of an LIA and send an LIA.
4.	Check that the inhibition is correctly performed and that the link enters in the «Local and remote inhibiting» state.
5.	Stop traffic and check that it was not disturbed.

TEST NUMBER: 7.6.1	PAGE: 1 of 1

REFERENCE: Q.704 § 10, Fig. 28

TITLE: Management inhibiting

SUB TITLE: Manual uninhibition of a link – with changeback

PURPOSE: To check for correct restoration when link uninhibition is requested by an operator

PRE-TEST CONDITIONS: End of test 7.1.1

CONFIGURATION: A	TYPE OF TEST: VAT, CPT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

SP A			SP B	
Link			Link	
:Start traffic				
1 – 2	TRAFFIC	------------------------->		
		<-------------------------	1 – 2	TRAFFIC
1 – 1	:Request uninhibition			
1 – 2	LUN, SLC 1 – 1	------------------------->		
		<-------------------------	1 – 2	LUA, SLC 1 – 1
CHANGEBACK (See note)			CHANGEBACK (See note)	
1 – 1	TRAFFIC (from 1 – 2)	------------------------->		
		<-------------------------	1 – 1	TRAFFIC (from 1 – 2)
1 – 2	TRAFFIC	------------------------->		
		<-------------------------	1 – 2	TRAFFIC
:Wait				
:Stop traffic				

Note – A changeback procedure is performed after uninhibition of link 1 – 1 but it is not described in this test which checks only uninhibition procedure.

TEST DESCRIPTION

1.	Start traffic to B and C on link 1 – 2.
2.	Request uninhibition of link 1 – 1, check the reception of an LUN and response with an LUA inside T12.
3.	Check that the uninhibition is performed and stop traffic.
4.	Check that the traffic was shared on links 1 – 1 and 1 – 2 according to the load sharing rules.
5.	Check that an uninhibition indication was given by the system.
6.	When B has initiated inhibition (point 5, test 7.1.1), repeat test in reverse direction. Check that uninhibition is not possible when it is requested by an operation in A.

TEST NUMBER: 7.6.2	PAGE: 1 of 1
REFERENCE: Q.704 § 10, Fig. 28	
TITLE: Management inhibiting	
SUB TITLE: Manual uninhibition of a link – without changeback	
PURPOSE: To check manual uninhibition procedure when the uninhibited link stays unavailable	
PRE-TEST CONDITIONS: End of test 7.1.2 without activation of link 1 – 2 (link 1 – 2 deactivated and inhibited)	

CONFIGURATION: A	TYPE OF TEST: VAT, CPT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

SP A			SP B	
Link			Link	
:Start traffic				
1 – 1	TRAFFIC	------------------------->		
		<-------------------------	1 – 1	TRAFFIC
1 – 2	:Request uninhibition			
1 – 1	LUN, SLC 1 – 2	------------------------->		
		<-------------------------	1 – 1	LUA, SLC 1 – 2
1 – 1	TRAFFIC	------------------------->		
		<-------------------------	1 – 1	TRAFFIC
:Wait				
:Stop traffic				

TEST DESCRIPTION

1.	Start traffic B (and C in VAT) on link 1 – 1.
2.	Request uninhibition of link 1 – 2 and check that an LUN is received and that an LUA is sent in response inside T12.
3.	Check that uninhibition is performed correctly and that link 1 – 2 stays unavailable.
4.	Stop traffic and check that it was not disturbed.
5.	When B has initiated inhibition (point 6, test 7.1.2), repeat test in reverse direction. Check that uninhibition is not possible when it is requested by an operator in A.

TEST NUMBER: 7.7	PAGE: 1 of 1
REFERENCE: Q.704 § 10, Fig. 28	
TITLE: Management inhibiting	
SUB TITLE: Expiration of T12	
PURPOSE: To check uninhibition procedure on expiration of time T12	
PRE-TEST CONDITIONS: End of test 7.1.1 (1 – 1 inhibited by A)	

CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

Link	SP A		Link	SP B
:Start traffic				
1 – 2	TRAFFIC	------------------------>		
		<------------------------	1 – 2	TRAFFIC
1 – 1	:Request uninhibition			
1 – 2	LUN, SLC 1 – 1	------------------------>		
	T12			
1 – 2	LUN, SLC 1 – 1	------------------------>		
		<------------------------	1 – 2	LUA, SLC 1 – 1
CHANGEBACK (See note)			CHANGEBACK (See note)	
1 – 1	TRAFFIC (from 1 – 2)	------------------------>		
		<------------------------	1 – 1	TRAFFIC (from 1 – 2)
1 – 2	TRAFFIC	------------------------>		
		<------------------------	1 – 2	TRAFFIC
:Wait				
:Stop traffic				

Note – A changeback procedure is performed but not described in this uninhibition test.

TEST DESCRIPTION

1.	Start traffic B and C on link 1 – 2.
2.	Request uninhibition of link 1 – 1 and check that an LUN is received.
3.	Check that after expiration of T12, a new LUN is received and acknowledged by an LUA.
4.	Check that uninhibition is performed correctly.
5.	Stop traffic and check it was shared on links 1 – 1 and 1 – 2 according with the load sharing rules and that it was not disturbed.
6.	Repeat the test but without sending of an LUA. Check that after the second expiration of T12 the procedure is stopped and an indication is given to the management.
7.	Check that the duration of T12 is inside the specified range.

<table>
<tr><td colspan="3">TEST NUMBER: 7.8</td><td>PAGE: 1 of 1</td></tr>
<tr><td colspan="4">REFERENCE: Q.704 § 10, Fig. 28</td></tr>
<tr><td colspan="4">TITLE: Management inhibiting</td></tr>
<tr><td colspan="4">SUB TITLE: Not possible uninhibition</td></tr>
<tr><td colspan="4">PURPOSE: To check the actions of the system when the uninhibition is not possible</td></tr>
<tr><td colspan="4">PRE-TEST CONDITIONS: Link 1 – 2 unavailable and inhibited and link 1 – 1 available</td></tr>
<tr><td>CONFIGURATION: A</td><td colspan="2">TYPE OF TEST: VAT, CPT</td><td>TYPE OF SP: ALL</td></tr>
<tr><td colspan="4">MESSAGE SEQUENCE:

SP A SP B

Link Link

1 – 1 :Deactivate

1 – X :Request uninhibition</td></tr>
<tr><td colspan="4">TEST DESCRIPTION</td></tr>
<tr><td>1.</td><td colspan="3">Deactivate link 1 – 1.</td></tr>
<tr><td>2.</td><td colspan="3">Check that uninhibition is not performed.</td></tr>
</table>

TEST NUMBER: 7.9		PAGE: 1 of 1
REFERENCE: Q.704 § 10, Fig. 28		
TITLE: Management inhibiting		
SUB TITLE: Automatic uninhibition of a link		
PURPOSE: To check that the system performs uninhibition procedure when a point becomes unaccessible		
PRE-TEST CONDITIONS: End of test 7.1.1		
CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

```
            SP    A                                               SP    B

     Link                                                   Link

:Start traffic

     1 - 2    TRAFFIC           ------------------------->
                                <-------------------------    1 - 2    TRAFFIC

     1 - 2    :Deactivate (failure)

     1 - 1    LUN, SLC 1 - 1    ------------------------->
                                <-------------------------    1 - 1    LUA, SLC 1 - 1

              POINT RESTART PROCEDURE IS APPLIED IN A AND B (see note)

     1 - 1    TRAFFIC           ------------------------->
                                <-------------------------    1 - 1    TRAFFIC

:Wait

:Stop traffic
```

Note – When link 1-1 becomes available, point restart procedure is applied in A and B but it is not described in this inhibition test to simplify the test description.

TEST DESCRIPTION

1.	Start traffic to B and C on link 1 – 2.
2.	Deactivate link 1 – 2 and check that an LUN is received on link 1 – 1 and response with an LUA within T12.
3.	Check that uninhibition is performed and that the traffic is restarted on link 1 – 1 (see note).
4.	Stop traffic, some messages have been lost.
5.	Repeat the test but without sending of an LUA. Check that after the second expiration of T12 the procedure is stopped, an indication is given to the OMAP and the link 1 – 1 does not carry traffic.

TEST NUMBER: 7.10.1		PAGE: 1 of 1
REFERENCE: Q.704 § 10, Fig. 28		
TITLE: Management inhibiting		
SUB TITLE: Forced uninhibition of a link – sending of an LFU		
PURPOSE: To check forced uninhibition procedure when a point becomes unaccessible		
PRE-TEST CONDITIONS: Link 1 – 1 available, link 1 – 2 inhibited by B		
CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

```
              SP    A                                                SP    B

       Link                                                   Link

:Start traffic

       1 – 1   TRAFFIC              ------------------------->

                                    <-------------------------    1 – 1   TRAFFIC

       1 – 1   :Deactivate (failure)

       1 – 2   LFU, SLC 1 – 2       ------------------------->

                                    <-------------------------    1 – 2   LUN, SLC 1 – 2

       1 – 2   LUA, SLC 1 – 2       ------------------------->

               POINT RESTART PROCEDURE IS APPLIED IN A AND B (see note)

       1 – 2   TRAFFIC              ------------------------->

                                    <-------------------------    1 – 2   TRAFFIC

:Wait

:Stop traffic
```

Note – When link 1 – 2 becomes available, point restart procedure is applied in A and B but it is not described in this inhibition test to simplify the test description.

TEST DESCRIPTION

1.	Start traffic to B and C on link 1 – 1.
2.	Deactivate link 1 – 1 and check the reception of an LFU on link 1 – 2. Response by an LUN. Check that T13 is stopped and that an LUA is received.
3.	Check that uninhibition is performed and that the traffic is restarted on link 1 – 2 (see note).
4.	Stop traffic, some messages have been lost.

TEST NUMBER: 7.10.2	PAGE: 1 of 1
REFERENCE: Q.704 § 10, Fig. 28	
TITLE: Management inhibiting	
SUB TITLE: Forced uninhibition of a link – reception of an LFU	
PURPOSE: To check uninhibition procedure on reception of an LFU	
PRE-TEST CONDITIONS: Link 1 – 1 available, link 1 – 2 inhibited by A	

CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE::

```
              SP   A                                                  SP   B

        Link                                              Link

:Start traffic

        1 – 1   TRAFFIC              ------------------------->
                                     <-------------------------   1 – 1   TRAFFIC

                                     <-------------------------   1 – 2   LFU, SLC 1 – 2

        1 – 1   LUN, SLC 1 – 2       ------------------------->
                                     <-------------------------   1 – 1   LUA, SLC 1 – 2

                CHANGEBACK (see note)

        1 – 1   TRAFFIC              ------------------------->
                                     <-------------------------   1 – 1   TRAFFIC

        1 – 1   TRAFFIC              ------------------------->
                                     <-------------------------   1 – 2   TRAFFIC

:Wait
:Stop traffic
```

Note – A changeback is performed but not described in this uninhibition test.

TEST DESCRIPTION

1.	Start traffic to B and C on link 1 – 1.
2.	Send an LFU to A on link 1 – 2 and check that an LUN is received within T13 and acknowledged by an LUA inside T12.
3.	Check that the uninhibition is performed.
4.	Stop traffic and check that it was carried on 1 – 1 and 1 – 2.

TEST NUMBER: 7.11	PAGE: 1 of 1

REFERENCE: Q.704 § 10, Fig. 28

TITLE: Management inhibiting

SUB TITLE: Expiration of T13

PURPOSE: To check uninhibition procedure when T13 expires

PRE-TEST CONDITIONS: Link 1 – 1 available and link 1 – 2 inhibited by B

CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

```
                SP    A                                                SP    B

        Link                                                      Link

:Start traffic

        1 – 1    TRAFFIC                  ------------------------->
                                          <-------------------------    1 – 1    TRAFFIC

        1 – 1    :Deactivate (failure)

        1 – 2    LFU, SLC 1 – 2           ------------------------->

                     T13

        1 – 2    LFU, SLC 1 – 2           ------------------------->
                                          <-------------------------    1 – 2    LUN, SLC 1 – 2
        1 – 2    LUA, SLC 1 – 2           ------------------------->
                 POINT RESTART PROCEDURE IS APPLIED IN A AND B (see note in 7.9)
        1 – 2    TRAFFIC                  ------------------------->
                                          <-------------------------    1 – 2    TRAFFIC

:Wait

:Stop traffic
```

TEST DESCRIPTION

1.	Start traffic to B and C on link 1 – 1.
2.	Deactivate link 1 – 1 and check the reception of an LFU. After T13 expires, check the reception of a second LFU and send an LUN. Check the reception of an LUA.
3.	Check that uninhibition is performed correctly.
4.	Stop traffic and check that it has been restarted on link 1 – 2. Some messages have been lost.
5.	Repeat the test but without sending an LUN. Check that after the second expiration of T13 the procedure is stopped, that an indication is given to the OMAP and that the link 1 – 2 carries traffic normally from A.
6.	Check that the duration of T13 is inside the specified range.

TEST NUMBER: 7.12	PAGE: 1 of 1
REFERENCE: Q.704 § 10, Fig. 28	
TITLE: Management inhibiting	
SUB TITLE: Additionnal uninhibition messages (LUA, LUN, LFU)	
PURPOSE: To check the actions of the system on reception of an additionnal LUA, LUN or LFU	
PRE-TEST CONDITIONS: Linkset with two available links	

CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

	PS A			PS B
Link			Link	
:Start traffic				
1 – 1, 2	TRAFFIC	------------------------->		
		<-------------------------	1 – 1, 2	TRAFFIC
		<-------------------------	1 – 2	LUA, SLC 1 – 1
1 – 1, 2	TRAFFIC	------------------------->		
		<-------------------------	1 – 1, 2	TRAFFIC
		<-------------------------	1 – 2	LUN, SLC 1 – 1
1 – X	LUA, SLC 1 – 1	------------------------->		
1 – 1, 2	TRAFFIC	------------------------->		
		<-------------------------	1 – 1, 2	TRAFFIC
		<-------------------------	1 – 2	LFU, SLC 1 – 1
1 – X	LUN, SLC 1 – 1	------------------------->		
:Wait				
:Stop traffic				

TEST DESCRIPTION

1.	Start traffic to B and C on link 1 – 1 and 1 – 2.
2.	Send an LUA (SLC 1 – 1) on link 1 – 2.
3.	Check that this message has been ignored without impact on the traffic.
4.	Send an LUN (SLC 1 – 1) on link 1 – 2.
5.	Check that an LUA is received in response without impact on the traffic.
6.	Send an LUA (SLC 1 – 1) on link 1 – 2.
7.	Check that an LUN is received in response without impact on the trafic.
8.	Stop traffic.

TEST NUMBER: 7.13	PAGE: 1 of 1

REFERENCE: Q.704 § 10, Fig. 28

TITLE: Management inhibiting

SUB TITLE: Uninhibition at one side after test 7.5

PURPOSE: To check uninhibition procedure when the inhibition has been asked by the two ends of a link

PRE-TEST CONDITIONS: End of test 7.5

CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

SP A			SP B	
Link			Link	
:Start traffic				
1 – 2	TRAFFIC	------------------------->		
		<-------------------------	1 – 2	TRAFFIC
1 – 1	:Request uninhibition			
1 – 2	LUN, SLC 1 – 1	------------------------->		
		<-------------------------	1 – 2	LUA, SLC 1 – 1
1 – 2	TRAFFIC	------------------------->		
		<-------------------------	1 – 2	TRAFFIC
:Wait				
:Stop traffic				

TEST DESCRIPTION

1. Start traffic to B and C on link 1 – 2.
2. Request uninhibition of link 1 – 1. Check that an LUN is received and response with an LUA within T12.
3. Check that the link stays inhibited (by B).
4. Stop traffic and check that it was not disturbed.
5. Repeat test in reverse direction.

TEST NUMBER: 7.14	PAGE: 1 of 1

REFERENCE: Q.704 § 10, Fig. 28

TITLE: Management inhibiting

SUB TITLE: Automatic uninhibition after test 7.5

PURPOSE: To check automatic uninhibition of a link when the inhibition has been initiated by the both ends

PRE-TEST CONDITIONS: End of test 7.5

CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

SP A			SP B	
Link			Link	
:Start traffic				
1 – 2	TRAFFIC	------------------------->		
		<-------------------------	1 – 2	TRAFFIC
1 – 2	:Deactivate (failure)			
1 – 1	LFU, SLC 1 – 1	------------------------->		
		<-------------------------	1 – 1	LFU, SLC 1 – 1
		<-------------------------	1 – 1	LUN, SLC 1 – 1
1 – 1	LUN, SLC 1 – 1	------------------------->		
1 – 1	LUA, SLC 1 –1	------------------------->		
		<-------------------------	1 – 1	LUA, SLC 1 – 1
	POINT RESTART PROCEDURE IS APPLIED IN A AND B (see note in 7.9)			
1 – 1	TRAFFIC	------------------------->		
		<-------------------------	1 – 1	TRAFFIC
:Wait				
:Stop traffic				

TEST DESCRIPTION

1.	Start traffic to B and C on link 1 – 2.
2.	Deactivate link 1 – 2 and check that forced uninhibition is requested by the both ends which send LFU.
3.	Check that LUNs are sent by both ends in response and that LUAs are sent for acknowledgement.
4.	Check that the traffic is restarted on link 1 – 1 and stop traffic.

TEST NUMBER: 7.15	PAGE: 1 of 1
REFERENCE: Q.704 § 10, Fig. 28	
TITLE: Management inhibiting	
SUB TITLE: Automatic uninhibition with two links inhibited	
PURPOSE: To check the actions of the system when two links are inhibited and when the third (and last) link is deactivated	
PRE-TEST CONDITIONS: Links 1 – 1 and 1 – 2 inhibited (by A) and link 1 – 3 available	

CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

SP A			SP B	
Link			Link	
:Start traffic				
1 – 3	TRAFFIC	------------------------->		
		<-------------------------	1 – 3	TRAFFIC
1 – 3	:Deactivate (failure)			
1 – X	LUN, SLC 1 – 1	------------------------->		
and/or	LUN, SLC 1 – 2	------------------------->		
	(implementation dependent: at least one link must be uninhibited)			
		<-------------------------	1 – X	LUA, SLC 1 – 1, and/or
		<-------------------------	1 – X	LUA, SLC 1 – 2
	POINT RESTART PROCEDURE IS APPLIED IN A AND B (see note in 7.9)			
1 – 1	TRAFFIC	------------------------->		
and/or		<-------------------------	1 – 1	TRAFFIC
1 – 2	TRAFFIC	------------------------->	and/or	
		<-------------------------	1 – 2	TRAFFIC
:Wait				
:Stop traffic				

TEST DESCRIPTION

1.	Deactivate link 1 – 3.
2.	Check that at least one LUN is received and acknowledged with an LUA.
3.	Check that the traffic is restarted on linkset 1. Some messages have been lost.
4.	Stop traffic.

TEST NUMBER: 7.16	PAGE: 1 of 1

REFERENCE: Q.704 § 10, Fig. 28

TITLE: Management inhibiting

SUB TITLE: Reception of traffic on an inhibited link

PURPOSE: To check the actions of the system on reception of traffic on an inhibited link

PRE-TEST CONDITIONS: Link 1 – 1 inhibited by A, link 1 – 2 available

CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

	SP A		SP B	
Link			Link	
:Start traffic				
1 – 2	TRAFFIC	------------------------>		
		<------------------------	1 – 2	TRAFFIC
		<------------------------	1 – 1	TRAFFIC
:Wait				
:Stop traffic				

TEST DESCRIPTION

1. Start traffic on link 1 – 1.
2. Send traffic from B to A on the inhibited link 1 – 2. Check that the messages received in A are normally treated.
3. Stop traffic.

TEST NUMBER: 7.17.1	PAGE: 1 of 3

REFERENCE: Q.704 § 10, Fig. 28

TITLE: Management inhibiting

SUB TITLE: Management inhibiting test – Normal procedure

PURPOSE: To check that the system performs correctly the management inhibiting test

PRE-TEST CONDITIONS: Link 1-1 inhibited by A, other links are available

CONFIGURATION: A	TYPE OF TEST: VAT, CPT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

```
              SP   A                                       SP   B

      Link                                       Link

      1 – X       LLT, SLC 1 – 1     ------------->
                  |                  <-------------    1 – X       LRT, SLC 1 – 1
                  | T22                                            |
                  |                                                | T23
                  ⊥                                                |
                                                                   ⊥

      1 – X       LLT, SLC 1 – 1     ------------->
                  |                  <-------------    1 – X       LRT, SLC 1 – 1
                  |                                                |
                  |                                                |
```

TEST DESCRIPTION

1.	Check that an LLT is periodically sent by A and check (in VAT) that the duration of timer T22 is inside the specified range.
2.	Check that on the reception of an LRT, no action is taken in A.
3.	As compatibility test, check that an LRT is periodically sent from B to A.

TEST NUMBER: 7.17.1 Continued	PAGE: 2 of 3

REFERENCE: Q.704 § 10, Fig. 28

TITLE: Management inhibiting

SUB TITLE: Inhibit test procedure – Normal procedure

PURPOSE: See page 1

PRE-TEST CONDITIONS: Link 1 – 1 inhibited by B, other links are available

CONFIGURATION: A	TYPE OF TEST: VAT, CPT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

Link	SP A		Link	SP B
1 – X	LRT, SLC 1 – 1	------------->		
		<-------------	1 – X	LLT, SLC 1 – 1
	T23			
				T22
1 – X	LRT, SLC 1 – 1	------------->		
		<-------------	1 – X	LLT, SLC 1 – 1

TEST DESCRIPTION

1.	Check that an LRT is periodically sent by A and, in VAT, check that the duration of the timer T23 is inside the specified range.
2.	Check that, on the reception of an LLT, no action is taken in A.
3.	As compatibility test, check that an LLT is periodically sent from B to A.

TEST NUMBER: 7.17.1 Continued	PAGE: 3 of 3
REFERENCE: Q.704 § 10, Fig. 28	
TITLE: Management inhibiting	
SUB TITLE: Inhibit test procedure – Normal procedure	
PURPOSE: See page 1	
PRE-TEST CONDITIONS: Link 1 – 1 inhibited by A and B. The other links are available	

CONFIGURATION: A	TYPE OF TEST: VAT, CPT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

```
         SP   A                                        SP   B

 Link                                     Link

 1 – X         LLT, SLC 1 – 1  ------------->
                               <-------------  1 – X   LRT, SLC 1 – 1
 1 – X   LRT,  SLC 1 – 1       ------------->
               T22             <-------------  1 – X                    LLT, SLC 1 – 1
         T23                                           T23
 1 – X         LLT, SLC 1 – 1  ------------->                           T22
                               <-------------  1 – X            LRT,    SLC 1 – 1
 1 – X   LRT,  SLC 1 – 1       ------------->
                               <-------------  1 – X                    LLT, SLC 1 – 1
               T22
         T23                                           T23
                                                                        T22
```

TEST DESCRIPTION

1.	Check that the LLT and LRT messages are periodically sent from A to B and from B to A.

TEST NUMBER: 7.17.2	PAGE: 1 of 1

REFERENCE: Q.704 § 10, Fig. 28

TITLE: Management inhibiting

SUB TITLE: Inhibit test procedure – Reception of an LLT or LRT on an uninhibited link

PURPOSE: To check the actions of the system on reception of an LLT or LRT on an uninhibited link

PRE-TEST CONDITIONS: Link 1 – 1 available

CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

	SP A			SP B
Link			Link	
		<------------------------	1 – 1	LLT, SLC 1 – 1
1 – 1	LFU, SLC 1 – 1	------------------------>		
	T13			
		<------------------------	1 – 1	LUN, SLC 1 – 1
1 – 1	LUA, SLC 1 – 1	------------------------>		
		<------------------------	1 – 1	LRT, SLC 1 – 1
1 – 1	LUN, SLC 1 – 1	------------------------>		
	T12			
		<------------------------	1 – 1	LUA, SLC 1 – 1

TEST DESCRIPTION

1.	Send an LLT from B to A and check that an LFU is received. Then, send an LUN and check that an LUA is received.
2.	Send an LRT from B to A and check that an LUN is received. Answer with an LUA.

TEST NUMBER: 7.17.3	PAGE: 1 of 1
REFERENCE: Q.704 § 10, Fig. 28	
TITLE: Management inhibiting	
SUB TITLE: Inhibit test procedure – Reception of an LLT on a link locally inhibited	
PURPOSE: To check the actions of the system on reception of an LLT on a link locally (not remotely) inhibited	
PRE-TEST CONDITIONS: Link 1 – 1 inhibited in A, other links are available	

CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

```
        SP    A                                              SP    B

   Link                                               Link

                          <-----------------------    1 – X   LLT, SLC 1 – 1

   1 – X    LFU, SLC 1 – 1    ----------------------->
            |
            | T13
            |             <-----------------------    1 – X   LUN, SLC 1 – 1
            ⊥

   1 – X    LUA, SLC 1 – 1    <-----------------------
```

TEST DESCRIPTION

1.	Send an LLT from B to A and check that an LFU is received as described above.

TEST NUMBER: 7.17.4	PAGE: 1 of 1
REFERENCE: Q.704 § 10, Fig. 28	
TITLE: Management inhibiting	
SUB TITLE: Inhibit test procedure – Reception of an LRT on a link remotely inhibited	
PURPOSE: To check the actions of the system on reception of an LRT on a link remotely inhibited	
PRE-TEST CONDITIONS: Link 1 – 1 inhibited by B, other links are available	

CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

SP A			SP B	
Link			Link	
		<------------	1 – X	LRT, SLC 1 – 1
1 – X	LUN, SLC 1 – 1	------------>		
	T12			
		<------------	1 – X	LUA, SLC 1 – 1

TEST DESCRIPTION

1.	Send an LRT from B to A and check that an LUN is received as described above.

TEST NUMBER: 8.1	PAGE: 1 of 1
REFERENCE: Q.704 § 11, 12.6, Fig. 46A	
TITLE: Signalling traffic flow control	
SUB TITLE: Reception of a TFC	
PURPOSE: To check the actions of the system on reception of a TFC	
PRE-TEST CONDITIONS: One or more link available	

CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

SP A		SP B
Link		Link
:Start traffic		
1 – 1 TRAFFIC	------------>	
	<------------	1 – 1 TRAFFIC
	<------------	1 – 1 TFC, DPC = C
:Wait		
:Stop traffic		

Note – This test requires further study.

TEST DESCRIPTION

1. Start traffic to B and C.
2. Send a TFC concerning C and check that this message is received correctly.

TEST NUMBER: 8.2	PAGE: 1 of 1

REFERENCE: Q.704 § 11, 12.6, Fig. 46A

TITLE: Signalling traffic flow control

SUB TITLE: Sending of TFCs

PURPOSE: To check the detection of a level 3 congestion

PRE-TEST CONDITIONS: All links available

CONFIGURATION: C	TYPE OF TEST: VAT	TYPE OF SP: STP

MESSAGE SEQUENCE:

```
                SP   B                          SP   A                       SP   C
      Link                  Link                                    Link

:Start traffic
  1 - 1      TRAFFIC   (>n/2 E) ------->  2 - 1  ----- (n E) ------->
                       <---------------   1 - 1  <----------------   2 - 1    TRAFFIC (<n E)
  1 - 2      TRAFFIC   (>n/2 E) ------->  2 - 1  ----- (n E) ------->
                       <---------------   1 - 2  <----------------   2 - 1    TRAFFIC (<n E)
:Wait
                       <---------------   1 - X  TFC, DPC = C
                                                 .
                                                 .
                                                 . One TFC each 8 messages sent to C
                                                 .
                       <---------------   1 - X  TFC, DPC = C
                                                 .
                                                 .
  1 - 1      TRAFFIC   (<n E) ---------->  2 - 1  ----------------->
                       <----------------  1 - 1  <----------------   2 - 1    TRAFFIC (<n E)
  1 - 2      TRAFFIC   (<n E) ---------->  2 - 1  ----------------->
                       <----------------  1 - 2  <----------------   2 - 1    TRAFFIC (<n E)
:Wait
:Stop traffic
```

Note – n is the maximum load capacity of linkset 2. The traffic model used in this test is described in Table 2/Q.706.

TEST DESCRIPTION

1.	Start traffic to C with a load exceeding n/2 erlang on links 1 – 1 and 1 – 2 (n is the maximum load that the link 2 may carry without congestion).
2.	Check that the signalling traffic flow control procedure is started in A. Check that a TFC message concerning C is received for each 8 messages received in B during the congestion.
3.	Reduce the load to 0.1 erlang or less on links 1 – 1 and 1 – 2.
4.	Check that the congestion disappears and that no TFC is received.
5.	Stop traffic.
6.	Check that the traffic from C to B has not been disturbed.

TEST NUMBER: 8.3		PAGE: 1 of 1
REFERENCE: Q.704 § 11.2.7		
TITLE: Signalling traffic flow control		
SUB TITLE: Reception of a UPU		
PURPOSE: To check the actions of the system on reception of a UPU		
PRE-TEST CONDITIONS: One link available		
CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: see note

MESSAGE SEQUENCE:

SP A				SP B
Link			Link	
:Star traffic				
1 – 1	TRAFFIC (DPC=B, SI=X)	------------>		
1 – 1	TRAFFIC (DPC=C, SI=X)	------------>		
		<------------	1 – 1	TRAFFIC (OPC=C, SI=X)
		<------------	1 – 1	UPU (OPC=B, SI=X)
1 – 1	TRAFFIC (DPC=C, SI=X)	------------>		
		<------------	1 – 1	TRAFFIC (OPC=C, SI=X)

:Wait

:Stop traffic

Note – The impact of the reception of a UPU on the traffic from A to B requires further study. The SPs having user part(s) are concerned.

TEST DESCRIPTION

1.	Start traffic to B and C with SI=X.
2.	Send a UPU from B to C with SI=X.
3.	Check that the UPU message is received correctly without impact on the traffic from to A to C.
4.	Wait and stop traffic.

TEST NUMBER: 8.4		PAGE: 1 of 1
REFERENCE: Q.704 § 11.2.7		
TITLE: Signalling traffic flow control		
SUB TITLE: Sending of a UPU		
PURPOSE: To check the detection of an unavailability of a user part		
PRE-TEST CONDITIONS: One link available		
CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: See note

MESSAGE SEQUENCE:

Link	SP A		Link	SP B
:Start traffic				
1 – 1	TRAFFIC (to B and C, SI=X)	------------------------>		
		<------------------------	1 – 1	TRAFFIC (from B and C, SI=X)
	:Deactivate user part X (see note)			
		<------------------------	1 – 1	MESSAGE (from B to A, SI=X)
1 – 1	UPU (DPC = B, SI=X)	------------------------>		
		<------------------------	1 – 1	MESSAGE (from C to A, SI=X)
1 – 1	UPU (DPC = C, SI=X)	------------------------>		
		<------------------------	1 – 1	MESSAGE (from B to A, SI=X)
1 – 1	UPU (DPC = B, SI=X)	------------------------>		
	:Reactivate user part X			
		<------------------------	1 – 1	TRAFFIC (from B and C to A, SI=X)
1 – 1	TRAFFIC (to B and C, SI=X)	------------------------>		

:Wait

:Stop traffic

Note – The notion of unavailability of a user part is specific to the implementation, consequently, the ability to deactivate a user part is implementation dependent. The SPs having user part(s) are concerned.

TEST DESCRIPTION

1. Start traffic to B and C with SI = X.
2. Deactivate the user part X.
3. Send a message from B to the user part X in A and check that this message is discarded and that a UPU is sent back.
4. Send a message from C to the user part X in A and check that this message is discarded and that a UPU is sent back.
5. Repeat point 3 and reactivate the user part.
6. Check that the messages sent from B and C are received correctly and that no UPU is sent back. Wait and stop traffic.

TEST NUMBER: 9.1.1	PAGE: 1 of 1
REFERENCE: Q.704 § 13, Fig. 29, Fig. 44	
TITLE: Signalling route management	
SUB TITLE: Sending of a TFP on an alternative route – failure of normal linkset	
PURPOSE: To check the sending of a TFP on the alternative route when the normal linkset becomes unavailable	
PRE-TEST CONDITIONS: All linksets available	

CONFIGURATION: D	TYPE OF TEST: VAT, CPT	TYPE OF SP: STP

MESSAGE SEQUENCE:

```
                SP   A                        SP   B          SP   C               SP  ●

        Link                           Link            Link               Link

:Start traffic

        1 – 1   TRAFFIC     ----------->  5 – 1  ---------------------------->    SP   D
                (from A and F)            6 – 1  ---------------------------->    SP   E
        2 – 1   TRAFFIC     ------------------------------->  7 – 1  -------->    SP   E
                (from A and F)

        1 – 1   :Deactivate   (MML command or failure)

        2 – 1   TFP, PC = B ------------------------------->

        2 – 1   TFP, PC = D ------------------------------->

        2 – 1   TRAFFIC     ------------------------------->  7 – 1  -------->    SP   E
                (from 1 – 1)                                  8 – 1  -------->    SP   D

:Wait
:Stop traffic
```

Note – A changeover procedure is performed after deactivation of link 1 – 1 but it is not described in this transfer prohibited test.

TEST DESCRIPTION

1.	Start traffic to D and E on linkset 1 and 2.
2.	Deactivate link 1 – 1 and check that TFPs concerning B and D are sent from A to C (alternative route to reach B and D). Check that no TFP concerning E is sent from A to C (load sharing between linksets 1 and 2 in A to reach E).
3.	Check that time out T8 is started for each TFP sent.
4.	Check that the traffic to D and E is diverted to C.
5.	Stop traffic and check that it was not disturbed.

TEST NUMBER: 9.1.2	PAGE: 1 of 1

REFERENCE: Q.704 § 13, Fig. 29, Fig. 44

TITLE: Signalling route management

SUB TITLE: Sending of a TFP on an alternative route – on reception of a TFP

PURPOSE: To check the sending of a TFP on the alternative route when the normal route becomes unavailable on reception of a TFP

PRE-TEST CONDITIONS: Linkset 4 unavailable

CONFIGURATION: D	TYPE PF TEST: VAT, CPT	TYPE OF SP: STP

MESSAGE SEQUENCE:

```
                 SP   A                         SP   B          SP   C               SP   ●
      Link                              Link            Link                  Link
:Start traffic
      1 – 1      TRAFFIC       ----------->  5 – 1   ----------------------------->    SP   D
                 (from A and F)              6 – 1   ----------------------------->    SP   E
      2 – 1      TRAFFIC       -------------------------------->  7 – 1  --------->    SP   E
                 (from A and F)

                                             5 – 1    :Deactivate
   See note                    <-----------  1 – 1    TFP, PC = D
      2 – 1      TFP, PC = D   -------------------------------->
      1 – 1      TRAFFIC       ----------->  6 – 1   ----------------------------->    SP   E
                 (from A and F)
      2 – 1      TRAFFIC       -------------------------------->  8 – 1  --------->    SP   D
                 (from A and F, and from 1 – 1 to D)              7 – 1  --------->    SP   E

:Wait
:Stop traffic
```

Note – A forced rerouting is performed after the reception of TFP for D in A but it is not described in this transfer prohibited test.

TEST DESCRIPTION

1.	Start traffic to D and E.
2.	Deactivate link 5 – 1 and check that a TFP concerning D is sent to A.
3.	Check that a TFP concerning D is received from A and that traffic to D is diverted via C.
4.	Check that a time out T8 is started.
5.	Stop traffic and check that traffic to E has not been disturbed. Some messages to D may have been lost.

TEST NUMBER: 9.2.1		PAGE: 1 of 1
REFERENCE: Q.704 § 13, Fig. 29, Fig. 44		
TITLE: Signalling route management		
SUB TITLE: Broadcast of TFPs – on one linkset failure		
PURPOSE: To check the broadcast of TFPs when one point is inaccessible		
PRE-TEST CONDITIONS: All linksets available		
CONFIGURATION: D	TYPE OF TEST: VAT, CPT	TYPE OF SP: STP

MESSAGE SEQUENCE:

```
                SP   A                      SP   B           SP   C           SP   F

      Link                            Link             Link             Link

:Start traffic
      3 – 1     TRAFFIC   ---------------------------------------------------->
                (from A, D and E)
      3 – 1     :Deactivate   (MML command or failure)
      1 – 1     TFP, PC = F    ------------>
      2 – 1     TFP, PC = F    ------------------------------->

:Wait

:Stop traffic
```

Note – The propagation of TFPs is not presented to simplify the test description.

TEST DESCRIPTION

1.	Start traffic to F.
2.	Deactivate link 1 – 1 and check that TFPs concerning F are broadcasted.
3.	Check that a timer T8 is started.
4.	Stop traffic.

TEST NUMBER: 9.2.2	PAGE: 1 of 2
REFERENCE: Q.704 § 13 Fig. 29, Fig. 44	
TITLE: Signalling route management	
SUB TITLE: Broadcast of TFPs – On multiple failures	
PURPOSE: To check the broadcast of TFPs when several point are inaccessible (various reasons)	
PRE-TEST CONDITIONS: Linkset 1 unavailable	

CONFIGURATION: D	TYPE OF TEST: VAT, CPT	TYPE OF SP: STP

MESSAGE SEQUENCE:

SP A SP B SP C SP ●

Link Link Link Link

:Start traffic

2 – 1 TRAFFIC ------------------------------> 7 – 1 ------------> SP E

(from A and F) 8 – 1 ------------> SP D

2 – 1 :Deactivate (MML command or failure)

3 – 1 TFP, PC = B ---> SP F

3 – 1 TFP, PC = C --->

3 – 1 TFP, PC = D --->

3 – 1 TFP, PC = E --->

:Wait

:Stop traffic

TEST DESCRIPTION

1.	Start traffic to D and E.
2.	Deactivate linkset 2 and check that TFPs concerning B, C, D and E are broadcasted (to F).
3.	Check that for each TFP sent a timer T8 is started.
4.	Repeat test but with linkset 2 unavailable as pre-test condition and then deactivate linkset 1.

TEST NUMBER: 9.2.2 Continued		PAGE: 2 of 2
REFERENCE: Q.704 § 13 Fig. 29, Fig. 44		
TITLE: Signalling route management		
SUB TITLE: Broadcast of TFPs – On multiple failures		
PURPOSE: See page 1		
PRE-TEST CONDITIONS: Linksets 1 and 4 unavailable		
CONFIGURATION: D	TYPE OF TEST: VAT, CPT	TYPE OF SP: STP

MESSAGE SEQUENCE:

```
        SP   A                      SP   C                  SP   D                SP   ●

 Link                                Link              Link                   Link
:Start traffic
 2 – 1  TRAFFIC        -------->    8 – 1             ----------->
        (from A and F)              7 – 1   ---------------------------------->            SP  E
                                    8 – 1   :Deactivate
                       <--------    2 – 1   TFP, PC = D
 3 – 1  TFP, PC = D    ----------------------------------------------------------->        SP  F
 2 – 1  TRAFFIC        -------->    7 – 1   ---------------------------------->            SP  E
        (from A and F)
:Wait
:Stop traffic
```

TEST DESCRIPTION

1.	Start traffic to D and E.
2.	Deactivate linkset 8 and check that a TFP (PC = D) is sent. Check that TFP's are broadcasted (here to F).
3.	Check that a time out T8 started.
4.	Stop traffic and check that traffic to E has not been disturbed.
5.	Repeat the test with linksets 2 and 4 unavailable as pre-test conditions and then deactivate linkset 5. Repeat the test with linksets 4 and 8 unavailable as pre-test conditions and then deactivate linkset 1.
6.	Repeat the test with linksets 4 and 5 unavailable as pre-test conditions and then deactivate linkset 2.

TEST NUMBER: 9.3	PAGE: 1 of 2

REFERENCE: Q.704 § 13 Fig. 29, Fig. 44

TITLE: Signalling route management

SUB TITLE: Reception of a message for an unaccessible destination

PURPOSE: To check that a TFP is sent in response to a message received for an unaccessible destination

PRE-TEST CONDITIONS: Linksets 1, 4 and 8 unavailable

CONFIGURATION: D	TYPE OF TEST: VAT	TYPE OF SP: STP

MESSAGE SEQUENCE:

Link	SP A		Link	SP F
				:Sent a message to D
		<---------------	3 – 1	MESSAGE TO D
3 – 1	TFP, PC = D	--------------->		
	T8			
		<---------------	3 – 1	MESSAGE TO D

TEST DESCRIPTION

1. Send from F a message with OPC = D to A.
2. Check that a TFP PC = D is sent in response. Check that a time out T8 is started.
3. During T8, send a new message with OPC = D to A and check that no TFP is sent.

TEST NUMBER: 9.3 Continued		PAGE: 2 of 2
REFERENCE: Q.704 § 13 Fig. 29, Fig. 44		
TITLE: Signalling route management		
SUB TITLE: Reception of a message for an unaccessible destination		
PURPOSE: See page 1		
PRE-TEST CONDITIONS: Linksets 1 and 8 unavailable		
CONFIGURATION: D	TYPE OF TEST: VAT	TYPE OF SP: STP

MESSAGE SEQUENCE:

```
      SP   A                     SP   B                 SP   C               SP   ●

 Link                       Link            Link                 Link

:Start traffic
 3 – 1   TRAFFIC     ----------------------------------------------->              SP   F
         (from A, D and
         E)
 3 – 1   :Deactivate (MML command or failure)
 2 – 1   TFP, PC = F    ------------------------->
          |             --------------------------┐
          |                                       |  4 – 1
          |   T8                   <--------------┘
          |
          |             <-------------------------   2 – 1              MESSAGE TO F
          |
```

TEST DESCRIPTION

1.	Start traffic to F.
2.	Deactivate linkset 3 and check that TFPs are broadcasted.
3.	Within T8, send one message with DPC = F from C to A and check that no TFP is sent in response.

TEST NUMBER: 9.4.1	PAGE: 1 of 1

REFERENCE: Q.704 § 13 Fig. 29, Fig. 45

TITLE: Signalling route management

SUB TITLE: Sending of a TFA on an alternative route – Recovery of normal linkset

PURPOSE: To check the sending of a TFA on an alternative route when the normal linkset becomes available

PRE-TEST CONDITIONS: Linkset 1 unavailable (end of test 9.1.1)

CONFIGURATION: D	TYPE OF TEST: VAT, CPT	TYPE OF SP: STP

MESSAGE SEQUENCE:

```
      SP   A                     SP   B                  SP   C              SP   ●

 Link                        Link          Link                   Link
:Start traffic
 2 – 1   TRAFFIC       ---------------------------->  8 – 1   ------------>            SP  D
         (from A and F)                               7 – 1   ------------>            SP  E
 1 – 1   :Activate (depending of the activation mean previously used)
 2 – 1   TFA, PC = B   ---------------------------->
 2 – 1   TFA, PC = D   ---------------------------->
 1 – 1   TFP, PC = D   -------->
 1 – 1   TFP, PC = E   -------->
 1 – 1   TRAFFIC       -------->   5 – 1   --------------------------------->          SP  D
         (from A and F             6 – 1   --------------------------------->          SP  E
         and from 2 – 1)
 2 – 1   TRAFFIC       ---------------------------->  7 – 1   ------------>            SP  E
         (from A and F)
:Wait
:Stop traffic
```

Note – a changeback procedure is performed after activation of link 1-1 but it is not described in this transfer allowed test.

TEST DESCRIPTION

1.	Start traffic to D and E.
2.	Activate linkset 1 and check that traffic to D and E is diverted on linkset 1 and that a TFA concerning D is sent from A to C. Check that no TFA is sent concerning E (load sharing in A between linksets 1 and 2).
3.	Stop traffic and check that is was rerouted correctly without loss of messages, duplication and missequencing.

TEST NUMBER: 9.4.2	PAGE: 1 of 1
REFERENCE: Q.704 § 13 Fig. 29, Fig. 45	
TITLE: Signalling route management	
SUB TITLE: Sending of a TFA on an alternative route – On reception of a TFA	
PURPOSE: To check that a TFA is sent on the alternative route when the normal route becomes available on reception of a TFA	
PRE-TEST CONDITIONS: Linksets 4 and 5 unavailable (end of test 9.1.2)	

CONFIGURATION: D	TYPE OF TEST: VAT, CPT	TYPE OF SP: STP

MESSAGE SEQUENCE:

```
     SP   A                  SP   B                  SP   C                SP   ●

  Link                       Link          Link                     Link

:Start traffic

 1 – 1   TRAFFIC          -------->   6 – 1   ---------------------------------->      SP  E
         (from A and F)
 2 – 1   TRAFFIC          ------------------------------>  7 – 1   ------------>      SP  E
         (from A and F)                                    8 – 1   ------------>      SP  D

                                      5 – 1   :Activate

      See note            <--------   1 – 1   TFA, PC = D
 1 – 1   TFP, PC = D      -------->
 2 – 1   TFA, PC = D      ------------------------------>

 1 – 1   TRAFFIC          -------->   5 – 1   ---------------------------------->      SP  D
 (from A and F, from 2 – 1 to D)      6 – 1   ---------------------------------->      SP  E
 2 – 1   TRAFFIC          ------------------------------>  7 – 1   ------------>      SP  E
         (from A and F)

:Wait

:Stop traffic
```

Note – a controlled rerouting is performed after the activation of linkset 5 it is not described in this transfer allowed test.

TEST DESCRIPTION

1.	Start traffic to D and E.
2.	Activate link 5 – 1 and check that a TFA concerning D is sent to A.
3.	Check that the traffic to D is diverted via B and check that a TFA concerning D is sent from A to C.
4.	Stop traffic and check that traffic was not disturbed.

TEST NUMBER: 9.5.1		PAGE: 1 of 1
REFERENCE: Q.704 § 13 Fig. 29, Fig. 45		
TITLE: Signalling route management		
SUB TITLE: Broadcast of TFAs – On one linkset recovery		
PURPOSE: To check the broadcast of TFA when a destination becomes accessible		
PRE-TEST CONDITIONS: Linkset 3 unavailable (end of test 9.2.1)		
CONFIGURATION: D	TYPE OF TEST: VAT, CPT	TYPE OF SP: STP

MESSAGE SEQUENCE:

```
        SP   A                    SP   B                SP   C                SP   ●

 Link                         Link             Link                Link

 3 – 1   :Activate (see Note 1)
 1 – 1   TFA, PC = F   -------->(see Note 2)
 2 – 1   TFA, PC = F   ----------------------------->(see Note 2)
:Start traffic
 3 – 1   TRAFFIC       ------------------------------------------------------->        SP  F
         (from A and F)
:Wait
:Stop traffic
```

Note 1 – After activation of the linkset 3, SPs A and F perform a point restart procedure which is not explicitly described in this test.

Note 2 – The propagation of TFAs is not presented to simplify the test description.

TEST DESCRIPTION

1.	Activate linkset 3.
2.	Check that TFAs concerning F are broadcasted.
3.	Start traffic to F and check that it is routed correctly; stop traffic.

TEST NUMBER: 9.5.2	PAGE: 1 of 2
REFERENCE: Q.704 § 13 Fig. 29, Fig. 45	
TITLE: Signalling route management	
SUB TITLE: Broadcast of TFAs – Various reasons	
PURPOSE: To check the broadcast of TFA when several destinations become accessible in various network situations	
PRE-TEST CONDITIONS: Linksets 1 and 2 unavailable (end of test 9.2.2 page 1 of 2)	

CONFIGURATION: D	TYPE OF TEST: VAT, CPT	TYPE OF SP: STP

MESSAGE SEQUENCE:

```
      SP   A                    SP   B                   SP   C                 SP   ●

 Link                          Link                Link                 Link

 2 – 1   :Activate
 3 – 1   TFA, PC = B  --------------------------------------------------------->          SP  F
 3 – 1   TFA, PC = C  --------------------------------------------------------->          SP  F
 3 – 1   TFA, PC = D  --------------------------------------------------------->          SP  F
 3 – 1   TFA, PC = E  --------------------------------------------------------->          SP  F
 2 – 1   TFP, PC = B  ------------------------------>
 2 – 1   TFP, PC = D  ------------------------------>
 2 – 1   TFP, PC = E  ------------------------------>
:Start traffic
 2 – 1   TRAFFIC      ------------------------------>  7 – 1  ----------->          SP  E
         (from A and F)                                8 – 1  ----------->          SP  D
:Wait
:Stop traffic
```

Note – After activation of the linkset 2, SPs A and C perform the point restart procedure which is not described in this test.

TEST DESCRIPTION

1.	Activate linkset 2.
2.	Check that TFAs concerning B, C, D and E are broadcasted.
3.	Start traffic and check that it is routed correctly; stop traffic.
4.	Repeat test but activate linkset 1 instead of linkset 2.

TEST NUMBER: 9.5.2 Continued	PAGE: 2 of 2

REFERENCE: Q.704 § 13 Fig. 29, Fig. 45

TITLE: Signalling route management

SUB TITLE: Broadcast of TFAs – Various reasons

PURPOSE: See page 1 of 2

PRE-TEST CONDITIONS: Linksets 1, 4 and 8 unavailable (end of tests 9.2.2 page 2 of 2)

CONFIGURATION: D	TYPE OF TEST: VAT, CPT	TYPE OF SP: STP

MESSAGE SEQUENCE:

```
      SP   A                     SP   B              SP   C                 SP   ●

 Link                          Link             Link                  Link

:Start traffic
  2 – 1   TRAFFIC       ----------------------------> 7 – 1   ----------->        SP  E
          (from A and F)
                                                      8 – 1   :Activate
                        <----------------------------  2 – 1   TFA, PC = D
  2 – 1   TFP, PC = D   ---------------------------->
  3 – 1   TFA, PC = D   -------------------------------------------------->        SP  F
  2 – 1   TRAFFIC       ----------------------------> 7 – 1   ----------->        SP  E
          (from A and F)                              8 – 1   ----------->        SP  D
:Wait
:Start traffic
```

TEST DESCRIPTION

1.	Start traffic to E.
2.	Activate linkset 8 and check that a TFA concerning D is sent from C to A. Check that A broadcasts TFAs concerning D.
3.	Check that the traffic to D is restarted.
4.	Repeat test with linksets 2, 4 and 5 unavailable as pre-test conditions and activate linkset 5. Repeat test with linksets 1, 4 and 8 unavailable as pre-test conditions and activate linkset 1. Repeat test with linksets 2, 4 and 5 as pre-test conditions and activate linkset 2.

TEST NUMBER: 9.6	PAGE: 1 of 1

REFERENCE: Q.704 § 13 Fig. 29, Fig. 46

TITLE: Signalling route management

SUB TITLE: Periodic sending of Signalling-Route-Set-Test messages (SRST)

PURPOSE: To check the periodic test of a unavailable signalling route is performed correctly

PRE-TEST CONDITIONS: Linkset 2 unavailable

CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

SP A			SP B	
link			link	
:Start traffic				
1 – 1	TRAFFIC	--------------->		
		<---------------	1 – 1	TRAFFIC
1 – 1	RST, PC = C	--------------->		
	T10			
1 – 1	RST, PC = C	--------------->		
	T10		2 – 1	:Activate
		<---------------	1 – 1	TFA, PC = C
1 – 1	TRAFFIC	--------------->		
		<---------------	1 – 1	TRAFFIC
:Wait				
:Stop traffic				

TEST DESCRIPTION

1.	Start traffic to B.
2.	Check that at each expiration of T10, a signalling-Route-Set-Test message concerning C is received from A without response.
3.	Activate linkset 2 and check that a TFA is received and that T10 is stopped.
4.	Check that traffic to C is restarted and stop traffic.
5.	Repeat the test but without sending of TFA after activation of linkset 2 and check that when a RST is received a TFA is sent in response. Check that T10 and signalling-route-set-test procedure are stopped.
6.	Check that the duration of T10 is inside the specified range.

TEST NUMBER: 9.7	PAGE: 1 of 1

REFERENCE: Q.704 § 13 Fig. 29, Fig. 46

TITLE: Signalling route management

SUB TITLE: Reception of a Signalling-Route-Set-Test-Message

PURPOSE: To check the actions of the system on reception of an SRST

PRE-TEST CONDITIONS: Linksets 2 and 3 unavailable

CONFIGURATION: D	TYPE OF TEST: VAT	TYPE OF SP: STP

MESSAGE SEQUENCE:

```
                      SP   A                          SP   B             SP   F

    Link                                       Link              Link
                                    <---------------   1 - 1 RST, PC = F
                                                                |
    3 - 1         :Activate                                     | T10
    1 - 1         TFA, PC = F       --------------->   (ignored)|
                                    <---------------   1 - 1 RST, PC = F
                                                                |
                                                                | T 10
    1 - 1         TFA, PC = F       --------------->            ⊥
    3 - 1         TRAFFIC           ---------------------------------->
                  (from A, D and E)
:Wait
:Stop traffic
```

TEST DESCRIPTION

1.	Send to A RST message concerning F and check that no response is received.
2.	Activate linkset 3 and check that a TFA is received but ignored in B.
3.	Send a RST message concerning F after activation of linkset 3 and check that a TFA is received in response.
4.	Repeat the test but with linksets 1 and 3 unavailable as pre-test conditions and RST message sent from C.

TEST NUMBER: 10.1.1	PAGE: 1 of 1

REFERENCE: Q.704 § 9

TITLE: Signalling point restart

SUB TITLE: Recovery of a linkset (SP A has not STP function) – With use of point restart procedure

PURPOSE: To check that point restart procedure is performed correctly when the recovery of a linkset restores connexity between two adjacent SPs

PRE-TEST CONDITIONS: Linksets 1, 2, 4 and 6 are unavailable

CONFIGURATION: B	TYPE OF TEST: VAT, CPT	TYPE OF SP: SP

MESSAGE SEQUENCE:

```
       SP    A                    SP    B               SP    C                SP   ●
  Link                              Link            Link                  Link
:Start traffic
3 – 1, 2   TRAFFIC    ------------------------------>  7 – 1   ------------>              SP  E
                                                        8 – 1   ------------>              SP  D
                      <------------------------------ 3 – 1, 2 <------------    7 – 1      SP  E
                                                                <------------    8 – 1      SP  D
  2 – 1    :Activate
           | T21      <--------   2 – 1 TFP (PC = C)
           |          <--------   2 – 1 TFP (PC = E)
           |          <--------   2 – 1 TRA
           ⊥
           TIME CONTROLLED DIVERSION IS APPLIED
  2 – 1    TRAFFIC     -------->   5 – 1   --------------------------------->              SP  D
           (from 3 – 1, 2)
                       <--------   2 – 1   <---------------------------------   5 – 1      SP  D
3 – 1, 2   TRAFFIC    ------------------------------>  7 – 1   ------------>              SP  E
                                                        8 – 1   ------------>              SP  D
                      <------------------------------ 3 – 1, 2 <------------    7 – 1      SP  E
:Wait
:Stop traffic
```

Note – The time controlled diversion procedure is applied in A and a changeback is performed in D. These procedures are not described in this point restart test.

TEST DESCRIPTION

1.	Start traffic to E (and D in VAT).
2.	Activate link 2 – 1 and check that the timer T21 is started. Check that TFPs sent from B are received in A. Check that the timer T21 is stopped on reception of the TRA message received from B.
3.	Check that the time controlled diversion procedure is performed at the end of T21. Check that the traffic to D is diverted to the link 2 – 1 in accordance with the load sharing rules in A. Check that the traffic to E is not diverted.
4.	Stop traffic and check that there were no lost messages, no duplication and no missequencing.
5.	Repeat the test (in VAT) without sending of TRA and check that the duration of timer T21 is inside the specified range.

TEST NUMBER: 10.1.2		PAGE: 1 of 1
REFERENCE: Q.704 § 9		
TITLE: Signalling point restart		
SUB TITLE: Recovery of a linkset (SP A has not STP function) – Without use of point restart procedure		
PURPOSE: To check the actions of the system in case of restart of a linkset		
PRE-TEST CONDITIONS: Linksets 1, 2 and 6 unavailable		
CONFIGURATION: B	TYPE OF TEST: VAT	TYPE OF SP: SP

MESSAGE SEQUENCE:

```
      SP    A                    SP    B                  SP    C                 SP    ●

 Link                            Link               Link                 Link

:Start traffic

3 – 1, 2  TRAFFIC   ---------------------------->  7 – 1   ----------->            SP  E
                                                   8 – 1   ----------->            SP  D
                            ┌4 – 1   <-------------------------------   5 – 1     SP  D
                            └-------------->   3 – 1, 2┐
                  <------------------------------------┘
                  <----------------------------  3 – 1, 2  <-----------   7 – 1     SP  E

 2 – 1    :Activate

          CHANGEBACKS ARE PERFORMED IN A AND B (see note)

 2 – 1    TRAFFIC   ------->  4 – 1   ------->  7 – 1   ----------->               SP  E
 2 – 1    TRAFFIC   ------->  5 – 1   ---------------------------------->          SP  D
3 – 1, 2  TRAFFIC   ---------------------------->  7 – 1   ----------->            SP  E
                                                   8 – 1   ----------->            SP  D
                    ------->  2 – 1   <-------------------------------   5 – 1     SP  D
                    ---------------------------->  3 – 1, 2  ----------->  7 – 1   SP  E

:Wait

:Stop traffic
```

Note – After activation of link 2 – 1, changebacks are performed in A and B but they are not explicitly described in this point restart test.

TEST DESCRIPTION

1.	Start traffic to E and D.
2.	Activate link 2 – 1. Check that the point restart procedure is not applied and that changebacks are performed.
3.	Check that the traffic from A is diverted to the link 2 – 1 in accordance with the load sharing rules in A.
4.	Check that the signalling route set test procedure is not applied after the activation of the link 2 – 1.
5.	Stop traffic and check that there were no lost messages, no duplication and no missequencing.

TEST NUMBER: 10.2.1	PAGE: 1 of 2
REFERENCE: Q.704 § 9	
TITLE: Signalling point restart	
SUB TITLE: Recovery of a linkset (SP A has the STP function) – With use of point restart procedure	
PURPOSE: To check that restart procedure is performed correctly when the recovery of a linkset restores the connectivity between two adjacent SPs	
PRE-TEST CONDITIONS: Linksets 1, 3, 4 and 6 unavailable	

CONFIGURATION: D	TYPE OF TEST: VAT, CPT	TYPE OF SP: STP

MESSAGE SEQUENCE:

```
         SP    A                       SP    B                    SP    C                  SP    ●

  Link                                      Link             Link                    Link
:Start traffic

  2 – 1    TRAFFIC     ----------------------------->  7 – 1   ------------>                   SP  E
           (from A)                                    8 – 1   ------------>                   SP  D
                       <-----------------------------  2 – 1   <------------   7 – 1           SP  E
                                                               <------------   8 – 1           SP  D
  1 – 1    :Activate
  1 – 1    |TFP (PC = F)  -------->             |
           |T21                                 |T21
           |              <--------    1 – 1    |TFPs (PC = E and PC = C)
  1 – 1    |TRA           -------->             ⊥
           |                           5 – 1     TFA (PC = A)                                  SP  D
           ⊥              <--------    1 – 1     TRA
  2 – 1    TFA (PC = B)  ----------------------------->
  1 – 1    TFP (PC = D)  -------->

           TIME CONTROLLED DIVERSION IS APPLIED

  1 – 1    TRAFFIC       -------->    5 – 1   ---------------------------------->              SP  D
                         <--------    1 – 1   <----------------------------------   5 – 1      SP  D
                         <-----------------------------  2 – 1   <------------   8 – 1         SP  D
  2 – 1    TRAFFIC       ----------------------------->  7 – 1   ------------>                 SP  E
                         <-----------------------------  2 – 1   <------------   7 – 1         SP  E
:Wait
:Stop traffic
```

TEST DESCRIPTION

1.	Start traffic to D and E.
2.	Activate link 1 – 1 and check that the timer T21 is started in A (and B in CPT). Check that TFPs are sent from B to A for E and C, and that a TFP is sent from A to B for F.
3.	Check that a TRA is sent from A to B and check that, on reception of TRA (sent from B to A), the timer T21 is stopped. Check that a TFA is sent from A to C for B.
4.	Check that the time controlled diversion is applied in A. Check that the traffic to D is diverted on link 1 – 1.
5.	Stop traffic. Check that there were no lost messages and no missequencing.
6.	In VAT, repeat the test without sending TRA from B to A and check that the duration of T21 is inside the specified range.

TEST NUMBER: 10.2.1 Continued		PAGE: 2 of 2
REFERENCE: Q.704 § 9		
TITLE: Signalling point restart		
SUB TITLE: Recovery of a linkset (SP A has the STP function) – With use of point restart procedure		
PURPOSE: See page 1 of 2		
PRE-TEST CONDITIONS: Linksets 3, 4 and 6 unavailable (end of page 1)		
CONFIGURATION: D	TYPE OF TEST: VAT	TYPE OF SP: STP

MESSAGE SEQUENCE:

```
      SP    A                    SP   B                 SP   C                SP   ●

  Link                          Link             Link                   Link

:Start traffic
 1 – 1   TRAFFIC       -------->  5 – 1  --------------------------------->           SP  D
                       <--------  1 – 1  <---------------------------------  5 – 1    SP  D
                       <------------------------------  2 – 1  <-----------  8 – 1    SP  D
 2 – 1   TRAFFIC       ------------------------------>  7 – 1  ----------->           SP  E
                       <------------------------------  2 – 1  <-----------  7 – 1    SP  E
 3 – 1   :Activate
 3 – 1   TRAFFIC       <---------------------------------------------------> 3 – 1    SP  F
                                                                                   |
                                                                                   |  T21
                                                                                   |
 3 – 1   TRA           ----------------------------------------------------->     _|_
 1 – 1   TFA (PC = F)  -------->
 2 – 1   TFA (PC = F)  ------------------------------>
 1 – 1   TRAFFIC       -------->  5 – 1  --------------------------------->           SP  D
         (from A and F)
                       <--------  1 – 1  <---------------------------------  5 – 1    SP  D
 2 – 1   TRAFFIC       ------------------------------>  7 – 1  ----------->           SP  E
         (from A and F)
                       <------------------------------  2 – 1  <-----------  7 – 1    SP  E
:Wait
:Stop traffic
```

TEST DESCRIPTION

1.	Start traffic.
2.	Activate the link 3 – 1 and check that the traffic from/to A to/from F is immediately restarted.
3.	Check that a TRA is sent from A to F and check that A broadcasts TFA for F.
4.	Stop traffic and check that there were no lost messages, no duplication and no missequencing.

TEST NUMBER: 10.2.2	PAGE: 1 of 1
REFERENCE: Q.704 § 9	
TITLE: Signalling point restart	
SUB TITLE: Recovery of a linkset (SP A has the STP function) – Without use of point restart procedure	
PURPOSE: To check the actions of the system in case of restart of a linkset	
PRE-TEST CONDITIONS: Linkset 1 unavailable	

CONFIGURATION: D	TYPE OF TEST: VAT	TYPE OF SP: STP

MESSAGES SEQUENCE:

SP A			SP B		SP C	SP ●
Link			Link		Link	Link
:Start traffic						
2 – 1	TRAFFIC	------------------------------>	8 – 1	------------>		SP D
	(from A and F)		7 – 1	------------>		SP E
		<------------------------------	2 – 1	<------------	7 – 1	SP E
				<------------	8 – 1	SP D
1 – 1	:Activate			(see Note 1)		
	CHANGEBACKS ARE PERFORMED IN A AND B (see Note 2)					
1 – 1	TRAFFIC	--------> 5 – 1		---------------------------------->		SP D
	(from A and F, from 2 – 1)	6 – 1		<----------------------------------		SP E
2 – 1	TRAFFIC	------------------------------>	7 – 1	------------>		SP E
		<------------------------------	2 – 1	<------------	7 – 1	SP E
				<------------	8 – 1	SP D
				(see Note 1)		
:Wait						
:Stop traffic						

Note 1 – Depending of the routing rules in D and E, the traffic to A and F may be carried either on linksets 5 or 8, or on linksets 6 or 7.

Note 2 – Changebacks are performed but they are not explicitly described in this point restart test.

TEST DESCRIPTION

1.	Start traffic to D and E.
2.	Activate link 1 – 1. Check that point restart procedure is not applied in this case and that changebacks are performed.
3.	Check that the traffic to D and E is diverted on link 1 – 1 in accordance with the load sharing rules in A.
4.	Check that the signalling route set test procedure is not used.
5.	Stop traffic and check there were no lost messages, no duplication and no missequencing.

TEST NUMBER: 10.3	PAGE: 1 of 1
REFERENCE: Q.704 § 9	
TITLE: Signalling point restart	
SUB TITLE: An adjacent SP becomes accessible via another SP (SP A has not STP function)	
PURPOSE: To check the actions of the system when an adjacent SP becomes accessible via another SP	
PRE-TEST CONDITIONS: Linksets 1, 3, 4, 5 and 6 are unavailable	

CONFIGURATION: B	TYPE OF TEST: VAT	TYPE OF SP: SP

MESSAGE SEQUENCE:

```
      SP    A                    SP    B                   SP    C                   SP    ●

  Link                          Link               Link                       Link

                                  4 - 1:Activate
                                        |
                                        | <--------     4 - 1  | TFP (A)
                          TFPs 4 - 1    | -------->            |
                          (D and E)     | T21                  | T21
                                        |                      |
                                        L <--------     4 - 1  | TRA
                            TRA 4 - 1     -------->            L
                    <--------   2 - X   TFAx            7 - 1   TFAs (A,B) ----->             SP E
              |                         (PCs = C, D     8 - 1   TFAs (A,B) ----->           | SP D
              | T21     (for D and C)   and E)                          T21 in D for A       |
  2 - 1, 2    |                         (Broadcasting                                        |
              | TRAFFIC  -------->  4 - 1  mode)        7 - 1   -------------->              | SP E
              |          <--------  2 - 1, 2 <--------  4 - 1   <--------------     7 - 1    | SP E
              |

  2 - 1, 2  TRAFFIC      -------->  4 - 1    -------->  8 - 1   -------------->               SP D
                         <--------  2 - 1, 2 <--------  4 - 1   <--------------     8 - 1     SP D

  :Wait

  :Stop traffic
```

TEST DESCRIPTION

1.	Activate link 4 – 1.
2.	Check that on the reception of TFAs the traffic is immediately restarted in A to E and that traffic to D is restarted after expiration of T21.
3.	Stop traffic and check that there were no lost messages, no duplication and no missequencing.

TEST NUMBER: 10.4	PAGE: 1 of 1

REFERENCE: Q.704 § 9

TITLE: Signalling point restart

SUB TITLE: An adjacent SP becomes accessible via another SP (SP A has STP function)

PURPOSE: To check the actions of the system when an adjacent SP becomes accessible via another SP on reception of a TFA

PRE-TEST CONDITIONS: Linksets 1, 3 and 4 are unavailable

CONFIGURATION: D	TYPE OF TEST: VAT	TYPE OF SP: STP

MESSAGES SEQUENCE:

```
     SP   A                    SP   B                  SP   C               SP   ●

 Link                         Link             Link                  Link

:Start traffic

2 - 1  TRAFFIC     ------------------------------>  7 - 1  ------------>              SP  E
       (from A)                                     8 - 1  ------------>              SP  D
                   <------------------------------  2 - 1  <------------   7 - 1      SP  E
                          4 - 1   :Activate                <------------   8 - 1      SP  D
                                  |   Point restart       |
                                  |T21 procedure is       | T21
                                  |   applied in B and C  |
                                  └<-------    4 - 1      | TRA
                       4 - 1  TRA ------->                ┴
                   <------------------------------  2 - 1  TFA (PC = B)
2 - 1  TFP (PC = F) ----------------------------->  4 - 1┐
       (sent to B via C)  <-------------------------------┘
2 - 1  TRAFFIC     ------------------------------>  7 - 1  ------------>              SP  E
                                                    8 - 1  <------------              SP  D
                   <------------------------------  2 - 1  <------------   7 - 1      SP  E
                                                           <------------   8 - 1      SP  D

:Wait

:Stop traffic
```

TEST DESCRIPTION

1.	Start traffic.
2.	Activate link 4 – 1.
3.	Check that, when the TFA is received for B, SP A is aware of that B is an adjacent point which restarts, and consequently A sends a TFP concerning F on link 2 – 1 to B.
4.	Stop traffic and check that it was not disturbed.

TEST NUMBER: 10.5	PAGE: 1 of 2

REFERENCE: Q.704 § 9

TITLE: Signalling point restart

SUB TITLE: Restart of an SP having no STP function

PURPOSE: To check the restart procedure in an SP having no STP function

PRE-TEST CONDITIONS: SP A unavailable

CONFIGURATION: B	TYPE OF TEST: VAT, CPT	TYPE OF SP: SP

MESSAGE SEQUENCE:

```
        SP  A                  SP  B              SP  C              SP  ●

 Link                          Link               Link               Link

           :Activate
 X - X     Activation (first link activated)

           :  T21

           <------------                 TRA  received from B or C

           FINAL SITUATION (WHEN ALL LINKS ARE AVAILABLE)
1 - 1, 2   TRAFFIC   ---------------------------------------------->                  SP  D
                     <----------------------------------------------  1 - 1, 2       SP  D
2 - 1, 2   TRAFFIC   -------->   5 - 1   -------------------------->                  SP  D
                                 6 - 1   -------------------------->                  SP  E
3 - 1, 2   TRAFFIC   ---------------------------->  8 - 1   ----------->              SP  D
                                                    7 - 1   ----------->              SP  E
                     <----------------------------  3 - 1, 2  <-----------  7 - 1     SP  E
:Wait
:Stop traffic
```

TEST DESCRIPTION

1.	Activate SP A.
2.	Check that when the first link is activated, the timer T21 is started.
3.	Check that, on reception of a TRA received from B or C, T21 is stopped.
4.	Check that, when all links are activated, the traffic is carried as described above.
5.	Stop traffic.

TEST NUMBER: 10.5 Continued		PAGE: 2 of 2
REFERENCE: Q.704 § 9		
TITLE: Signalling point restart		
SUB TITLE: Restart of an SP having no STP function		
PURPOSE: To check the restart procedure in an SP having no STP function		
PRE-TEST CONDITIONS: SP A, linksets 6 and 7 unavailable		
CONFIGURATION: B	TYPE OF TEST: VAT	TYPE OF SP: SP

MESSAGE SEQUENCE:

```
        SP    A                    SP    B                  SP    C                SP   ●

  Link                                Link            Link                  Link

 1 - 1    :Activate
 1 - 1   | TRAFFIC    ----------------------------------------------------->             SP  D
         |            <-----------------------------------------------------   1 - 1     SP  D
 1 - 2   | Activate                (changeback is performed)
 1 - 2   | TRAFFIC    ----------------------------------------------------->             SP  D
         |            <-----------------------------------------------------   1 - 2     SP  D
         | T21
 2 - 1   | Activate            (traffic from/to B is immediately restarted)
         |
         |            <--------  2 - 1 TFP (PC = E)
         |            <--------  2 - 1 TRA
                               5 - 1 TFA (PC = A)
                               -------------------------------------->                   SP  D
                               4 - 1 TFA (PC = A)
                               ----------------->
                      <--------   2 - 1    <--------    4 - 1 TFP (PC = E)
 2 - 2    Activate                 (changeback is performed)
 3 - 1, 2 Activate                 (changebacks are performed)
 1 - 1, 2 TRAFFIC     ----------------------------------------------------->             SP  D
                      <-----------------------------------------------------  1 - 1, 2   SP  D
 2 - 1, 2 TRAFFIC     -------->   5 - 1    --------------------------------->            SP  D
 3 - 1, 2 TRAFFIC     ------------------------------>   8 - 1   ----------->             SP  D
```

:Wait

:Stop traffic

Note – Changebacks are performed, but they are not described in this point restart test.

TEST DESCRIPTION

1.	Activate the link 1 – 1.
2.	Check that after activation on link 1 – 1, the traffic between A and D is immediately restarted and check that T21 is started in A. Activate 1 – 2.
3.	Activate link 2 – 1 and send a TFP for E from B to A. Check that T21 is stopped on reception of the TRA message.
4.	Check that the traffic is carried as described above, after the restart.
5.	Stop traffic.

TEST NUMBER: 10.6		PAGE: 1 of 2
REFERENCE: Q.704 § 9		
TITLE: Signalling point restart		
SUB TITLE: Restart of an SP having the STP function		
PURPOSE: To check the restart procedure in an SP having STP function		
PRE-TEST CONDITIONS: SP A unavailable		
CONFIGURATION: D	TYPE OF TEST: VAT, CPT	TYPE OF SP: STP

MESSAGES SEQUENCE:

```
        SP   A                     SP   B                 SP   C                 SP   ●
 Link                          Link              Link                 Link

        :Activate
 X – X   Activation
           <-------- TRA may be received from B or C
        | T18                      | T21           | T21                    | T21
        |                          |               |                        |
        ⊥ all links are aligned    |               |                        |
        |                          |               |                        |
        |   <-------- TRA may be received from B or C                       |
        |                          |               |                        |
        ⊥ T19 (see note)           |               |                        |
                                   |               |                        |
 1 – 1  | TFPs (for D and E) -->   |               |                        |
 2 – 1  | TFPs (for D and E) ----------------> | -------->                  |
        ⊥ T20                      |               |                        |
 1 – 1    TRA        -------->     ⊥ TFAs (A) are sent                      |
 2 – 1    TRA        ---------------------------------->  ⊥ TFAs (A) are sent
 3 – 1    TRA        ------------------------------------------------------->  ⊥     SP  F
 1 – 1    TRAFFIC    -------->   5 – 1   ---------------------------------->         SP  D
          (from A and F) <-------        Via B or C to A and F  ------------> 5 – 1 or 8 – 1   SP  D
                                 6 – 1   ---------------------------------->         SP  E
 2 – 1    TRAFFIC    ------------------------------>  7 – 1   ------------>          SP  E
          (from A and F) <-------        Via B or C to A and F  ------------> 6 – 1 or 7 – 1   SP  E
```

:Wait

:Stop traffic

Note – If all TRAs are received during T18, T19 is not started.

TEST DESCRIPTION

1.	Activate signalling point A.
2.	Check that the signalling links become available and check that the received TRAs are correctly handled.
3.	Check that when all TRAs are received in A, TRAs are broadcasted from A.
4.	Check that the traffic is restarted correctly, wait and stop traffic.
5.	Repeat the test (in VAT) but send the traffic from F to D and E via A immediately after alignment of link 3 – 1 and check that this traffic is treated normally in A.

TEST NUMBER: 10.6 Continued	PAGE: 2 of 2

REFERENCE: Q.704 § 9

TITLE: Signalling point restart

SUB TITLE: Restart of an SP having the STP function

PURPOSE: To check the restart procedure in an SP having STP function

PRE-TEST CONDITIONS: SP A, linksets 2 and 4 unavailable

CONFIGURATION: D	TYPE OF TEST: VAT	TYPE OF SP: STP

MESSAGE SEQUENCE:

```
        SP    A                    SP    B                  SP    C                SP   ●

 Link                           Link              Link                     Link

         :Activate
 3 - 1   Activation (traffic from/to F is immediately restarted)
         | T18
 1 - 1   | Activation (traffic from/to B is immediately restarted)
         |              <------   1 - 1   | TFP (PC = C)
         |              <------   1 - 1   | TRA
         |                                |
         |                                |
         | T19                            | T21                              T21
 3 - 1   | TFP (PC = C) ---------------------------------------------->      SP  F
 1 - 1   | TFPs         -------->         |
         | (PC = C, D and E)              |
         | T20                            |
 1 - 1     TRA          -------->         |
 3 - 1     TRA          ---------------------------------------------->
 1 - 1     TRAFFIC      -------->   5 - 1   ---------------------------->    SP  D
           (from A and F)           6 - 1   ---------------------------->    SP  E
                              to A and F  <----------------------------  5 - 1   SP  D
                              to A and F  <----------------------------  6 - 1   SP  E
 :Wait
 :Stop traffic
```

TEST DESCRIPTION

1.	Activate signalling point A beginning by the activation of 3 – 1. After activation of 3 – 1, activate link 1 – 1.
2.	Check that T19 is started after expiration of T18. Check that the duration of T18 is inside the specified range.
3.	Check that T20 is started after expiration of T19. Check that the duration of T19 is inside the specified range.
4.	Check that TFPs are sent during T20.
5.	Check that when T20 expires TRAs are broadcasted and that the traffic is correctly restarted, wait and stop traffic.
6.	Repeat the test with activation of 2 – 1 during T19 and check that this event is treated outside the procedure.

TEST NUMBER: 10.7.1	PAGE: 1 of 1
REFERENCE: Q.704 § 9	
TITLE: Signalling point restart	
SUB TITLE: Reception of an unexpected TRA – In an SP having no STP function	
PURPOSE: To check the actions of the system in case of reception of an unexpected TRA	
PRE-TEST CONDITIONS: Linkset with one available link	

CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: SP

MESSAGES SEQUENCE:

Link	SP A		Link	SP B
:Start traffic				
1 – 1	TRAFFIC	--------------->		
		<---------------	1 – 1	TRAFFIC
		<---------------	1 – 1	TRA
1 – 1	TRAFFIC	--------------->		
		<---------------	1 – 1	TRAFFIC
:Wait				
:Stop traffic				

TEST DESCRIPTION

1.	Start traffic to B and C on link 1 – 1.
2.	Send a TRA from B to A and check that this message is ignored.
3.	Stop traffic and check that it has not been disturbed.

TEST NUMBER: 10.7.2	PAGE: 1 of 1
REFERENCE: Q.704 § 9	
TITLE: Signalling point restart	
SUB TITLE: Reception of an unexpected TRA – In an SP having STP function	
PURPOSE: See test 10.7.1	
PRE-TEST CONDITIONS: Linksets 1, 4 and 8 unavailable	

CONFIGURATION: D	TYPE OF TEST: VAT	TYPE OF SP: STP

MESSAGE SEQUENCE:

SP A			SP B	SP C		SP ●	
Link			Link	Link		Link	
:Start traffic							
2 – 1	TRAFFIC (from A and F)	------------------------------>	7 – 1	------------>			SP E
		<------------------------------	2 – 1	<------------		7 – 1	SP E
		<------------------------------	2 – 1	TRA			
2 – 1	TFP (PC = B)	------------------------------>					
2 – 1	TFP (PC = D)	------------------------------>					
2 – 1	TRAFFIC (from A and F)	------------------------------>	7 – 1	------------>			SP E
		<------------------------------	2 – 1	<------------		7 – 1	SP E
:Wait							
:Stop traffic							

TEST DESCRIPTION

1.	Start traffic to E.
2.	Send a TRA from C to A and check that TFPs concerning B and D are received, then, check that a TRAs received from A.
3.	Stop traffic and check that it was not disturbed.

TEST NUMBER: 11	PAGE: 1 of 1
REFERENCE: Q.706	
TITLE: Traffic test	
SUB TITLE:	
PURPOSE: To check the behaviour of an STP in various traffic situations	
PRE-TEST CONDITIONS: All links available	

CONFIGURATION: C	TYPE OF TEST: VAT	TYPE OF SP: STP

MESSAGE SEQUENCE:

			SP B			SP A			SP C	
	Link					Link			Link	
:Start traffic										
	1 – 1	TRAFFIC		----------->		2 – 1	----------->			
	1 – 2	TRAFFIC		----------->		2 – 1	----------->			
				<-----------		1 – 1	<-----------		2 – 1	TRAFFIC
				<-----------		1 – 2				
:Wait										
:Stop traffic										

TEST DESCRIPTION

1.	Start traffic between B and C in both directions via A using the traffic models presented in Recommendation Q.706.
2.	Check that the time to cross the STP is better than 20 milliseconds.
3.	Stop traffic and check that it was not disturbed.
4.	Repeat test but with a traffic model including 5% of messages with an SIF = 272 octets.

TEST NUMBER: 12.1	PAGE: 1 of 1
REFERENCE: Q.707	
TITLE: Signalling link test	
SUB TITLE: After activation of a link	
PURPOSE: To check the signalling link test procedure after activation of a signalling link	
PRE-TEST CONDITIONS: Signalling link 1 – 2 available	

CONFIGURATION: A	TYPE OF TEST: VAT, CPT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

Link	SP A		Link	SP B
:Start traffic				
1 – 2	TRAFFIC	--------------->		
		<---------------	1 – 2	TRAFFIC
1 – 1	:Activate			
1 – 1	SLTM	--------------->		
		<---------------	1 – 1	SLTA
		<---------------	1 – 1	SLTM
1 – 1	SLTA	--------------->		
CHANGEBACK				
1 – 1, 2	TRAFFIC	--------------->		
	TRAFFIC	<---------------	1 – 1, 2	TRAFFIC
:Wait				
:Stop traffic				

TEST DESCRIPTION

1. Start traffic to B (and C in VAT).
2. Activate link 1 – 1 and check that an SLTM is received from A.
3. Send an SLTM to A and check that an SLTA is received.
4. Check that the link 1 – 1 becomes available and that changeback is performed correctly.
5. Stop traffic.
6. In VAT, repeat the test with link 1 – 1 unavailable and inhibited (in this case changeback is not performed). Check that the link 1 – 1 becomes available and stays inhibited.

TEST NUMBER: 12.2	PAGE: 1 of 1

REFERENCE: Q.707

TITLE: Signalling link test

SUB TITLE: No acknowledgement to first SLTM

PURPOSE: To check that a second SLTM is sent if the first is not acknowledged

PRE-TEST CONDITIONS: Signalling link 1 – 2 available

CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

```
                    SP    A                                              SP    B

        Link                                          Link
:Start traffic
        1 - 2       TRAFFIC      --------------->
                                 <---------------     1 - 2     TRAFFIC
        1 - 1       :Activate
        1 - 1       SLTM         --------------->
                 |
                 | T1
                 |
        1 - 1       SLTM         --------------->
                                 <---------------     1 - 1     SLTA
                                 <---------------     1 - 1     SLTM
        1 - 1       SLTA         --------------->
CHANGEBACK
       1 - 1, 2     TRAFFIC      --------------->
                                 <---------------    1 - 1, 2   TRAFFIC
:Wait
:Stop traffic
```

TEST DESCRIPTION

1.	Start traffic to B and C.
2.	Activate link 1 – 1 and check that an SLTM is received and not acknowledged.
3.	Check that when the time T1 expires a new SLTM is sent. Check that the duration of this time is inside of the specified range.
4.	Check that the link 1 – 1 becomes available and that the changeback is performed correctly.
5.	Stop traffic.
6.	Repeat the test with link 1 – 1 unavailable and inhibited (in this case changeback is not performed). Check that the link becomes available and stays inhibited.

TEST NUMBER: 12.3	PAGE: 1 of 1
REFERENCE: Q.707	
TITLE: Signalling link test	
SUB TITLE: No acknowledgement to second SLTM	
PURPOSE: To check that the link stays unavailable when the second SLTM is not acknowledged	
PRE-TEST CONDITIONS: Signalling link 1 – 2 available	

CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

Link	SP A		Link	SP B
:Start traffic				
1 – 2	TRAFFIC	--------------->		
		<---------------	1 – 2	TRAFFIC
1 – 1	:Activate			
1 – 1	SLTM	--------------->		
	T1			
1 – 1	SLTM	--------------->		
	T1			
1 – 2	TRAFFIC	--------------->		
		<---------------	1 – 2	TRAFFIC
:Wait				
:Stop traffic				

TEST DESCRIPTION

1.	Start traffic to B and C.
2.	Activate link 1 – 1 and check that two SLTMs are received from A.
3.	Check that after the second expiration of T1, link 1 – 1 stays unavailable and that the management system is informed.
4.	Repeat the test with link 1 – 1 unavailable and inhibited.

TEST NUMBER: 12.4	PAGE: 1 of 1

REFERENCE: Q.707

TITLE: Signalling link test

SUB TITLE: Unreasonable field in an SLTA

PURPOSE: To check the actions of the system on reception of an SLTA with an unreasonable field

PRE-TEST CONDITIONS: Signalling link 1 – 2 available

CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

Link	SP A		Link	SP B
:Start traffic				
1 – 2	TRAFFIC	--------------->		
		<---------------	1 – 2	TRAFFIC
1 – 1	:Activate			
1 – 1	SLTM	--------------->		
		<---------------	1 – 1	SLTA (erroneous test pattern)
1 – 1	SLTM	--------------->		
		<---------------	1 – 1	SLTA
CHANGEBACK				
1 – 1, 2	TRAFFIC	--------------->		
		<---------------	1 – 1, 2	TRAFFIC
:Wait				
:Stop traffic				

TEST DESCRIPTION

1.	Start traffic to B and C.
2.	Activate link 1 – 1 and check that an SLTM is received and acknowledged with an SLTA containing an erroneous test pattern.
3.	Check that a second SLTM is sent from A and correctly acknowledged.
4.	Check that link 1 – 1 becomes available and that changeback is performed correctly.
5.	Wait and stop traffic.
6.	Repeat the test with a first SLTA containing an erroneous SLC then OPC.
7.	Repeat the test with the first and second erroneous SLTA and check that link 1 – 1 stays unavailable and that management system is informed.

TEST NUMBER: 12.5	PAGE: 1 of 1
REFERENCE: Q.707	
TITLE: Signalling link test	
SUB TITLE: Reception of an SLTM in an attempt state	
PURPOSE: To check the actions of the system when an SLTM is received in an attempt state	
PRE-TEST CONDITIONS: Signalling link 1 – 2 available	

CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

Link	SP A		Link	SP B
:Start traffic				
1 – 2	TRAFFIC	--------------->		
		<---------------	1 – 2	TRAFFIC
1 – 1	:Activate			
1 – 1	SLTM	--------------->		
	T1	<---------------	1 – 1	SLTM
1 – 1	SLTA	--------------->		
1 – 1	SLTM	--------------->		
	T1	<---------------	1 – 1	SLTM
1 – 1	SLTA	--------------->		
		<---------------	1 – 1	STLA
CHANGEBACK				
1 – 1, 2	TRAFFIC	--------------->		
		<---------------	1 – 1, 2	TRAFFIC
:Wait				
:Stop traffic				

TEST DESCRIPTION

1.	Start traffic to B and C.
2.	Activate link 1 – 1 and check that SLTM is received. Send an SLTM and check that an SLTA is received.
3.	On reception of the second SLTM, send an SLTM and check that an SLTA is received. Send an SLTA to A.
4.	Check that changeback is performed correctly, and stop traffic.

TEST NUMBER: 12.6		PAGE: 1 of 1
REFERENCE: Q.707		
TITLE: Signalling link test		
SUB TITLE: Additional SLTA and SLTM		
PURPOSE: To check the actions of the system on reception of additional SLTA and SLTM		
PRE-TEST CONDITIONS: Signalling link 1 – 2 available		
CONFIGURATION: A	TYPE OF TEST: VAT, CPT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

```
                    SP    A                                           SP    B

     Link                                      Link
:Start traffic
     1 – 2     TRAFFIC       --------------->
                             <---------------   1 – 2     TRAFFIC
                             <---------------   1 – 2     SLTA
                             <---------------   1 – 2     SLTM
     1 – 2     SLTA          --------------->
:Wait
:Stop traffic
```

TEST DESCRIPTION

1.	Start traffic to B (and C in VAT).
2.	Check that the reception of an SLTA is ignored.
3.	Send an SLTM to A and check that an SLTA is received.
4.	Stop traffic and check that it was not disturbed.

TEST NUMBER: 13.1	PAGE: 1 of 1
REFERENCE: Q.704 Tab. 1	
TITLE: Invalid messages	
SUB TITLE: Invalid H0.H1 in a signalling network management message	
PURPOSE: To check the actions of the system when a signalling network management message is received with a nonexisting H0.H1	
PRE-TEST CONDITIONS: All links available	

CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

	SP A		Link	SP B
Link			Link	
:Start traffic				
ALL	TRAFFIC	--------------->		
		<---------------	ALL	TRAFFIC
		<---------------	1 – X	SIGNALLING NETWORK MANAGEMENT MESSAGE (Invalid H0.H1)
ALL	TRAFFIC	--------------->		
		<---------------	ALL	TRAFFIC
:Wait				
:Stop traffic				

TEST DESCRIPTION

1.	Start traffic to B and C on all links.
2.	Send a signalling network management message with a nonexisting H0.H1.
3.	Check that this message is discarded without impact on the traffic.
4.	Stop traffic.

TEST NUMBER: 13.2	PAGE: 1 of 1
REFERENCE: Q.704 § 15	
TITLE: Invalid messages	
SUB TITLE: Invalid changeover messages	
PURPOSE: To check the actions of the system on reception of changeover messages with an invalid SLC or OPC	
PRE-TEST CONDITIONS: Linkset with two available links	

CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

Link	SP A		Link	SP B
:Start traffic				
1 – 1	TRAFFIC	--------------->		
		<---------------	1 – 1	TRAFFIC
1 – 2	TRAFFIC	--------------->		
		<---------------	1 – 2	TRAFFIC
		<---------------	1 – 2	COO, SLC 1 – X (nonexisting SLC)
		<---------------	1 – 2	COO, SLC 1 – 1 (nonexisting OPC)
		<---------------	1 – 2	ECO, SLC 1 – X (nonexisting SLC)
		<---------------	1 – 2	ECO, SLC 1 – 1 (nonexisting OPC)
		<---------------	1 – 2	COA, SLC 1 – X (nonexisting SLC)
		<---------------	1 – 2	COA, SLC 1 – 1 (nonexisting OPC)
		<---------------	1 – 2	ECA, SLC 1 – X (nonexisting SLC)
		<---------------	1 – 2	ECA, SLC 1 – 1 (nonexisting OPC)
1 – 1	TRAFFIC	--------------->		
		<---------------	1 – 1, 2	TRAFFIC
:Wait				
:Stop traffic				

TEST DESCRIPTION

1.	Start traffic to B and C on all links.
2.	Send the invalid messages as described above and check that they are ignored.
3.	Stop traffic and check that it was not disturbed.

TEST NUMBER: 13.3		PAGE: 1 of 1
REFERENCE: Q.704 § 15		
TITLE: Invalid messages		
SUB TITLE: Invalid changeback messages		
PURPOSE: To check the actions of the system on reception of changeback messages with an invalid SLC or OPC		
PRE-TEST CONDITIONS: Linkset with two available links		
CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

Link	SP A		Link	SP B
:Start traffic				
1 – 1	TRAFFIC	--------------->		
		<---------------	1 – 1	TRAFFIC
1 – 2	TRAFFIC	--------------->		
		<---------------	1 – 2	TRAFFIC
		<---------------	1 – 2	CBD, SLC 1 – X (nonexisting SLC)
		<---------------	1 – 2	CBD, SLC 1 – 1 (nonexisting OPC)
		<---------------	1 – 2	CBA, SLC 1 – X (nonexisting SLC)
		<---------------	1 – 2	CBA, SLC 1 – 1 (nonexisting OPC)
1 – 1, 2	TRAFFIC	--------------->		
		<---------------	1 – 1, 2	TRAFFIC
:Wait				
:Stop traffic				

TEST DESCRIPTION

1. Start traffic to B and C on all links.
2. Send the invalid messages described above and check that they are ignored.
3. Stop traffic and check that it was not disturbed.

TEST NUMBER: 13.4	PAGE: 1 of 1

REFERENCE: Q.704 § 15

TITLE: Invalid messages

SUB TITLE: Invalid changeback code

PURPOSE: To check the actions of the system on reception of an invalid changeback code in a changeback message

PRE-TEST CONDITIONS: Linkset with one link available

CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

Link	SP A		Link	SP B
:Start traffic				
1 – 2	TRAFFIC	--------------->		
		<---------------	1 – 2	TRAFFIC
1 – 1	:Activate (depending of the deactivation mean previously used)			
1 – 2	CBD, SLC 1 – 1	--------------->		
	T4	<---------------	1 – 2	CBA, SLC 1 – 1 (invalid changeback code ≠ CBD)
1 – 2	CBD, SLC 1 – 1	--------------->		
	T5			
1 – 1	TRAFFIC (from 1 – 2)	--------------->		
		<---------------	1 – 1	TRAFFIC (from 1 – 2 see note)
1 – 2	TRAFFIC	--------------->		
		<---------------	1 – 2	TRAFFIC
:Wait				
:Stop traffic				

Note. – B may perform a changeback or not.

TEST DESCRIPTION

1. Start traffic to B and C on link 1 – 2.
2. Activate link 1 – 1, check that a CBD is received and acknowledged by a CBA with an invalid changeback code.
3. Check that a new CBD is received after T4 expires and acknowledged by a correct CBA. Check that changeback is performed.
4. Stop traffic and check that the invalid message has been discarded without impact on the traffic.

TEST NUMBER: 13.5		PAGE: 1 of 3
REFERENCE: Q.704 § 15		
TITLE: Invalid messages		
SUB TITLE: Invalid inhibition messages		
PURPOSE: To check the actions of the system on reception of an invalid inhibition messages		
PRE-TEST CONDITIONS: Linkset with two available links		
CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

SP A Link			SP B Link	
:Start traffic				
1 – 1	TRAFFIC	--------------->		
		<---------------	1 – 1	TRAFFIC
1 – 2	TRAFFIC	--------------->		
		<---------------	1 – 2	TRAFFIC
		<---------------	1 – 2	LIN, SLC 1 – X (nonexisting SLC)
		<---------------	1 – 2	LIN, SLC 1 – 2 (nonexisting OPC)
		<---------------	1 – 2	LIA, SLC 1 – X (nonexisting SLC)
		<---------------	1 – 2	LIA, SLC 1 – 1 (nonexisting OPC)
		<---------------	1 – 2	LID, SLC 1 – X (nonexisting SLC)
		<---------------	1 – 2	LID, SLC 1 – 1 (nonexisting OPC)

TEST DESCRIPTION

1.	Start traffic to B and C.
2.	Send the invalid messages described above and check that these are ignored.
3.	Stop traffic and check that it was not disturbed.

TEST NUMBER: 13.5 Continued		PAGE: 2 of 3
REFERENCE: Q.704 § 15		
TITLE: Invalid messages		
SUB TITLE: Invalid inhibition messages		
PURPOSE: As page 1		
PRE-TEST CONDITIONS: Linkset with two available links		
CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

SP A Link		Link	SP B
	<---------------	1 – 2	LUN, SLC 1 – X (nonexisting SLC)
	<---------------	1 – 2	LUN, SLC 1 – 1 (nonexisting OPC)
	<---------------	1 – 2	LUA, SLC 1 – X (nonexisting SLC)
	<---------------	1 – 2	LUA, SLC 1 – 1 (nonexisting OPC)
	<---------------	1 – 2	LFU, SLC 1 – X (nonexisting SLC)
	<---------------	1 – 2	LFU, SLC 1 – 1 (nonexisting OPC)

TEST DESCRIPTION

See page 1.

TEST NUMBER: 13.5 Continued		PAGE: 3 of 3
REFERENCE: Q.704 § 15		
TITLE: Invalid messages		
SUB TITLE: Invalid inhibition messages		
PURPOSE: As page 1		
PRE-TEST CONDITIONS: Linkset with two available links		
CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

SP A			SP B	
Link			Link	
		<---------------	1 – 2	LLT, SLC 1 – X (nonexisting SLC)
		<---------------	1 – 2	LLT, SLC 1 – 1 (nonexisting OPC)
		<---------------	1 – 2	LRT, SLC 1 – X (nonexisting SLC)
		<---------------	1 – 2	LRT, SLC 1 – 1 (non existing OPC)
ALL	TRAFFIC	--------------->		
		<---------------	ALL	TRAFFIC

:Wait

:Stop traffic

TEST DESCRIPTION

	See page 1.

TEST NUMBER: 13.6	PAGE: 1 of 1

REFERENCE: Q.704 § 15

TITLE: Invalid messages

SUB TITLE: Invalid transfer control messages

PURPOSE: To check that there is no problem on reception of a TFC with spare field or SLC not coded 00

PRE-TEST CONDITIONS: Link 1 – 1 available

CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

	SP A			SP B
Link			Link	
:Start traffic				
1 – 1	TRAFFIC	--------------->		
		<---------------	1 – 1	TRAFFIC
		<---------------	1 – 1	TFC, PC = C (spare field ≠ 0)
		<---------------	1 – 1	TFC, PC = C (SLC ≠ 0000)
		<---------------	1 – 1	TFC, PC = X (nonexisting PC)
1 – 1	TRAFFIC	--------------->		
		<---------------	1 – 1	TRAFFIC
:Wait				
:Stop traffic				

TEST DESCRIPTION

1.	Start traffic to B and C.
2.	Send a TFC with invalid spare field to A, then a TFC with an invalid SLC then a TFC with a nonexisting PC.
3.	Check that these messages are correctly received without disturbances due to these incorrect values.
4.	Stop traffic.

TEST NUMBER: 13.7	PAGE: 1 of 1
REFERENCE: Q.704 § 15	
TITLE: Invalid messages	
SUB TITLE: Invalid signalling route management messages	
PURPOSE: To check the actions of the system on reception of invalid TFA or TFP	
PRE-TEST CONDITIONS: Link 1 – 1 available	

CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGES SEQUENCE:

Link	SP A		Link	SP B
:Start traffic				
1 – 1	TRAFFIC	--------------->		
		<---------------	1 – 1	TRAFFIC
		<---------------	1 – 1	TFP, PC = X (nonexisting PC)
		<---------------	1 – 1	TFA, PC = X (nonexisting PC)
		<---------------	1 – 1	TFP, PC = C (nonexisting OPC)
		<---------------	1 – 1	TFP, PC = C (spare bits ≠ 00)
		<---------------	1 – 1	TFP, PC = C (SLC ≠ 0000)
			2 – 1	:Deactivate
		<---------------	1 – 1	TFP, PC = C
		<---------------	1 – 1	TFA, PC = C (nonexisting OPC)
		<---------------	1 – 1	TFA, PC = C (spare bits ≠ 00)
		<---------------	1 – 1	TFA, PC = C (SLC ≠ 0000)
1 – 1	TRAFFIC	--------------->		
		<---------------	1 – 1	TRAFFIC
:Wait				
:Stop traffic				

TEST DESCRIPTION

1.	Start traffic to B and C.
2.	Send TFPs and TFAs with invalid values to A (as described above). Check that these messages are discarded without impact on the traffic.
3.	Deactivate linkset 2 and check that B becomes inaccessible.
4.	Send TFAs concerning C with invalid values to A (as described above) and check that these messages are discarded without impact on the traffic.
5.	Check the indications are given by the system (except for SLC and spare bits ≠ 0).
6.	Stop traffic.

TEST NUMBER: 13.8		PAGE: 1 of 1
REFERENCE: Q.704 § 15		
TITLE: Invalid messages		
SUB TITLE: Invalid Signalling-Route-Set-Test messages		
PURPOSE: To check the actions of the system on reception of invalid SRST messages		
PRE-TEST CONDITIONS: Link 1 – 1 available		
CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: STP

MESSAGES SEQUENCE:

Link	SP A		Link	SP B
:Start traffic				
1 – 1	TRAFFIC	--------------->		
		<---------------	1 – 1	TRAFFIC
		<---------------	1 – 1	RST, PC = X (nonexisting PC)
		<---------------	1 – 1	RST, PC = C (nonexisting OPC)
		<---------------	1 – 1	RST, PC = C (spare bits ≠ 00)
		<---------------	1 – 1	RST, PC = C (SLC ≠ 0000)
1 – 1	TRAFFIC	--------------->		
		<---------------	1 – 1	TRAFFIC
:Wait				
:Stop traffic				

TEST DESCRIPTION

1.	Start traffic to B and C.
2.	Send to A the invalid messages described above and check that these messages are discarded without impact on the traffic.
3.	Stop traffic.

TEST NUMBER: 13.9	PAGE: 1 of 1
REFERENCE: Q.704 § 15	
TITLE: Invalid messages	
SUB TITLE: Invalid traffic restart allowed message	
PURPOSE: To check the actions of the system on reception of an invalid traffic restart allowed message	
PRE-TEST CONDITIONS: Linkset with two available links	

CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

SP A			SP B	
Link			Link	
:Start traffic				
1 – 1, 2	TRAFFIC	--------------->		
		<---------------	1 – 1, 2	TRAFFIC
		<---------------	1 – 1	TRA (unknown OPC)
1 – 1, 2	TRAFFIC	--------------->		
		<---------------	1 – 1, 2	TRAFFIC
:Wait				
:Stop traffic				

TEST DESCRIPTION

1.	Start traffic to B and C.
2.	Send the invalid message described above and check that this message is ignored.
3.	Stop traffic and check that it was not disturbed.

TEST NUMBER: 13.10	PAGE: 1 of 1
REFERENCE: Q.707	
TITLE: Invalid messages	
SUB TITLE: Invalid H0-H1 in a signalling network testing and maintenance message	
PURPOSE: To check the actions of the system on reception of this invalid message	
PRE-TEST CONDITIONS: Link 1 – 1 available	

CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

Link	SP A		Link	SP B
:Start traffic				
1 – 1	TRAFFIC	--------------->		
		<---------------	1 – 1	TRAFFIC
		<---------------	1 – 1	SIGNALLING NETWORK TESTING AND MAINTENANCE MESSAGE (Invalid H0-H1)
1 – 1	TRAFFIC	--------------->		
		<---------------	1 – 1	TRAFFIC
:Wait				
:Stop traffic				

TEST DESCRIPTION

1.	Start traffic to B and C.
2.	Send a signalling network testing and maintenance message with a nonexisting H0-H1.
3.	Check that this message is discarded without impact on the traffic.
4.	Stop traffic.

TEST NUMBER: 13.11	PAGE: 1 of 1
REFERENCE: Q.707	
TITLE: Invalid messages	
SUB TITLE: Invalid signalling link test messages	
PURPOSE: To check the actions of the system on reception of an invalid signalling link test message	
PRE-TEST CONDITIONS: Link 1 – 1 available	

CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

Link	SP A		Link	SP B
:Start traffic				
1 – 1	TRAFFIC	--------------->		
		<---------------	1 – 1	TRAFFIC
		<---------------	1 – 1	SLTM (invalid SLC)
		<---------------	1 – 1	SLTA (invalid SLC)
1 – 1	TRAFFIC	--------------->		
		<---------------	1 – 1	TRAFFIC
:Wait				
:Stop traffic				

TEST DESCRIPTION

1.	Start traffic to B and C.
2.	Send the invalid SLTM and SLTA described above and check that they are discarded without impact on the traffic.
3.	Stop traffic.

TEST NUMBER: 13.12	PAGE: 1 of 1

REFERENCE: Q.704 § 15

TITLE: Invalid messages

SUB TITLE: Invalid user part unavailable messages

PURPOSE: To check the actions of the system on reception of an invalid user part unavailable message

PRE-TEST CONDITIONS: Link 1 – 1 available

CONFIGURATION: A	TYPE OF TEST: VAT	TYPE OF SP: ALL

MESSAGE SEQUENCE:

	SP A			SP B
Link			Link	
:Start traffic				
1 – 1	TRAFFIC	--------------->		
		<---------------	1 – 1	TRAFFIC
		<---------------	1 – 1	UPU (nonexisting OPC)
		<---------------	1 – 1	UPU (nonexisting SI)
1 – 1	TRAFFIC	--------------->		
		<---------------	1 – 1	TRAFFIC
:Wait				
:Stop traffic				

TEST DESCRIPTION

1.	Start traffic to B and C.
2.	Send the invalid UPUs described above and check that these messages are ignored.
3.	Stop traffic and check that it was not disturbed.

TUP TEST SPECIFICATION

1 Introduction

This Recommendation contains a set of detailed tests for the Signalling System No. 7 Telephony User Part (TUP). These tests are intended to validate the protocol specified in Q.721-Q.724 Recommendations. This Recommendation conforms to Q.780 Recommendations which describes the basic rules of the test specification.

2 General principles of TUP tests

The TUP tests aim at testing TUP protocol conformance in a given implementation. The tests are described as "Validation" tests or "Validation" and "Compatibility" tests. Each test description indicates in the field "type of test" whether the test is "Validation" or "Validation" and "Compatibility". As the TUP also describes the required call control actions resulting from TUP message transfer the TUP tester also checks the result of those call control actions, e.g. that speech/information transfer is possible.

3 Test configuration

A stable signalling relation is required between "SP A" and "SP B" in order to effectively test the TUP. In addition telephony circuits are required for some of the tests.

4 TUP test list

All tests may be validation tests. Tests marked "*" are compatibility tests. Tests marked "fs" are for further study.

	1 *Circuit supervision*
*	1.1 Non allocated circuits
	1.2 Reset of circuits
	1.2.1 RSC received on an idle circuit
	1.2.2 RSC sent on an idle circuit
	1.2.3 Group reset received
	1.2.4 Group reset sent
	1.3 Blocking of circuits
	1.3.1 Group blocking/unblocking
	1.3.1.1 HGB received
	1.3.1.2 HGB sent
*	1.3.1.3 MGB received
*	1.3.1.4 MGB sent
	1.3.2 Circuit blocking/unblocking
*	1.3.2.1 BLO received
*	1.3.2.2 BLO sent
*	1.3.2.3 Circuit blocking from both ends; removal of blocking from one end
	1.3.2.4 Interruption for FDM circuits

1.4 Continuity check test call

* 1.4.1 CCTC received: successful

* 1.4.2 CCTC sent: successful

1.4.3 CCTC received: unsuccessful

1.4.4 CCTC sent: unsuccessful

1.5 Receipt of unreasonable signalling information

1.5.1 Received

2 *Normal call set-up*

2.1 Both way circuit selection

* 2.1.1 IAM sent by controlling SP

* 2.1.2 IAM sent by non controlling SP

2.2 Called address sending

* 2.2.1 "en bloc" operation

* 2.2.2 Overlap operation

2.3 Successful call set-up

2.3.1 Ordinary call (with various ACM and ANS)

* 2.3.2 Call switched via satellite

* 2.3.3 Test for echo suppressor call set-up

* 2.3.4 Blocking and unblocking during a call (initiated)

* 2.3.5 Blocking and unblocking during a call (received)

3 *Normal call release*

* 3.1 Calling party clears: before ACM

* 3.2 Calling party clears: before ANS

* 3.3 Calling party clears: after ANS

* 3.4 Calling party clears: after CLEAR BACK

* 3.5 Reanswer

4 *Unsuccessful set-up*

4.1 SEC

4.1.1 SEC received

4.1.2 SEC sent

4.2 CGC

4.2.1 CGCreceived

4.2.2 CGC sent

4.3 NNC

4.3.1 NNC received

4.3.2 NNC sent

4.4 ADI

* 4.4.1 ADI received

* 4.4.2 ADI sent

4.5 CFL

4.5.1 CFL received

4.5.2 CFL sent

4.6 SSB

* 4.6.1 SSB received

* 4.6.2 SSB sent

4.7 UNN

* 4.7.1 UNN received

* 4.7.2 UNN sent

4.8 LOS

4.8.1 LOS received

4.8.2 LOS sent

4.9 SST

4.9.1 SST received

4.9.2 SST sent

4.10 ACB

4.10.1 ACB received

4.10.2 ACB sent

4.11 DPN

4.11.1 DPN received

4.11.2 DPN sent

5 *Abnormal situation during a call*

5.1 Inability to release in response to a CLF

5.2 Inability to release in response to a backward signal

5.3 Timers

5.3.1 T2

5.3.2 T3

5.3.3 T4

5.3.4 T5

5.3.5 T6

* 5.3.6 ANS signal not received (Q.118 Timer)

* 5.3.7 Delay in clearing by calling party (Q.118 Timer)

5.4 Reset of circuits during a call

5.4.1 Of an outgoing circuit

5.4.2 Of an incoming circuit

5.5 Receipt of unreasonable signalling information

5.5.1 (Now test No. 1.5.1)

fs 5.5.2 Received

5.6 Interruption of signalling relation

6 *Special call set-up*

6.1 Continuity check call

* 6.1.1 COT applied on an outgoing circuit

* 6.1.2 COT applied on previous circuit

* 6.1.3 COT on a satellite circuit

6.1.4 Calling party clears during a COT

* 6.1.5 Delay of through connect

6.1.6 COT unsuccessful

6.1.7 COT received on incoming circuit

6.2 Automatic repeat attempt

6.2.1 Dual seizure

6.2.2 Circuit reset

6.2.3 Reception of unreasonable signal information

* 6.2.4 Blocking of the circuit

6.2.5 Continuity check failure

6.3 Dual seizure

6.3.1 Dual seizure for controlling side

7 *Supplementary services*

fs 7.1 CUG

fs 7.2 User access to the calling line identity

fs 7.3 User access to the called line identity

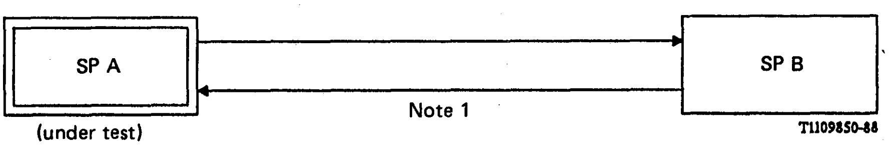
fs 7.4 Redirection of calls

fs 7.5 CCBS

fs 7.6 Network access to calling line identity

8 *Performance tests*

Note – For further study.



Note 1 – The arrows indicate a signalling relation, and any necessary telephone circuits.

FIGURE 1/Q.783

Test configuration for TUP level 4 tests
Configuration 1

TEST NUMBER: 1.1

REFERENCE:

TITLE: Circuit supervision

SUBTITLE: Non-allocated circuits

PURPOSE: To verify that on receipt of a CIC relating to a circuit which does not exist, SP A will discard the message and alert maintenance personnel

PRE-TEST CONDITIONS: Arrange the data in signalling point B such that the CIC identifies a circuit that does not exist between SP A and SP B

CONFIGURATION: 1	TYPE OF TEST: VAT and CPT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

SP A		SP B
	<-------------------------	IAM

TEST DESCRIPTION

1.	Arrange for SP B to send an initial address message. Record the message sequence using a signal monitor.
2.	CHECK A: IS THE CIRCUIT IDLE?......
3.	CHECK B: WAS THE MESSAGE SEQUENCE AS SHOWN ABOVE?......
4.	CHECK C: WAS THE INDICATION GIVEN TO THE MAINTENANCE PERSONNEL?......

TEST NUMBER: 1.2.1		
REFERENCE: Q.724 § 1.15.1		
TITLE: Reset of circuits		
SUBTITLE: RSC received on an idle circuit		
PURPOSE: To verify that on receipt of a reset circuit signal SP A will respond by sending a release guard signal		
PRE-TEST CONDITIONS: The circuit is idle		
CONFIGURATION: 1	TYPE OF TEST: VAT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

SP A		SP B
	<-------------------------	RSC
RLG	------------------------->	

TEST DESCRIPTION

1.	Arrange for SP B to send a reset-circuit signal. Record the message sequence using a signal monitor.
2.	CHECK A: IS THE CIRCUIT IDLE?......
3.	CHECK B: WAS THE MESSAGE SEQUENCE AS ABOVE?......

TEST NUMBER: 1.2.2		
REFERENCE: Q.724 § 1.15.1		
TITLE: Reset of circuits		
SUBTITLE: RSC sent on an idle circuit		
PURPOSE: To verify that SP A is able to generate reset-circuit signal		
PRE-TEST CONDITIONS: The circuit is idle		
CONFIGURATION: 1	TYPE OF TEST: VAT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

SP A		SP B
RSC	------------------------->	
	<-------------------------	RLG

TEST DESCRIPTION

1.	Arrange for SP A to send a reset-circuit signal. Record the message sequence using a signal monitor.
2.	CHECK A: IS THE CIRCUIT IDLE?......
3.	CHECK B: WAS THE MESSAGE SEQUENCE AS ABOVE?......

TEST NUMBER: 1.2.3

REFERENCE: Q.724 § 1.15.2

TITLE: Reset of circuits

SUBTITLE: Group reset received

PURPOSE: To verify that on receipt of two circuit group reset messages within a period of 5 seconds, SP A will respond by sending a circuit reset acknowledge message

PRE-TEST CONDITIONS:

CONFIGURATION: 1	TYPE OF TEST: VAT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

SP A		SP B
	<-------------------------	GRS
	<-------------------------	GRS
GRA	------------------------->	

TEST DESCRIPTION

1.	Arrange for SP B to send two circuit group reset messages within a period of 5 seconds. Record the message sequence using a signal monitor.
2.	CHECK A: IS THE CIRCUIT GROUP IDLE?......
3.	CHECK B: WAS THE MESSAGE SEQUENCE AS ABOVE?......

TEST NUMBER: 1.2.4

REFERENCE: Q.724 § 1.15.2

TITLE: Reset of circuits

SUBTITLE: Group reset sent

PURPOSE: To verify that SP A is able to generate a circuit group reset message

PRE-TEST CONDITIONS:

CONFIGURATION: 1	TYPE OF TEST: VAT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

SP A		SP B
GRS	------------------------->	
GRS	------------------------->	
	<-------------------------	GRA

TEST DESCRIPTION

1.	Arrange for SP A to send two circuit group reset messages within a period of 5 seconds. Record the message sequence using a signal monitor.
2.	CHECK A: IS THE CIRCUIT GROUP IDLE?......
3.	CHECK B: WAS THE MESSAGE SEQUENCE AS ABOVE?......

TEST NUMBER: 1.3.1.1

REFERENCE: Q.724 § 5.2

TITLE: Group blocking/unblocking

SUBTITLE: HGB received

PURPOSE: To verify that the hardware failure group blocking procedure can be correctly initiated

PRE-TEST CONDITIONS:

CONFIGURATION: 1	TYPE OF TEST: VAT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

SP A		SP B
	<-------------------------	HGB
	<-------------------------	HGB
HBA	------------------------->	
	<-------------------------	HGU
	<-------------------------	HGU
HUA	------------------------->	

TEST DESCRIPTION

1.	Arrange for SP B to send two hardware failure oriented group blocking messages within a period of 5 seconds. Record the message sequence using a signal monitor.
2.	CHECK A: VERIFY THAT A CALL CAN ONLY BE ORIGINATED FROM SP B ON THE CIRCUITS INDICATED BY THE RANGE FIELD IN THE HGB MESSAGE
3.	Arrange for SP B to send two hardware failure oriented group unblocking messages within a period of 5 seconds.
4.	CHECK B: VERIFY THAT A CALL CAN BE ORIGINATED FROM EITHER SP ON THE CIRCUITS INDICATED BY THE RANGE FIELD
5.	CHECK C: WAS THE MESSAGE SEQUENCE AS ABOVE?......

TEST NUMBER: 1.3.1.2

REFERENCE: Q.724 § 5.2

TITLE: Group blocking/unblocking

SUBTITLE: HGB sent

PURPOSE: To verify that SP A is able to generate both hardware failure oriented group blocking messages and hardware failure oriented group unblocking messages

PRE-TEST CONDITIONS:

CONFIGURATION: 1	TYPE OF TEST: VAT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

SP A		SP B
HGB	------------------------->	
HGB	------------------------->	
	<-------------------------	HGB
HGU	------------------------->	
HGU	------------------------->	
	<-------------------------	HUA

TEST DESCRIPTION

1.	Arrange for SP A to send two hardware failure oriented group blocking messages within a period of 5 seconds. Record the message sequence using a signal monitor.
2.	CHECK A: VERIFY THAT A CALL CAN ONLY BE ORIGINATED FROM SP A ON THE CIRCUITS INDICATED BY THE RANGE FIELD IN THE HGB MESSAGE
3.	Arrange for SP A to send two hardware failure oriented group unblocking messages within a period of 5 seconds.
4.	CHECK B: VERIFY THAT A CALL CAN BE ORIGINATED FROM EITHER SP ON THE CIRCUIT INDICATED BY THE RANGE FIELD
5.	CHECK C: WAS THE MESSAGE SEQUENCE AS ABOVE?......

TEST NUMBER: 1.3.1.3		
REFERENCE: Q.724 § 5.1		
TITLE: Group blocking/unblocking		
SUBTITLE: MGB received		
PURPOSE: To verify that the maintenance oriented group blocking procedure can be correctly initiated		
PRE-TEST CONDITIONS:		
CONFIGURATION: 1	TYPE OF TEST: VAT and CPT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

SP A		SP B
	<-------------------------	MGB
	<-------------------------	MGB
MBA	------------------------->	
	<-------------------------	MGU
	<-------------------------	MGU
MUA	------------------------->	

TEST DESCRIPTION

1.	Arrange for SP B to send two maintenance oriented group blocking messages within a period of 5 seconds. Record the message sequence using a signal monitor.
2.	CHECK A: VERIFY THAT A CALL CAN ONLY BE ORIGINATED FROM SP B ON THE CIRCUITS INDICATED BY THE RANGE FIELD IN THE MGB MESSAGE
3.	Arrange for SP B to send two maintenance oriented group unblocking messages within a period of 5 seconds.
4.	CHECK B: VERIFY THAT A CALL CAN BE ORIGINATED FROM EITHER SP ON THE CIRCUITS INDICATED BY THE RANGE FIELD
5.	CHECK C: WAS THE MESSAGE SEQUENCE AS ABOVE?......

TEST NUMBER: 1.3.1.4		
REFERENCE: Q.724 § 5.1		
TITLE: Group blocking/unblocking		
SUBTITLE: MGB sent		
PURPOSE: To verify that SP A is able to generate both maintenance oriented group blocking messages and maintenance oriented group unblocking messages		
PRE-TEST CONDITIONS:		
CONFIGURATION: 1	TYPE OF TEST: VAT and CPT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

SP A		SP B
MGB	------------------------->	
MGB	------------------------->	
	<-------------------------	MGA
MGU	------------------------->	
MGU	------------------------->	
	<-------------------------	MUA

TEST DESCRIPTION

1.	Arrange for SP A to send two maintenance oriented group blocking messages within a period of 5 seconds. Record the message sequence using a signal monitor.
2.	CHECK A: VERIFY THAT A CALL CAN ONLY BE ORIGINATED FROM SP A ON THE CIRCUITS INDICATED BY THE RANGE FIELD IN THE MGB MESSAGE
3.	Arrange for SP A to send two maintenance oriented group unblocking messages within a period of 5 seconds.
4.	CHECK B: VERIFY THAT A CALL CAN BE ORIGINATED FROM EITHER SP ON THE CIRCUIT INDICATED BY THE RANGE FIELD
5.	CHECK C: WAS THE MESSAGE SEQUENCE AS ABOVE?......

TUP LEVEL 4 TEST SPECIFICATION

TEST NUMBER: 1.3.2.1

REFERENCE: Q.724 § 5.1

TITLE: Circuit blocking/unblocking

SUBTITLE: BLO received

PURPOSE: To verify that the blocking/unblocking procedure can be correctly initiated

PRE-TEST CONDITIONS:

CONFIGURATION: 1	TYPE OF TEST: VAT and CPT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

SP A		SP B
	<-------------------------	BLO
BLA	------------------------->	
	<-------------------------	UBL
UBA	------------------------->	

TEST DESCRIPTION

1.	Arrange for SP B to send a blocking signal. Record the message sequence using a signal monitor.
2.	CHECK A: VERIFY THAT A CALL CAN ONLY BE ORIGINATED FROM SP B ON THIS CIRCUIT
3.	Arrange for SP B to send an unblocking signal.
4.	CHECK B: VERIFY THAT A CALL CAN BE ORIGINATED FROM EITHER EXCHANGE ON THIS CIRCUIT
5.	CHECK C: WAS THE MESSAGE SEQUENCE AS ABOVE?......

TEST NUMBER: 1.3.2.2		
REFERENCE: Q.724 § 5.1		
TITLE: Circuit blocking/unblocking		
SUBTITLE: BLO sent		
PURPOSE: To verify that SP A is able to generate blocking messages		
PRE-TEST CONDITIONS:		
CONFIGURATION: 1	TYPE OF TEST: VAT and CPT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

```
SP   A                                                     SP   B

BLO               ------------------------->
                  <-------------------------               BLA
UBL               ------------------------->
                  <-------------------------               UBA
```

TEST DESCRIPTION

1.	Arrange for SP A to send a blocking signal. Record the message sequence using a signal monitor.
2.	CHECK A: VERIFY THAT A CALL CAN ONLY BE ORIGINATED FROM SP A ON THIS CIRCUIT
3.	Arrange for SP A to send an unblocking signal.
4.	CHECK B: VERIFY THAT A CALL CAN BE ORIGINATED FROM EITHER SP ON THIS CIRCUIT
5.	CHECK C: WAS THE MESSAGE SEQUENCE AS SHOWN ABOVE?......

TEST NUMBER: 1.3.2.3

REFERENCE: Q.724 § 5.1

TITLE: Circuit blocking/unblocking

SUBTITLE: Blocking from both ends: removal of blocking from one end

PURPOSE: To verify that the blocking/unblocking procedure can be correctly initiated

PRE-TEST CONDITIONS:

CONFIGURATION: 1	TYPE OF TEST: VAT and CPT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

SP A		SP B
BLO	------------------------->	
	<-------------------------	BLA
	<-------------------------	BLO
BLA	------------------------->	
UBL	------------------------->	
	<-------------------------	UBA
	<-------------------------	UBL
UBA	------------------------->	

TEST DESCRIPTION

1.	Arrange for SP A to send a blocking signal. Record the message sequence using a signal monitor.
2.	CHECK A: VERIFY THAT A CALL CAN ONLY BE ORIGINATED FROM SP A ON THIS CIRCUIT
3.	Arrange for SP B to send a blocking signal.
4.	CHECK B: VERIFY THAT A CALL CANNOT BE ORIGINATED ON THIS CIRCUIT BY EITHER SP
5.	Arrange for SP A to send an unblocking signal.
6.	CHECK C: VERIFY THAT A CALL CAN ONLY BE ORIGINATED BY SP B
7.	Arrange for SP B to send an unblocking signal.
8.	CHECK D: WAS THE MESSAGE SEQUENCE AS ABOVE?......

TEST NUMBER: 1.3.2.4		
REFERENCE: Q.724 § 9.2		
TITLE: Circuit blocking/unblocking		
SUBTITLE: Interruption from FDM circuits		
PURPOSE: To verify that an interruption of the pilot in FDM system causes a blocking signal to be sent		
PRE-TEST CONDITIONS: The signalling points must be linked by a transmission system using FDM		
CONFIGURATION: 1	TYPE OF TEST: VAT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

SP A		SP B
BLO	------------------------->	
	<-------------------------	BLA
UBL	------------------------->	
	<-------------------------	UBA

TEST DESCRIPTION

1.	Arrange for the reception of the pilot signal at SP A to be interrupted more than 4-15 seconds. Record the message sequence using a signal monitor.
2.	CHECK A: CONFIRM THAT A CALL CANNOT BE INITIATED BY EITHER SP
3.	Arrange for the interruption of the pilot tone to be terminated.
4.	CHECK B: CONFIRM THAT A CALL CAN BE INITIATED BY EITHER SP AFTER A PERIOD OF 4-15 SECONDS
5.	CHECK C: WAS THE MESSAGE SEQUENCE AS ABOVE?......

TEST NUMBER: 1.4.1		
REFERENCE: Q.724 § 7.5		
TITLE: Continuity check test call		
SUBTITLE: CCTC received: Successful		
PURPOSE: To verify that the continuity test call procedure can be correctly performed		
PRE-TEST CONDITIONS: Circuit must be idle		
CONFIGURATION: 1	TYPE OF TEST: VAT and CPT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

```
SP   A                                                 SP   B

                 <-------------------------            CCR
                 |-------------------------            Check tone
                  -------------------------
                 <-------------------------            CLF
RLG              ------------------------->
```

TEST DESCRIPTION

1.	Initiate the continuity test call procedure at SP B. Record the message sequence using a signal monitor.
2.	CHECK A: IS THE CIRCUIT IDLE?......
3.	CHECK B: WAS THE MESSAGE SEQUENCE AS ABOVE?......

TEST NUMBER: 1.4.2		
REFERENCE: Q.724 § 7.5		
TITLE: Continuity check test call		
SUBTITLE: CCTC sent: successful		
PURPOSE: To verify that the continuity test call procedure can be correctly performed		
PRE-TEST CONDITIONS: Circuit must be idle		
CONFIGURATION: 1	TYPE OF TEST: VAT and CPT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

SP A		SP B
CCR	------------------------->	
Check Tone	------------------------------------- | -------------------------------------	
CLF	------------------------->	
	<-------------------------	RLG

TEST DESCRIPTION

1.	Initiate the continuity test call procedure at SP A. Record the message sequence using a signal monitor.
2.	CHECK A: IS THE CIRCUIT IDLE?......
3.	CHECK B: WAS THE MESSAGE SEQUENCE AS ABOVE?......

TEST NUMBER: 1.4.3

REFERENCE: Q.724 § 7.5

TITLE: Continuity check test call

SUBTITLE: CCTC received: unsuccessful

PURPOSE: To verify that the continuity check procedure can be correctly received

PRE-TEST CONDITIONS: Ensure that no backward check tone is detected within the specified time out

CONFIGURATION: 1	TYPE OF TEST: VAT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

SP A			SP B
	<-------------------------		CCR
	|--------------------------------------- --------		Check tone
	<-------------------------		CCF
		1-3 minutes	T10
	<-------------------------		CCR
	|--------------------------------------- --------		Check tone
	<-------------------------		CCF
Maintenance staff alerted		1-3 minutes	T10
	<-------------------------		CCR
	|--------------------------------------- --------------		Check tone
	<-------------------------		CCF

TEST DESCRIPTION

1.	Initiate the continuity test call procedure at SP B. Record the message sequence using a signal monitor.
2.	CHECK A: WAS THE SECOND CONTINUITY CHECK INITIATED WITHIN 1 TO 3 MINUTES?......
3.	CHECK B: WERE THE MAINTENANCE STAFF ALERTED ON FAILURE OF THE SECOND CONTINUITY CHECK?......
4.	CHECK C: WAS THE CHECK REPEATED AT INTERVALS OF 1 TO 3 MINUTES?......
5.	CHECK D: WAS THE MESSAGE SEQUENCE AS ABOVE?......

TEST NUMBER: 1.4.4

REFERENCE: Q.724 § 7.5.3

TITLE: Continuity check test call

SUBTITLE: CCTC sent: unsuccessful

PURPOSE: To verify that the continuity test call procedure can be correctly invoked

PRE-TEST CONDITIONS: Ensure that no backward tone is detected within the specified timeout

CONFIGURATION: 1	TYPE OF TEST: VAT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

SP A		SP B
CCR	------------------------->	
Check tone	-------------------------|	
CCF	------------------------->	
T10 1-3 minutes		
CCR	------------------------->	
Check tone	-------------------------|	
CCF	------------------------->	
T10 1-3 minutes		Maintenance staff alerted
CCR	------------------------->	
Check tone	-------------------------|	
CCF	------------------------->	

TEST DESCRIPTION

1.	Initiate the continuity test call procedure at SP A. Record the message sequence using a signal monitor.
2.	CHECK A: WAS THE SECOND CONTINUITY CHECK INITIATED WITHIN 1 TO 3 MINUTES?......
3.	CHECK B: WERE THE MAINTENANCE STAFF ALERTED ON FAILURE OF THE SECOND CONTINUITY CHECK?......
4.	CHECK C: WAS THE CHECK REPEATED AT INTERVALS OF 1 TO 3 MINUTES?......
5.	CHECK D: WAS THE MESSAGE SEQUENCE AS ABOVE?......

TEST NUMBER: 1.5.1

REFERENCE: Q.724 § 6.5

TITLE: Receipt of unreasonable information

SUBTITLE: Received

PURPOSE: To verify that the action taken by a signalling point upon receipt of unreasonable signalling information is as stated in Q.724 § 6.5

PRE-TEST CONDITIONS:

a) Arrange the data in signalling point B such that CLF, RLG, and UBL messages may be initiated

b) The circuit should be idle and unblocked

CONFIGURATION: 1	TYPE OF TEST: VAT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

SP A		SP B
a)		
	<-------------------------	CLF
RLG	------------------------->	
b)		
	<-------------------------	RLG
c)	<-------------------------	UBL
UBA	------------------------->	

TEST DESCRIPTION

1.	Arrange for SP B to send a clear forward signal.
2.	CHECK A: IS THE CIRCUIT IDLE?......
3.	CHECK B: WAS THE MESSAGE SEQUENCE AS IN a) ABOVE?......
4.	Arrange for SP B to send a release guard signal.
5.	CHECK C: IS THE CIRCUIT IDLE?......
6.	CHECK D: WAS THE MESSAGE SEQUENCE AS IN b) ABOVE?......
7.	Arrange for SP B to send an unblocking signal.
8.	CHECK E: IS THE CIRCUIT IDLE?......
9.	CHECK F: WAS THE MESSAGE SEQUENCE AS IN c) ABOVE?......

Note – This test covers only some of the ambiguous messages which could be received.

TEST NUMBER: 2.1.1

REFERENCE: Q.724 § 1

TITLE: Both way circuit selection

SUBTITLE: IAM sent by controlling SP

PURPOSE: To verify that signalling point A can initiate an outgoing call on a circuit capable of bothway operation when the controlling SP is A

PRE-TEST CONDITIONS:

a) Called termination is free
b) Circuit selected is capable of bothway operation
c) Circuit selected is as in test number 2.1.2
d) SP A is the controlling signalling point

CONFIGURATION: 1	TYPE OF TEST: VAT and CPT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

SP A		SP B
IAM	------------------------->	
	<-------------------------	ACM
	-------------------------------------	Ringing tone
	<-------------------------	ANC
Speech	– – – – – – – – – – – – –	Speech
CLF	------------------------->	
	<-------------------------	RLG

TEST DESCRIPTION

1.	Make a call from SP A TO SP B. Record the message sequence using a signal monitor.
2.	CHECK A: CAN RINGING TONE BE HEARD?......
3.	The called party should answer the call.
4.	CHECK B: IS SPEECH POSSIBLE?......
5.	The calling party should clear the call.
6.	CHECK C: IS THE CIRCUIT IDLE?......
7.	CHECK D: WAS THE MESSAGE SEQUENCE AS ABOVE?......

TUP LEVEL 4 TEST SPECIFICATION

TEST NUMBER: 2.1.2

REFERENCE: Q.724 § 1

TITLE: Bothway circuit selection

SUBTITLE: IAM sent by non-controlling SP

PURPOSE: To verify that signalling point A can initiate an outgoing call on a circuit capable of bothway operation when the non-controlling SP is A

PRE-TEST CONDITIONS:

a) Called termination is free
b) Circuit selected is capable of bothway operation
c) Circuit selected is as in test number 2.1.1
d) SP B is the controlling signalling point

CONFIGURATION: 1	TYPE OF TEST: VAT and CPT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

SP A		SP B
IAM	------------------------>	
	<------------------------	ACM
	------------------------------------	Ringing tone
	<------------------------	ANC
Speech	— — — — — — — — — — — —	
CLF	------------------------>	
	<------------------------	RLG

TEST DESCRIPTION

1.	Make a call from SP A to SP B. Record the message sequence using a signal monitor.
2.	CHECK A: CAN RINGING TONE BE HEARD?......
3.	The called party should answer the call.
4.	CHECK B: IS SPEECH POSSIBLE?......
5.	The calling party should clear the call.
6.	CHECK C: IS THE CIRCUIT IDLE?......
7.	CHECK D: WAS THE MESSAGE SEQUENCE AS ABOVE?......

TEST NUMBER: 2.2.1
REFERENCE: Q.724 § 1
TITLE: Called address sending
SUBTITLE: "EN BLOC" operation
PURPOSE: To verify that a call can be successfully established (all digits included in the IAM)
PRE-TEST CONDITIONS: a) Called termination is free b) The exchange data is arranged such that all digits are included in the IAM

CONFIGURATION: 1	TYPE OF TEST: VAT and CPT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

SP A		SP B
IAM	------------------------->	
	<-------------------------	ACM
	--------------------------------------	Ringing tone
	<-------------------------	ANC
Speech	– – – – – – – – – – – – –	Speech
CLF	------------------------->	
	<-------------------------	RLG

TEST DESCRIPTION

1.	Make a call from SP A to SP B. Record the message sequence using a signal monitor.
2.	CHECK A: IS RINGING TONE HEARD?......
3.	The called party should answer the call.
4.	CHECK B: IS SPEECH POSSIBLE?......
5.	The calling party should clear the call.
6.	CHECK C: IS THE CIRCUIT IDLE?......
7.	CHECK D: WAS THE MESSAGE SEQUENCE AS ABOVE?......
8.	For validation testing repeat this test in the reverse direction Where SPA is in a position to know, by digit analysis that the final digit has been sent. Confirm that an End-of-pulsing (ST) signal is included in the IAM.

TEST NUMBER: 2.2.2

REFERENCE: Q.724 § 1

TITLE: Called address sending

SUBTITLE: Overlap operation (with SAM and SAO)

PURPOSE: To verify that signalling point A can initiate a call using an IAM followed by SAM and a SAO

PRE-TEST CONDITIONS:

a) Called termination is free

b) The signalling point data is arranged such that digits are generated in an IAM followed by a SAM and a SAO

CONFIGURATION: 1	TYPE OF TEST: VAT and CPT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

```
SP  A                                                     SP  B

IAM          ------------------------->
SAM          ------------------------->
SAO          ------------------------->
             <-------------------------                   ACM
              -------------------------                   Ringing tone
             <-------------------------                   ANC

Speech        - - - - - - - - - - - - -                   Speech

CLF          ------------------------->
             <-------------------------                   RLG
```

TEST DESCRIPTION

1.	Make a call from SP A to SP B. Record the message sequence using a signal monitor.
2.	CHECK A: IS RINGING TONE HEARD? . . . . . .
3.	The called party should answer the call.
4.	CHECK B: IS SPEECH POSSIBLE? . . . . . .
5.	The calling party should clear the call.
6.	CHECK C: IS THE CIRCUIT IDLE? . . . . . .
7.	CHECK D: WAS THE MESSAGE SEQUENCE AS ABOVE? . . . . . .
8.	For validation testing repeat this test in the reverse direction. Note – The message flow may not be as above (There may be various SAMs and SAOs). Where SPA is in a position to know by digit analysis that the final digit has been sent. Confirm that an end-of-pulsing (ST) signal is included in the last address message.

TEST NUMBER: 2.3.1

REFERENCE: Q.724 § 1.6 and 1.10

TITLE: Successful call set-up

SUBTITLE: Ordinary call (with various ACM and ANS)

PURPOSE: To verify that a call can be successfully completed using various combinations of address complete messages and answer messages

PRE-TEST CONDITIONS: Called termination is free

CONFIGURATION: 1	TYPE OF TEST: VAT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

SP A		SP B
IAM	------------------------->	
	<-------------------------	ACM
	-------------------------------------	Ringing tone
	<-------------------------	ANC
Speech	– – – – – – – – – – – –	Speech
CLF	------------------------->	
	<-------------------------	RLG

TEST DESCRIPTION

1.	Make a call from SP A to SP B. Record the message sequence using a signal monitor.
2.	CHECK A: CAN RINGING TONE BE HEARD?......
3.	The called party should answer the call.
4.	CHECK B: IS SPEECH POSSIBLE?......
5.	The calling party should clear the call.
6.	CHECK C: IS THE CIRCUIT IDLE?......
7.	CHECK D: WAS THE MESSAGE SEQUENCE AS ABOVE?......
8.	Repeat steps 1-7 with all combinations of bits A&B in the address complete message.
9.	Repeat steps 1-8 with ANC replaced with an ANN.
10.	Repeat this test in the reverse direction.

TEST NUMBER: 2.3.2

REFERENCE: Q.724 § 1

TITLE: Successful call set-up

SUBTITLE: Call switched via a satellite

PURPOSE: To verify the satellite indicator in the initial address message is correctly set

PRE-TEST CONDITIONS:

a) Called termination is free

b) The signalling point data is arranged such that the call is switched via a satellite connection or has a satellite connection already included in the path

CONFIGURATION: 1	TYPE OF TEST: VAT and CPT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

SP A		SP B
IAM	------------------------->	
	<-------------------------	ACM
	-------------------------------------	Ringing tone
	<-------------------------	ANC
Speech	– – – – – – – – – – – – –	Speech
CLF	------------------------->	
	<-------------------------	RLG

TEST DESCRIPTION

1.	Make a call from SP A to SP B. Record the message sequence using a signal monitor.
2.	CHECK A: IS RINGING TONE HEARD?......
3.	The called party should answer the call.
4.	CHECK B: IS SPEECH POSSIBLE?......
5.	The calling party should clear the call.
6.	CHECK C: IS THE CIRCUIT IDLE?......
7.	CHECK D: WAS THE MESSAGE SEQUENCE AS ABOVE?......
8.	CHECK E: WAS THE SATELLITE INDICATOR BIT IN THE IAM SET TO 1?......
9.	For validation testing repeat this test in the reverse direction?......

TEST NUMBER: 2.3.3

REFERENCE: Q.724 § 11

TITLE: Successful call set-up

SUBTITLE: Test for echo suppressor call set-up

PURPOSE: To verify that a call can be successfully established with the inclusion of echo suppressors

PRE-TEST CONDITIONS:

a) Called termination is free

b) The signalling point data is arranged such that the call is routed over a route requiring echo suppressors or already has an echo suppressor included in the connection

CONFIGURATION: 1	TYPE OF TEST: VAT and CPT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

SP A		SP B
IAM	------------------------->	
	<-------------------------	ACM
	---	Ringing tone
	<-------------------------	ANC
Speech	– – – – – – – – – – – – –	Speech
CLF	------------------------->	
	<-------------------------	RLG

TEST DESCRIPTION

1.	Make a call from SP A to SP B. Record the message sequence using a signal monitor.
2.	CHECK A: IS RINGING TONE HEARD?......
3.	The called party should answer.
4.	CHECK B: IS SPEECH POSSIBLE?......
5.	CHECK C: IS ECHO PERCEIVED BY EITHER PARTY?......
6.	The calling party should clear the call.
7.	CHECK D: IS THE CIRCUIT IDLE?......
8.	CHECK E: WAS THE MESSAGE SEQUENCE AS ABOVE?......
9.	CHECK F: WAS THE MESSAGE INDICATOR BIT G (OUTGOING HALF ECHO SUPPRESSOR INCLUDED) IN THE IAM SET TO 1?......
10.	CHECK G: WAS THE MESSAGE INDICATOR BIT D (INCOMING HALF ECHO SUPPRESSOR INCLUDED) IN THE ACM SET TO 1?......
11.	For validation testing repeat this test in the reverse direction.

TEST NUMBER: 2.3.4

REFERENCE: Q.724 § 5

TITLE: Successful call set-up

SUBTITLE: Blocking and unblocking during a call (initiated)

PURPOSE: To verify that the circuit blocking and unblocking procedure can be correctly initiated during a call

PRE-TEST CONDITIONS: Called termination is free

CONFIGURATION: 1	TYPE OF TEST: VAT and CPT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

SP A		SP B
IAM	------------------------->	
	<-------------------------	ACM
	--	Ringing tone
	<-------------------------	ANC
Speech	– – – – – – – – – – – – –	Speech
BLO	------------------------->	
	<-------------------------	BLA
CLF	------------------------->	
	<-------------------------	RLG
UBL	------------------------->	
	<-------------------------	UBA

TEST DESCRIPTION

1.	Make a call from SP A to SP B. Record the message sequence using a signal monitor.
2.	CHECK A: CAN RINGING TONE BE HEARD?......
3.	The called party should answer the call.
4.	CHECK B: IS SPEECH POSSIBLE?......
5.	SP A should initiate circuit blocking relating to the circuit used for this call.
6.	CHECK C: IS SPEECH STILL POSSIBLE?......
7.	The calling party should clear the call.
8.	CHECK D: VERIFY THAT A CALL CAN ONLY BE ORIGINATED ON THIS CIRCUIT BY SP A?......
9.	SP A should send an unblocking signal.
10.	CHECK E: VERIFY THAT A CALL CAN BE SUCCESSFULLY ORIGINATED FROM EITHER SP.
11.	CHECK F: WAS THE MESSAGE SEQUENCE AS ABOVE?......
12.	Repeat this test in the reverse direction.
	Note – The blocking signal may be generated after the call has cleared.

TEST NUMBER: 2.3.5		
REFERENCE: Q.724 § 5		
TITLE: Successful call set-up		
SUBTITLE: Blocking and unblocking during a call (received)		
PURPOSE: To verify that the circuit blocking and unblocking procedure can be correctly received during a call		
PRE-TEST CONDITIONS: Called termination is free		
CONFIGURATION: 1	TYPE OF TEST: VAT and CPT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

SP A		SP B
IAM	------------------------->	
	<-------------------------	ACM
	--	Ringing tone
	<-------------------------	ANC
Speech	– – – – – – – – – – – – –	Speech
	<-------------------------	BLO
BLA	------------------------->	
CLF	------------------------->	
	<-------------------------	RLG
	<-------------------------	UBL
UBA	------------------------->	

TEST DESCRIPTION

1.	Make a call from SP A to SP B. Record the message sequence using a signal monitor.
2.	CHECK A: CAN RINGING TONE BE HEARD?......
3.	The called party should answer the call.
4.	CHECK B: IS SPEECH POSSIBLE?......
5.	SP B should initiate circuit blocking relating to the circuit used for this call.
6.	CHECK C: IS SPEECH STILL POSSIBLE?......
7.	The calling party should clear the call.
8.	CHECK D: VERIFY THAT A CALL CAN ONLY BE ORIGINATED ON THIS CIRCUIT BY SP B?......
9.	SP B should send an unblocking signal.
10.	CHECK E: VERIFY THAT A CALL CAN BE SUCCESSFULLY ORIGINATED FROM EITHER SP.
11.	CHECK F: WAS THE MESSAGE SEQUENCE AS ABOVE?......
12.	Repeat this test in the reverse direction. *Note* – The blocking signal may be generated after the call has cleared.

TEST NUMBER: 3.1		
REFERENCE: Q.724 § 1.14		
TITLE: Normal call release		
SUBTITLE: Calling party clears before address complete		
PURPOSE: To verify that the calling party can successfully release a call prior to receipt of an address complete message		
PRE-TEST CONDITIONS:		
CONFIGURATION: 1	TYPE OF TEST: VAT and CPT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

SP A		SP B
IAM	------------------------->	
CLF	------------------------->	
	<-------------------------	RLG

TEST DESCRIPTION

1.	Make a call from SP A to SP B. Record the message sequence using a signal monitor.
2.	The calling party should clear the call prior to receipt of the address complete signal.
3.	CHECK A: IS THE CIRCUIT IDLE?......
4.	CHECK B: WAS THE MESSAGE SEQUENCE AS ABOVE?......
5.	Repeat this test in the reverse direction.

TEST NUMBER: 3.2

REFERENCE: Q.724 § 1.14

TITLE: Normal call release

SUBTITLE: Calling party clears before answer

PURPOSE: To verify that the calling party can successfully release a call prior to receipt of answer

PRE-TEST CONDITIONS: Called termination is free

CONFIGURATION: 1	TYPE OF TEST: VAT and CPT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

SP A		SP B
IAM	------------------------->	
	<-------------------------	ACM
	-------------------------------------	Ringing tone
CLF	------------------------->	
	<-------------------------	RLG

TEST DESCRIPTION

1.	Make a call from SP A to SP B. Record the message sequence using a signal monitor.
2.	CHECK A: IS RINGING TONE HEARD?......
3.	The calling party should clear the call prior to receipt of an answer signal.
4.	CHECK B: IS THE CIRCUIT IDLE?......
5.	CHECK C: WAS THE MESSAGE SEQUENCE AS ABOVE?......
6.	For validation testing this test should be repeated in the reverse direction.

TEST NUMBER: 3.3

REFERENCE: Q.724 § 1.14

TITLE: Normal call release

SUBTITLE: Calling party clears after answer

PURPOSE: To verify that the calling party can successfully release a call in the speech state

PRE-TEST CONDITIONS: Called termination is free

CONFIGURATION: 1	TYPE OF TEST: VAT and CPT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

SP A		SP B
IAM	------------------------->	
	<-------------------------	ACM
	-------------------------------------	Ringing tone
	<-------------------------	ANC
Speech	– – – – – – – – – – – – –	Speech
CLF	------------------------->	
	<-------------------------	RLG

TEST DESCRIPTION

1.	Make a call from SP A to SP B. Record the message sequence using a signal monitor.
2.	CHECK A: IS RINGING TONE HEARD?......
3.	The called party should answer the call.
4.	CHECK B: IS SPEECH POSSIBLE?......
5.	The calling party should clear the call.
6.	CHECK C: IS THE CIRCUIT IDLE?......
7.	CHECK D: WAS THE MESSAGE SEQUENCE AS ABOVE?......
8.	For validation testing this test should be repeated in the reverse direction.

TEST NUMBER: 3.4		
REFERENCE: Q.724 § 1.14		
TITLE: Normal call release		
SUBTITLE: Called party clears		
PURPOSE: To verify that the calling party can successfully release a call in the clear back state		
PRE-TEST CONDITIONS: Called termination is free		
CONFIGURATION: 1	TYPE OF TEST: VAT and CPT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

SP A		SP B
IAM	------------------------->	
	<-------------------------	ACM
	-------------------------------------	Ringing tone
	<-------------------------	ANC
Speech	— — — — — — — — — — — —	Speech
	<-------------------------	CBK
CLF	------------------------->	
	<-------------------------	RLG

TEST DESCRIPTION

1.	Make a call from SP A to SP B. Record the message sequence using a signal monitor.
2.	CHECK A: IS RINGING TONE HEARD? ......
3.	The called party should answer the call.
4.	CHECK B: IS SPEECH POSSIBLE? ......
5.	The called party should clear the call.
6.	The calling party should clear the call.
7.	CHECK C: IS THE CIRCUIT IDLE? ......
8.	CHECK D: WAS THE MESSAGE SEQUENCE AS ABOVE? ......
9.	For validation testing repeat this test in the reverse direction.

TEST NUMBER: 3.5

REFERENCE: Q.724 § 1.14

TITLE: Normal call release

SUBTITLE: Called party clears and reanswers

PURPOSE: To verify that the called subscriber can successfully clear and reanswer a call in the speech state

PRE-TEST CONDITIONS: Called termination is free

CONFIGURATION: 1	TYPE OF TEST: VAT and CPT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

SP A		SP B
IAM	------------------------->	
	<-------------------------	ACM
	--	Ringing tone
	<-------------------------	ANC
Speech	– – – – – – – – – – – – –	Speech
	<-------------------------	CBK
	<-------------------------	RAN
Speech	– – – – – – – – – – – – –	Speech
CLF	------------------------->	
	<-------------------------	RLG

TEST DESCRIPTION

1.	Make a call from SP A to SP B. Record the message sequence using a signal monitor.
2.	CHECK A: IS RINGING TONE HEARD?......
3.	The called party should answer the call.
4.	CHECK B: IS SPEECH POSSIBLE?......
5.	The called party should clear the call.
6.	The called party should reanswer the call.
7.	CHECK C: IS SPEECH STILL POSSIBLE?......
8.	The calling party should clear the call.
9.	CHECK D: IS THE CIRCUIT IDLE?......
10.	CHECK E: WAS THE MESSAGE SEQUENCE AS ABOVE?......
11.	For validation testing repeat this test in the reverse direction.

TEST NUMBER: 4.1.1		
REFERENCE: Q.724 § 1.8		
TITLE: SEC		
SUBTITLE: SEC received		
PURPOSE: To verify the call will be immediately released by the outgoing signalling point if a switching equipment congestion signal is received and the correct indication is given to the calling party		
PRE-TEST CONDITIONS: Arrange the data in signalling point B such that switching equipment congestion is returned to the request		
CONFIGURATION: 1	TYPE OF TEST: VAT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

```
SP A                                                SP B

IAM          ------------------------->
             <-------------------------             SEC
CLF          ------------------------->
             <-------------------------             RLG
```

TEST DESCRIPTION

1.	Attempt to make a call from SP A to SP B. Record the message sequence with a signal monitor.
2.	CHECK A: IS THE APPROPRIATE TONE OR ANNOUNCEMENT RETURNED TO THE CALLING PARTY?......
3.	CHECK B: IS THE CIRCUIT IDLE?......
4.	CHECK C: WAS THE MESSAGE SEQUENCE AS ABOVE?...... *Note* – It may not be possible to confirm that the appropriate tone is returned to the calling party. In this case it must be verified that the signalling point under test retransmits the signal received.

TEST NUMBER: 4.1.2		
REFERENCE: Q.724 § 1.8		
TITLE: SEC		
SUBTITLE: SEC sent		
PURPOSE: To verify that SP A is able to generate a switching equipment congestion message		
PRE-TEST CONDITIONS: Arrange the data in SP A such that switching equipment congestion is returned to the call request		
CONFIGURATION: 1	TYPE OF TEST: VAT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

SP A		SP B
	<-------------------------	IAM
SEC	------------------------->	
	<-------------------------	CLF
RLG	------------------------->	

TEST DESCRIPTION

1. Attempt to make a call from SP B to SP A.
   Record the message sequence with a signal monitor.
2. CHECK A: IS THE APPROPRIATE TONE OR ANNOUNCEMENT RETURNED TO THE CALLING PARTY?......
3. CHECK B: IS THE CIRCUIT IDLE?......
4. CHECK C: WAS THE MESSAGE SEQUENCE AS ABOVE?......

Note – It may not be possible to confirm that the appropriate tone is returned to the calling party. In this case it must be verified that the signalling point under test retransmits the signal received.

TEST NUMBER: 4.2.1		
REFERENCE: Q.724 § 1.8		
TITLE: CGC		
SUBTITLE: CGC received		
PURPOSE: To verify that a call will be immediately released by the outgoing signalling point if a circuit group congestion signal is received and the correct indication is given to the calling party		
PRE-TEST CONDITIONS: Arrange the data in signalling point B such that a circuit group congestion signal is returned to the call request		
CONFIGURATION: 1	TYPE OF TEST: VAT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

SP A		SP B
IAM	------------------------->	
	<-------------------------	CGC
CLF	------------------------->	
	<-------------------------	RLG

TEST DESCRIPTION

1.	Attempt to make a call from SP A to SP B. Record the message sequence using a signal monitor.
2.	CHECK A: IS THE APPROPRIATE TONE OR ANNOUNCEMENT RETURNED TO THE CALLING PARTY?......
3.	CHECK B: IS THE CIRCUIT IDLE?......
4.	CHECK C: WAS THE MESSAGE SEQUENCE AS ABOVE?......

Note 1 – An address complete signal (without subscriber free) may be sent in the backward direction before a CGC signal is sent.

Note 2 – It may not be possible to confirm that the appropriate tone is returned to the calling party. In this case it must be verified that the signalling point under test retransmits the signal received.

TEST NUMBER: 4.2.2

REFERENCE: Q.724 § 1.8

TITLE: CGC

SUBTITLE: CGC sent

PURPOSE: To verify that SP A is able to generate a circuit group congestion signal

PRE-TEST CONDITIONS: Arrange the data in signalling point A such that a circuit group congestion signal is returned to the call request

CONFIGURATION: 1	TYPE OF TEST: VAT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

```
SP   A                                                SP   B

                    <-------------------------        IAM
CGC                 ------------------------->
                    <-------------------------        CLF
RLG                 ------------------------->
```

TEST DESCRIPTION

1.	Attempt to make a call from SP B to SP A. Record the message sequence using a signal monitor.
2.	CHECK A: IS THE APPROPRIATE TONE OR ANNOUNCEMENT RETURNED TO THE CALLING PARTY?......
3.	CHECK B: IS THE CIRCUIT IDLE?......
4.	CHECK C: WAS THE MESSAGE SEQUENCE AS ABOVE?......

Note 1 – An address complete signal (without subscriber free) may be sent in the backward direction before a CGC signal is sent.

Note 2 – It may not be possible to confirm that the appropriate tone is returned to the calling party. In this case it must be verified that the signalling point under test retransmits the signal received.

TEST NUMBER: 4.3.1

REFERENCE: Q. 724 § 1.8

TITLE: NNC

SUBTITLE: NNC received

PURPOSE: To verify that the call will be immediately released by the outgoing signalling point if a national network congestion signal is received and the correct indication is given to the calling party

PRE-TEST CONDITIONS: Arrange the data in SP B such that a national network congestion signal is returned to the call request

CONFIGURATION: 1	TYPE OF TEST: VAT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

SP A		SP B
IAM	------------------------->	
	<-------------------------	NNC
CLF	------------------------->	
	<-------------------------	RLG

TEST DESCRIPTION

1.	Attempt to make a call from SP A to SP B. Record the message sequence using a signal monitor.
2.	CHECK A: IS THE APPROPRIATE TONE OR ANNOUNCEMENT RETURNED TO THE CALLING PARTY?......
3.	CHECK B: IS THE CIRCUIT IDLE?......
4.	CHECK C: WAS THE MESSAGE SEQUENCE AS ABOVE?......

Note 1 – An address complete signal (without subscriber free) may be sent in the backward direction before a NNC signal is sent.

Note 2 – It may not be possible to confirm that the appropriate tone is returned to the calling party. In this case it must be verified that the signalling point under test retransmits the signal received.

TEST NUMBER: 4.3.2		
REFERENCE: Q.724 § 1.8		
TITLE: NNC		
SUBTITLE: NNC sent		
PURPOSE: To verify that SP A is able to generate a national network congestion signal		
PRE-TEST CONDITIONS: Arrange the data in signalling point A such that a national network congestion signal is returned to the call request, where SP A is now an I/C exchange		
CONFIGURATION: 1	TYPE OF TEST: VAT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

SP A		SP B
	<-------------------------	IAM
NNC	------------------------->	
	<-------------------------	CLF
RLG	------------------------->	

TEST DESCRIPTION

1.	Attempt to make a call from SP B to SP A.
2.	CHECK A: IS THE APPROPRIATE TONE OR ANNOUNCEMENT RETURNED TO THE CALLING PARTY?......
3.	CHECK B: IS THE CIRCUIT IDLE?......
4.	CHECK C: WAS THE MESSAGE SEQUENCE AS ABOVE?......
	Note 1 – An address complete signal (without subscriber free) may be sent in the backward direction before a NNC signal is sent.
	Note 2 – It may not be possible to confirm that the appropriate tone is returned to the calling party. In this case it must be verified that the signalling point under test retransmits the signal received.

TEST NUMBER: 4.4.1
REFERENCE: Q.724 § 1.7
TITLE: ADI
SUBTITLE: ADI received
PURPOSE: To verify that on receipt of an address incomplete message the call is immediately released and the correct indication given to the calling party
PRE-TEST CONDITIONS: Signalling point B should be able to determine that the proper number of digits has not been received

CONFIGURATION: 1	TYPE OF TEST: VAT and CPT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

SP A		SP B
IAM	------------------------->	
	<-------------------------	ADI
CLF	------------------------->	
	<-------------------------	RLG

TEST DESCRIPTION

1.	Make a call from SP A to SP B, but do not enter the final digit. Record the message sequence using a signal monitor.
2.	CHECK A: WAS THE CORRECT TONE OR ANNOUNCEMENT SENT TO THE CALLING SUBSCRIBER?......
3.	CHECK B: IS THE CIRCUIT IDLE?......
4.	CHECK C: WAS THE MESSAGE SEQUENCE AS ABOVE?......
	Note – It may not be possible to confirm that the appropriate tone is returned to the calling party. In this case it must be verified that the signalling point under test retransmits the signal received.

TEST NUMBER: 4.4.2

REFERENCE: Q.724 § 1.7

TITLE: ADI

SUBTITLE: ADI sent

PURPOSE: To verify that signalling point A is able to generate an address incomplete signal

PRE-TEST CONDITIONS: SP A should be able to determine that the proper number of digits has not been received

CONFIGURATION: 1	TYPE OF TEST: VAT and CPT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

SP A		SP B
	<-------------------------	IAM
ADI	------------------------->	
	<-------------------------	CLF
RLG	------------------------->	

TEST DESCRIPTION

1. Make a call from SP B to SP A, but do not enter the final digit.
   Record the message sequence using a signal monitor.
2. CHECK A: WAS THE CORRECT TONE OR ANNOUNCEMENT SENT TO THE CALLING SUBSCRIBER?......
3. CHECK B: IS THE CIRCUIT IDLE?......
4. CHECK C: WAS THE MESSAGE SEQUENCE AS ABOVE?......

Note – It may not be possible to confirm that the appropriate tone is returned to the calling party. In this case it must be verified that the signalling point under test retransmits the signal received.

TEST NUMBER: 4.5.1		
REFERENCE: Q.724 § 6.3		
TITLE: CFL		
SUBTITLE: CFL received		
PURPOSE: To verify that the call will be immediately released by the outgoing signalling point if a call failure signal is received and the correct indication is given to the calling party		
PRE-TEST CONDITIONS: Arrange the data in signalling point B such that a call failure signal is returned to the call request		
CONFIGURATION: 1	TYPE OF TEST: VAT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

SP A		SP B
IAM	------------------------->	
	<-------------------------	CFL
CLF	------------------------->	
	<-------------------------	RLG

TEST DESCRIPTION

1.	Attempt to make a call from SP A to SP B. Record the message sequence using a signal monitor.
2.	CHECK A: IS THE APPROPRIATE TONE OR ANNOUNCEMENT RETURNED TO THE CALLING PARTY?......
3.	CHECK B: IS THE CALL IDLE?......
4.	CHECK C: WAS THE MESSAGE SEQUENCE AS ABOVE?......

Note 1 – An address complete signal may be sent in the backward direction before a CFL signal is sent.

Note 2 – It may not be possible to confirm that the appropriate tone is returned to the calling party. In this case it must be verified that the signalling point under test retransmits the signal received.

TEST NUMBER: 4.5.2		
REFERENCE: Q.724 § 6.3		
TITLE: CFL		
SUBTITLE: CFL sent		
PURPOSE: To verify that signalling point A is able to generate a call failure signal		
PRE-TEST CONDITIONS: Arrange the data in SP A such that a call failure signal is returned to the call request		
CONFIGURATION: 1	TYPE OF TEST: VAT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

SP A		SP B
	<-------------------------	IAM
CFL	------------------------->	
	<-------------------------	CLF
RLG	------------------------->	

TEST DESCRIPTION

1.	Attempt to make a call from SP B to SP A. Record the message sequence using a signal monitor.
2.	CHECK A: IS THE APPROPRIATE TONE OR ANNOUNCEMENT RETURNED TO THE CALLING PARTY?......
3.	CHECK B: IS THE CALL IDLE?......
4.	CHECK C: WAS THE MESSAGE SEQUENCE AS ABOVE?......

Note 1 – An address complete signal may be sent in the backward direction before a CFL signal is sent.

Note 2 – It may not be possible to confirm that the appropriate tone is returned to the calling party. In this case it must be verified that the signalling point under test retransmits the signal received.

TEST NUMBER: 4.6.1		
REFERENCE: Q.724 § 1.9		
TITLE: SSB		
SUBTITLE: SSB Received		
PURPOSE: To verify that the call will be immediately released by SP A if a Subscriber-busy signal is received and the correct indication is given to the calling party		
PRE-TEST CONDITIONS: Called termination must be busy		
CONFIGURATION: 1	TYPE OF TEST: VAT and CPT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

SP A		SP B
IAM	------------------------->	
	<-------------------------	SSB
CLF	------------------------->	
	<-------------------------	RLG

TEST DESCRIPTION

1.	Attempt to make a call from SP A to SP B. Record the message sequence with a signal monitor.
2.	CHECK A: IS THE APPROPRIATE TONE OR ANNOUNCEMENT RETURNED TO THE CALLING PARTY?......
3.	CHECK B: IS THE CIRCUIT IDLE?......
4.	CHECK C: WAS THE MESSAGE SEQUENCE AS ABOVE?......

Note 1 – It may not be possible to confirm that the appropriate tone is returned to the calling party. In this case it must be verified that the signalling point under test retransmits the signal received.

Note 2 – This sequence may not be possible at International Gateways.

TEST NUMBER: 4.6.2		
REFERENCE: Q.724 § 1.9		
TITLE: SSB		
SUBTITLE: SSB Sent		
PURPOSE: To verify that signalling point A is able to generate or retransmit a subscriber busy signal		
PRE-TEST CONDITIONS: The called termination must be busy		
CONFIGURATION: 1	TYPE OF TEST: VAT and CPT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

```
SP   A                                                  SP   B

                 <------------------------              IAM
SSB              ------------------------->
                 <------------------------              CLF
RLG              ------------------------->
```

TEST DESCRIPTION

1.	Attempt to make a call from SP B to SP A. Record the message sequence using a signal monitor.
2.	CHECK A: IS THE APPROPRIATE TONE OR ANNOUNCEMENT RETURNED TO THE CALLING PARTY?......
3.	CHECK B: IS THE CIRCUIT IDLE?......
4.	CHECK C: WAS THE MESSAGE SEQUENCE AS ABOVE?......

Note 1 – It may not be possible to confirm that the appropriate tone is returned to the calling party. In this case it must be verified that the signalling point under test retransmits the signal received.

Note 2 – This sequence may not be possible at International Gateways.

TEST NUMBER: 4.7.1

REFERENCE: Q.724

TITLE: UNN

SUBTITLE: UNN Received

PURPOSE: To verify that the call will be immediately released by SP A if an Unallocated-number signal is received and the correct indication is given to the calling party

PRE-TEST CONDITIONS: Arrange the data in signalling point B such that a UNN Signal is returned to the call request

CONFIGURATION: 1	TYPE OF TEST: VAT and CPT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

```
SP  A                                                 SP  B

IAM        ------------------------->
           <-------------------------                 UNN
CLF        ------------------------->
           <-------------------------                 RLG
```

TEST DESCRIPTION

1. Attempt to make a call from SP A to SP B.
   Record the message sequence with a signal monitor.
2. CHECK A: IS THE APPROPRIATE TONE OR ANNOUNCEMENT RETURNED TO THE CALLING PARTY?......
3. CHECK B: IS THE CIRCUIT IDLE?......
4. CHECK C: WAS THE MESSAGE SEQUENCE AS ABOVE?......

Note 1 – It may not be possible to confirm that the appropriate tone is returned to the calling party. In this case it must be verified that the signalling point under test retransmits the signal received.

Note 2 – This sequence may not be possible at International Gateways.

TEST NUMBER: 4.7.2

REFERENCE: Q.724

TITLE: UNN

SUBTITLE: UNN Sent

PURPOSE: To verify that signalling point A is able to generate an Unallocated-number signal

PRE-TEST CONDITIONS: Arrange the data in signalling point A such that a UNN Signal is returned to the call request

CONFIGURATION: 1	TYPE OF TEST: VAT and CPT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

```
SP   A                                                  SP   B

                 <-------------------------             IAM
UNN              ------------------------->
                 <-------------------------             CLF
RLG              ------------------------->
```

TEST DESCRIPTION

1. Attempt to make a call from SP B to SP A.
   Record the message sequence using a signal monitor.
2. CHECK A: IS THE APPROPRIATE TONE OR ANNOUNCEMENT RETURNED TO THE CALLING PARTY?......
3. CHECK B: IS THE CIRCUIT IDLE?......
4. CHECK C: WAS THE MESSAGE SEQUENCE AS ABOVE?......

Note 1 – It may not be possible to confirm that the appropriate tone is returned to the calling party. In this case it must be verified that the signalling point under test retransmits the signal received.

Note 2 – This sequence may not be possible at International Gateways.

TEST NUMBER: 4.8.1
REFERENCE: Q.724
TITLE: LOS
SUBTITLE: LOS Received
PURPOSE: Verify that the call will be immediately released by SP A if a Line out of service signal is received and the correct indication is given to the calling party
PRE-TEST CONDITIONS: Arrange the data in signalling point B such that a LOS Signal is returned to the call request

CONFIGURATION: 1	TYPE OF TEST: VAT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

```
SP   A                                                    SP   B

IAM            ------------------------->
               <-------------------------                 LOS
CLF            ------------------------->
               <-------------------------                 RLG
```

TEST DESCRIPTION

1.	Attempt to make a call from SP A to SP B. Record the message sequence with a signal monitor.
2.	CHECK A: IS THE APPROPRIATE TONE OR ANNOUNCEMENT RETURNED TO THE CALLING PARTY?......
3.	CHECK B: IS THE CIRCUIT IDLE?......
4.	CHECK C: WAS THE MESSAGE SEQUENCE AS ABOVE?......
	Note – It may not be possible to confirm that the appropriate tone is returned to the calling party. In this case it must be verified that the signalling point under test retransmits the signal received.

TEST NUMBER: 4.8.2

REFERENCE: Q.724

TITLE: LOS

SUBTITLE: LOS Sent

PURPOSE: To verify that signalling point A is able to retransmit a Line-out-of-service signal

PRE-TEST CONDITIONS: Arrange the data in signalling point A such that a LOS Signal is returned to the call request

CONFIGURATION: 1	TYPE OF TEST: VAT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

```
SP   A                                                   SP   B

                  <-------------------------             IAM
LOS               ------------------------->
                  <-------------------------             CLF
RLG               ------------------------->
```

TEST DESCRIPTION

1.	Attempt to make a call from SP B to SP A. Record the message sequence using a signal monitor.
2.	CHECK A: IS THE APPROPRIATE TONE OR ANNOUNCEMENT RETURNED TO THE CALLING PARTY?......
3.	CHECK B: IS THE CIRCUIT IDLE?......
4.	CHECK C: WAS THE MESSAGE SEQUENCE AS ABOVE?......

Note 1 – It may not be possible to confirm that the appropriate tone is returned to the calling party. In this case it must be verified that the signalling point under test retransmits the signal received.

Note 2 – This sequence may not be possible at International Gateways.

TEST NUMBER: 4.9.1		
REFERENCE: Q.724		
TITLE: SST		
SUBTITLE: SST received		
PURPOSE: To verify that a call will be immediately released by the outgoing signalling point if a send-special-information-tone signal is received and the correct indication is given to the calling party		
PRE-TEST CONDITIONS: Arrange the data in signalling point B such that a SST signal is returned to the call request		
CONFIGURATION: 1	TYPE OF TEST: VAT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

SP A		SP B
IAM	------------------------->	
	<-------------------------	SST
CLF	------------------------->	
	<-------------------------	RLG

TEST DESCRIPTION

1.	Attempt to make a call from SP A to SP B Record the message sequence with a signal monitor.
2.	CHECK A: IS THE APPROPRIATE TONE RETURNED TO THE CALLING PARTY?......
3.	CHECK B: IS THE CIRCUIT IDLE?......
4.	CHECK C: WAS THE MESSAGE SEQUENCE AS ABOVE?......
	Note – It may not be possible to confirm that the appropriate tone is returned to the calling party. In this case it must be verified that the signalling point under test retransmits the signal received.

TEST NUMBER: 4.9.2

REFERENCE: Q.724

TITLE: SST

SUBTITLE: SST sent

PURPOSE: To verify that signalling point A is able to generate a send-special-information-tone signal

PRE-TEST CONDITIONS: Arrange the data in signalling point A such that a SST signal is returned to the call request

CONFIGURATION: 1	TYPE OF TEST: VAT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

SP A		SP B
	<-------------------------	IAM
SST	------------------------->	
	<-------------------------	CLF
RLG	------------------------->	

TEST DESCRIPTION

1.	Attempt to make a call from SP B to SP A Record the message sequence with a signal monitor.
2.	CHECK A: IS THE APPROPRIATE TONE RETURNED TO THE CALLING PARTY?......
3.	CHECK B: IS THE CIRCUIT IDLE?......
4.	CHECK C: WAS THE MESSAGE SEQUENCE AS ABOVE?......

Note – It may not be possible to confirm that the appropriate tone is returned to the calling party. In this case it must be verified that the signalling point under test retransmits the signal received.

TEST NUMBER: 4.10.1

REFERENCE: Q.724 § 10.2

TITLE: ACB

SUBTITLE: ACB received

PURPOSE: To verify that because of incompatible CUG information the call is rejected and an access barred signal is returned to the call request

PRE-TEST CONDITIONS: Arrange the signalling point data such that the CUG information contained in the IAI is compatible with the information stored at SP B

CONFIGURATION: 1	TYPE OF TEST: VAT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

SP A		SP B
IAI	------------------------->	
	<-------------------------	ACB
CLF	------------------------->	
	<-------------------------	RLG

TEST DESCRIPTION

1.	Make a CUG call from SP A to SP B. Record the message sequence using a signal monitor.
2.	CHECK A: IS THE APPROPRIATE TONE OR ANNOUNCEMENT RETURNED TO THE CALLING PARTY?......
3.	CHECK B: IS THE CIRCUIT IDLE?......
4.	CHECK C: WAS THE MESSAGE SEQUENCE AS ABOVE?...... *Note* – It may not be possible to confirm that the appropriate tone is returned to the calling party. In this case it must be verified that the signalling point under test retransmits the signal received.

TEST NUMBER: 4.10.2

REFERENCE: Q.724 § 10.2

TITLE: ACB

SUBTITLE: ACB sent

PURPOSE: To verify that SP A is able to generate or receive an access barred signal

PRE-TEST CONDITIONS:

CONFIGURATION: 1	TYPE OF TEST: VAT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

SP A		SP B
	<-------------------------	IAI
ACB	------------------------->	
	<-------------------------	CLF
RLG	------------------------->	

TEST DESCRIPTION

1. Make a CUG call from SP B to SP A.
   Record the message sequence using a signal monitor.
2. CHECK A: IS THE APPROPRIATE TONE OR ANNOUNCEMENT RETURNED TO THE CALLING PARTY?......
3. CHECK B: IS THE CIRCUIT IDLE?......
4. CHECK C: WAS THE MESSAGE SEQUENCE AS ABOVE?......

Note – It may not be possible to confirm that the appropriate tone is returned to the calling party. In this case it must be verified that the signalling point under test retransmits the signal received.

TEST NUMBER: 4.11.1

REFERENCE: Q.724 § 10.7

TITLE: DPN

SUBTITLE: DPN received

PURPOSE: To verify that the call will be immediately released by the SP A if a digital path not provided signal is received and the correct indicator is given to the calling party

PRE-TEST CONDITIONS:

a) Ensure the IAM is set to indicate that an all digital path is required.

b) Ensure the data in signalling point B is configured such that a digital path not provided signal is returned to the call request.

CONFIGURATION: 1	TYPE OF TEST: VAT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

SP A		SP B
IAM	------------------------->	
	<-------------------------	DPN
CLF	------------------------->	
	<-------------------------	RLG

TEST DESCRIPTION

1. Attempt to make a call from SP A to SP B.
Ensuring that the IAM is set to indicate that an all digital path is required. Record the message sequence using a signal monitor.

2. CHECK A: IS THE CIRCUIT IDLE?......

3. CHECK B: WAS THE MESSAGE SEQUENCE AS ABOVE?......

Note – It may not be possible to confirm that the appropriate tone is returned to the calling party. In this case it must be verified that the signalling point under test retransmits the signal received.

TEST NUMBER: 4.11.2		
REFERENCE: Q.724 § 10.7		
TITLE: DPN		
SUBTITLE: DPN sent		
PURPOSE: To verify that signalling point A is able to generate a digital path not provided signal		
PRE-TEST CONDITIONS: Arrange the data in signalling point A such that a DPN signal is returned to the call request		
CONFIGURATION: 1	TYPE OF TEST: VAT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

SP A		SP B
	<-------------------------	IAM
DPN	------------------------->	
	<-------------------------	CLF
RLG	------------------------->	

TEST DESCRIPTION

1. Attempt to make a call from SP B to SP A.
   Record the message sequence with a signal monitor.
2. CHECK B: IS THE CIRCUIT IDLE? . . . . . .
3. CHECK C: WAS THE MESSAGE SEQUENCE AS SHOWN ABOVE? . . . . . .

Note – It may not be possible to confirm that the appropriate tone is returned to the calling party. In this case it must be verified that the signalling point under test retransmits the signal received.

TEST NUMBER: 5.1

REFERENCE: Q.724 § 6.2.1

TITLE: Inability to release in response to a CLF

SUBTITLE:

PURPOSE: To verify that if the signalling point is unable to return a circuit to the idle condition in response to a clear forward signal, the circuit will be blocked

PRE-TEST CONDITIONS: Arrange the data in signalling point A such that it is unable to return the circuit to the idle condition in response to a clear forward signal

CONFIGURATION: 1	TYPE OF TEST: VAT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

SP A		SP B
	<-------------------------	IAM
ACM	------------------------->	
Ringing tone	-------------------------------------	
ANC	------------------------->	
Speech	– – – – – – – – – – – – –	Speech
	<-------------------------	CLF
BLO	------------------------->	
	<-------------------------	BLA
RLG	------------------------->	

TEST DESCRIPTION

1.	Make a call from SP A to SP B. Record the message sequence using a signal monitor.
2.	CHECK A: IS RINGING TONE HEARD?......
3.	The called party should answer the call
4.	CHECK B: IS SPEECH POSSIBLE?......
5.	The calling party should release the call.
6.	CHECK C: VERIFY THAT A CALL CAN NOT BE ORIGINATED FROM EITHER SP
7.	CHECK D: WAS THE MESSAGE SEQUENCE AS ABOVE?......
8.	Repeat this test in the reverse direction.

TEST NUMBER: 5.2	
REFERENCE: Q.724 § 6.2.2	
TITLE: Inability to release in response to a backward signal	
SUBTITLE:	
PURPOSE: To verify that if signalling point is unable to return the circuit to an idle condition in response to a backward signal, the circuit will be blocked	
PRE-TEST CONDITIONS: Arrange the data in signalling point A such that it is unable to return the circuit to an idle condition in response to a backward signal	

CONFIGURATION: 1	TYPE OF TEST: VAT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

SP A		SP B
IAM	------------------------->	
	<-------------------------	ADI
BLO	------------------------->	
	<-------------------------	BLA
CLF	------------------------->	
	<-------------------------	RLG

TEST DESCRIPTION

1.	Make a call from SP A to SP B, but do not enter the final digit.
2.	CHECK A: VERIFY THAT A CALL CAN NOT BE ORIGINATED FROM EITHER EXCHANGE
3.	CHECK B: WAS THE MESSAGE SEQUENCE AS ABOVE?......
4.	Repeat this test in the reverse direction.

TEST NUMBER: 5.3.1

REFERENCE: Q.724 § 6.4.3a

TITLE: Timers

SUBTITLE: T2

PURPOSE: To check the value of timer T2

PRE-TEST CONDITIONS: Arrange the data in signalling point B such that an address complete message is not returned to the call request

CONFIGURATION: 1	TYPE OF TEST: VAT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

```
SP   A                                                    SP   B

IAM  ┬                  ------------------------>
     │
  T2 │ 20-30 seconds
     │
CLF  ┴                  ------------------------>
                        <------------------------         RLG
```

TEST DESCRIPTION

1.	Attempt to make a call from SP A to SP B. Record the message sequence with a signal monitor.
2.	CHECK A: WAS THE CLEAR FORWARD SIGNAL SENT BEFORE 20-30 SECONDS?......
3.	CHECK B: IS THE CIRCUIT IDLE?......
4.	CHECK C: WAS THE MESSAGE SEQUENCE AS ABOVE?......

TEST NUMBER: 5.3.2		
REFERENCE: Q.724 § 6.4.3b		
TITLE: Timers		
SUBTITLE: T3		
PURPOSE: To check the value of timer T3		
PRE-TEST CONDITIONS: a) Signalling point A should be able to determine that the proper number of digits have not been received. b) Arrange the data in signalling point B such that a clear forward signal is not returned in response to an address incomplete message.		
CONFIGURATION: 1	TYPE OF TEST: VAT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

SP A		SP B
	<-------------------------	IAM
ADI	------------------------->	
T3 4-15 seconds		
CFL	------------------------->	
	<-------------------------	CLF
RLG	------------------------->	

TEST DESCRIPTION

1.	Attempt to make a call from SP B to SP A but do not dial the last digit. Record the message sequence using a signal monitor.
2.	CHECK A: WAS A CALL FAILURE SIGNAL SENT BETWEEN 4-15 SECONDS AFTER SENDING OF THE ADDRESS INCOMPLETE MESSAGE?......
3.	CHECK B: IS THE CIRCUIT IDLE?......
4.	CHECK C: WAS THE MESSAGE SEQUENCE AS ABOVE?......

TEST NUMBER: 5.3.3

REFERENCE: Q.724 § 6.4.3b

TITLE: Timers

SUBTITLE: T4

PURPOSE: To check the value of timer T4

PRE-TEST CONDITIONS:

a) Signalling point A should be able to determine that the proper number of digits have not been received.

b) Arrange the data in signalling point B such that a clear forward signal is not returned in response to an address incomplete message.

c) Arrange the data in signalling point B such that a clear forward signal is not returned in response to a call failure signal.

CONFIGURATION: 1	TYPE OF TEST: VAT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

SP A			SP B
		<------------------------	IAM
ADI		------------------------>	
T3	4-15 seconds		
CFL		------------------------>	
T4	4-15 seconds		
CFL		------------------------>	

TEST DESCRIPTION

1.	Attempt to make a call from SP B to SP A but do not send the last digit. Record the message sequence using a signal monitor.
2.	CHECK A: WAS THE CALL FAILURE SIGNAL REPEATED BETWEEN 4-15 SECONDS AFTER SENDING THE INITIAL CALL FAILURE SIGNAL?......
3.	CHECK B: WAS THE MESSAGE SEQUENCE AS ABOVE?......

TEST NUMBER: 5.3.4

REFERENCE: Q.724 § 6.4.3b

TITLE: Timers

SUBTITLE: T5

PURPOSE: To check the value of timer T5

PRE-TEST CONDITIONS:

a) Signalling point A should be able to determine that the proper number of digits have not been received.
b) Arrange the data in signalling point B such that a clear forward signal is not returned in response to an address incomplete message.
c) Arrange the data in signalling point B such that a clear forward signal is not returned in response to a call failure signal.

CONFIGURATION: 1	TYPE OF TEST: VAT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

```
SP      A                                                  SP        B

                               <-------------------------  IAM
ADI                  -+-       ------------------------->
                 T3   |  4-15 seconds
CFL          -+-     -+-       ------------------------->
              |  T4   |  4-15 seconds
CFL           |      -+-       ------------------------->
              |  T4   |  4-15 seconds
CFL           |      -+-       ------------------------->
         T5   |  1 minute
RSC          -+-               ------------------------->
```

TEST DESCRIPTION

1.	Attempt to make a call from SP B to SP A but do not send the last digit. Record the message sequence using a signal monitor.
2.	CHECK A: WAS THE CALL FAILURE SIGNAL REPEATED BETWEEN 4-15 SECONDS AFTER SENDING THE INITIAL CALL FAILURE SIGNAL?......
3.	CHECK B: WAS THE CALL FAILURE SIGNAL REPEATED FOR A PERIOD OF ONE MINUTE?......
4.	CHECK C: WAS A RESET CIRCUIT SIGNAL SENT ON THE EXPIRY OF TIMER T5?......
5.	CHECK D: WAS THE MESSAGE SEQUENCE AS ABOVE?......

TEST NUMBER: 5.3.5

REFERENCE: Q.724 § 6.2.3

TITLE: Timers

SUBTITLE: T6

PURPOSE: To check the value of timer T6

PRE-TEST CONDITIONS: Arrange the data in signalling point B such that a release guard is not returned in response to a clear forward signal

CONFIGURATION: 1	TYPE OF TEST: VAT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

```
SP   A                                                        SP   B

IAM                        ------------------------->
                           <-------------------------         ACM
                           -------------------------          Ringing tone

CLF                        ------------------------->

   T6    4-15 seconds

CLF                        ------------------------->
```

TEST DESCRIPTION

1. Make a call from SP A to SP B, record the message sequence using a signal monitor.
2. CHECK A: IS RINGING TONE HEARD?......
3. The calling party should clear the call.
4. CHECK B: WAS THE CLEAR FORWARD SIGNAL REPEATED BEFORE 4-15 SECONDS AFTER SENDING THE INITIAL CLEAR FORWARD SIGNAL?......
5. CHECK C: WAS THE MESSAGE SEQUENCE AS ABOVE?......

TEST NUMBER: 5.3.6		
REFERENCE: Q.118		
TITLE: Q.118 timers		
SUBTITLE: Answer signal not received		
PURPOSE: To verify that if an answer signal is not received within 2-4 minutes after receiving an address complete signal the connection is released by the outgoing signalling point		
PRE-TEST CONDITIONS: The called party should not answer the call		
CONFIGURATION: 1	TYPE OF TEST: VAT and CPT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

```
SP   A                                                  SP   B

IAM                  ------------------------->
                     <-------------------------         ACM
       |
       | 2-4 minutes
       |
CLF                  ------------------------->
                     <-------------------------         RLG
```

TEST DESCRIPTION

1.	Attempt to make a call from SP A to SP B. Record the message sequence using a signal monitor.
2.	CHECK A: IS RINGING TONE HEARD?......
3.	The called party should NOT answer the call.
4.	CHECK B: WAS THE CLEAR FORWARD SEND WITHIN A PERIOD OF 2 To 4 MINUTES SIGNAL?......
5.	CHECK C: IS THE CIRCUIT IDLE?......
6.	CHECK D: WAS THE MESSAGE SEQUENCE AS ABOVE?......
	Note – The timer need only be run at the outgoing international exchange.

TEST NUMBER: 5.3.7		
REFERENCE: Q.118		
TITLE: Q.118 timers		
SUBTITLE: Delay in clearing by calling party		
PURPOSE: Verify that the call will be released if the calling party has not cleared the call within 1-2 minutes after the called party clears		
PRE-TEST CONDITIONS: The called party should not answer the call		
CONFIGURATION: 1	TYPE OF TEST: VAT and CPT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

SP A		SP B
IAM	------------------------->	
	<-------------------------	ACM
	-------------------------------------	Ringing tone
	<-------------------------	ANC
Speech	– – – – – – – – – – – – –	Speech
	<-------------------------	CBK
1-2 minutes		
CLF	------------------------->	
	<-------------------------	RLG

TEST DESCRIPTION

1.	Make a call from SP A to SP B. Record the message sequence using a signal monitor.
2.	CHECK A: IS RINGING TONE HEARD?......
3.	The called party should answer the call.
4.	CHECK B: IS SPEECH POSSIBLE?......
5.	The called party should clear the call.
6.	CHECK C: WAS THE CLEAR FORWARD SENT WITHIN A PERIOD OF BETWEEN 1 AND 2 MINUTES?......
7.	CHECK D: IS THE CIRCUIT IDLE?......
8.	CHECK E: WAS THE MESSAGE SEQUENCE AS ABOVE?......

TEST NUMBER: 5.4.1

REFERENCE: Q.724 § 1.15

TITLE: Reset of circuits during a call

SUBTITLE: Of an outgoing circuit

PURPOSE: To verify that on receipt of a reset circuit signal the call is immediately released

PRE-TEST CONDITIONS:

a) Called termination is free

CONFIGURATION: 1	TYPE OF TEST: VAT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

SP A		SP B
IAM	------------------------->	
	<-------------------------	ACM
	-------------------------------------	Ringing tone
	<-------------------------	ANC
Speech	– – – – – – – – – – – – –	Speech
	<-------------------------	RSC
CLF	------------------------->	
	<-------------------------	RLG

TEST DESCRIPTION

1.	Make a call for SP A to SP B. Record the message sequence using a signal monitor.
2.	CHECK A: IS RINGING TONE HEARD? . . . . . .
3.	The called party should answer the call.
4.	CHECK B: IS SPEECH POSSIBLE? . . . . . .
5.	Arrange for SP B to send a reset-circuit signal.
6.	CHECK C: IS THE CIRCUIT IDLE? . . . . . .
7.	CHECK D: WAS THE MESSAGE SEQUENCE AS ABOVE? . . . . . .

TEST NUMBER: 5.4.2		
REFERENCE: Q.724 § 1.15		
TITLE: Reset of circuit during call		
SUBTITLE: Of an incoming circuit		
PURPOSE: To verify that the circuit reset procedure can be correctly initiated during a call		
PRE-TEST CONDITIONS: a) Called termination is free		
CONFIGURATION: 1	TYPE OF TEST: VAT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

SP A		SP B
	<-------------------------	IAM
ACM	------------------------->	
Ringing tone	-------------------------------------	
ANC	------------------------->	
Speech	– – – – – – – – – – – – –	Speech
	<-------------------------	RSC
RLG	------------------------->	

TEST DESCRIPTION

1.	Make a call from SP B to SP A. Record the message sequence with a signal monitor.
2.	CHECK A: IS RINGING TONE HEARD?......
3.	The called party should answer the call.
4.	CHECK B: IS SPEECH POSSIBLE?......
5.	Arrange for SP B to send a reset circuit signal.
6.	CHECK C: IS THE CIRCUIT IDLE?......
7.	CHECK D: WAS THE MESSAGE SEQUENCE AS ABOVE?......

TUP LEVEL 4 TEST SPECIFICATION

TEST NUMBER: 5.5.1

REFERENCE: Q.724 § 6.5

TITLE: Receipt of unreasonable information during a call

SUBTITLE: Received

PURPOSE: To verify that the action taken by a signalling point upon receipt of unreasonable signalling information is as stated in Q.724 Section 6.5

PRE-TEST CONDITIONS:

a) Circuit idle and unblocked

CONFIGURATION: 1	TYPE OF TEST: VAT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

SP A		SP B
IAM	------------------------->	
	<-------------------------	ACM
	-------------------------------------	Ring tone
	<-------------------------	See Item 3 below
	<-------------------------	ANC
	– – – – – – – – – – – – –	Speech
	<-------------------------	See Item 6 below
CLF	------------------------->	
	<-------------------------	RLG

TEST DESCRIPTION

1.	Make a call from SP A to SP B. Record the message sequence using a signal monitor.
2.	CHECK A: IS RINGING TONE HEARD?......
3.	Send a message which would be unreasonable at this point in the call (i.e. COT) and confirm that the message is discarded.
4.	The called party should answer the call.
5.	CHECK B: IS SPEECH POSSIBLE?......
6.	SP B should send such a message which would be unreasonable at this point in the call (i.e. ACM) and confirm that the message is discarded.
7.	The calling point should clear the call.
8.	CHECK C: IS THE CIRCUIT IDLE?......
9.	CHECK D: WAS THE MESSAGE AS SHOWN ABOVE

Note – This test covers only some of the ambiguous messages which could be received.

TEST NUMBER: 6.1.1

REFERENCE: Q.724 § 7.3

TITLE: Continuity check call

SUBTITLE: COT applied on an outgoing circuit

PURPOSE: To verify that a call can be set up on a circuit requiring a continuity check

PRE-TEST CONDITIONS: Arrange the data in signalling point A such that a continuity check is required on this circuit

CONFIGURATION: 1	TYPE OF TEST: VAT and CPT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

SP A		SP B
IAM	------------------------->	
Check tone	-------------------------|	

COT	------------------------->	
	<-------------------------	ACM
	- - - - - - - - - - - - -	Ringing tone
	<-------------------------	ANC
Speech	- - - - - - - - - - - - -	Speech
CLF	------------------------->	
	<-------------------------	RLG

TEST DESCRIPTION

1.	Make a call from SP A to SP B. Record the message sequence using a signal monitor.
2.	CHECK A: IS RINGING TONE HEARD?......
3.	The called party should answer the call
4.	CHECK B: IS SPEECH POSSIBLE?......
5.	The calling party should clear the call.
6.	CHECK C: IS THE CIRCUIT IDLE?......
7.	CHECK D: WAS THE MESSAGE SEQUENCE AS SHOWN ABOVE?......
8.	For validation testing repeat this test in the reverse direction.

TEST NUMBER: 6.1.2		
REFERENCE: Q.724 § 7.3		
TITLE: Special call set up		
SUBTITLE: COT applied on a previous circuit		
PURPOSE: To verify that a call can be set up if a continuity check is being performed on a previous circuit		
PRE-TEST CONDITIONS: Arrange the data in signalling point A such that the signalling information indicates that a continuity check has been performed on a previous circuit		
CONFIGURATION: 1	TYPE OF TEST: VAT and CPT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

SP A		SP B
IAM	------------------------->	
	|	
	delay while check performed on previous circuit	
	|	
COT	------------------------->	
	<-------------------------	ACM
	- - - - - - - - - - - - -	Ringing tone
	<-------------------------	ANC
Speech	- - - - - - - - - - - - -	Speech
CLF	------------------------->	
	<-------------------------	RLG

TEST DESCRIPTION

1.	Make a call from SP A to SP B. Record the message sequence using a signal monitor.
2.	CHECK A: IS RINGING TONE HEARD?......
3.	The called party should answer the call.
4.	CHECK B: IS SPEECH POSSIBLE?......
5.	The calling party should clear the call.
6.	CHECK C: IS THE CIRCUIT IDLE?......
7.	CHECK D: WAS THE MESSAGE SEQUENCE AS ABOVE?......
8.	CHECK E: WAS THE CONTINUITY CHECK INDICATOR SET TO A BINARY VALUE OF TWO (MESSAGE INDICATOR BITS E and F IN IAM)?......
9.	For validation testing repeat this test in the reverse direction.

TEST NUMBER: 6.1.3

REFERENCE: Q.724 § 7.5

TITLE: Continuity check call

SUBTITLE: COT on a satellite circuit

PURPOSE: To verify that a continuity check can be performed on a satellite circuit

PRE-TEST CONDITIONS: Arrange the data in signalling point A such that the call is routed over a satellite circuit, with a continuity check applied for

CONFIGURATION: 1	TYPE OF TEST: VAT and CPT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

SP A		SP B
IAM	------------------------->	
Check tone	--------------------------------------- | ---------------------------------------	
COT	------------------------->	
	<-------------------------	ACM
	---------------------------------------	Ringing tone
	<-------------------------	ANC
Speech	– – – – – – – – – – – – –	Speech
CLF	------------------------->	
	<-------------------------	RLG

TEST DESCRIPTION

1.	Make a call from SP A to SP B. Record the message sequence using a signal monitor.
2.	CHECK A: IS RINGING TONE HEARD?......
3.	The called party should answer the call.
4.	CHECK B: IS SPEECH POSSIBLE?......
5.	The calling party should clear the call.
6.	CHECK C: IS THE CIRCUIT IDLE?......
7.	CHECK D: WAS THE MESSAGE SEQUENCE AS ABOVE?......
8.	CHECK E: WAS THE SATELLITE INDICATOR BIT IN THE IAM SET TO 1?......
9.	For validation testing repeat this test in the reverse direction.

TEST NUMBER: 6.1.4		
REFERENCE: Q.724 § 6.1		
TITLE: Continuity check call		
SUBTITLE: Calling party clears during COT		
PURPOSE: To verify that the calling party can successfully clear during the continuity check phase of the call		
PRE-TEST CONDITIONS: Arrange the data in signalling point B such that a continuity check is applied on this call		
CONFIGURATION: 1	TYPE OF TEST: VAT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

SP A		SP B
IAM	------------------------->	
Check tone	---------------------------------------	
CLF	------------------------->	
	<-------------------------	RLG

TEST DESCRIPTION

1.	Make a call from SP A to SP B. Record the message sequence with a signal monitor.
2.	The calling party should clear the call during the continuity check phase.
3.	CHECK A: IS THE CIRCUIT IDLE?......
4.	CHECK B: WAS THE MESSAGE SEQUENCE AS ABOVE?......
5.	For validation testing repeat this test in the reverse direction.

TEST NUMBER: 6.1.5

REFERENCE: Q.724 § 7.3

TITLE: Continuity check call

SUBTITLE: Delay of through connect

PURPOSE: To verify that the switching though of the speech path is delayed until the residual check-tone has propagated through the return of the speech path

PRE-TEST CONDITIONS:

a) The called termination is free

b) Arrange the data in signalling point A such that a continuity check is applied on this call

CONFIGURATION: 1	TYPE OF TEST: VAT and CPT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

SP A		SP B
IAM	------------------------->	
Check tone	--		
	--	
COT	------------------------->	
	<-------------------------	ACM
	--	Ringing tone
	<-------------------------	ANC
Speech	– – – – – – – – – – – – –	Speech
CLF	------------------------->	
	<-------------------------	RLG

TEST DESCRIPTION

1.	Make a call from SP A to SP B. Record the message sequence using a signal monitor.
2.	CHECK A: WAS THE CONTINUITY CHECK TONE HEARD BY EITHER CALLED OR CALLING PARTY?......
3.	CHECK B: IS RINGING TONE HEARD?......
4.	The called party should answer the call.
5.	CHECK B: IS SPEECH POSSIBLE?......
6.	The calling party should clear the call.
7.	CHECK C: IS THE CIRCUIT IDLE?......
8.	CHECK D: WAS THE MESSAGE SEQUENCE AS SHOWN ABOVE?......
9.	For validation testing repeat this test in the reverse direction.

TEST NUMBER: 6.1.6

REFERENCE: Q.724 § 7.3

TITLE: Continuity check call

SUBTITLE: COT unsuccessful

PURPOSE: To verify that a repeat attempt of the continuity check is made on the failed circuit

PRE-TEST CONDITIONS: Ensure that no backward tone is detected within the specified timeout

CONFIGURATION: 1	TYPE OF TEST: VAT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

```
SP   A                                                    SP   B

IAM                     ------------------------->
Check tone              --------------------------------------|
                                        --------------

CCF  ┬                  ------------------------->
 T9  │ 1-10 seconds
CCR  ┴                  ------------------------->

Check tone              --------------------------------------|
                                        --------------

CCF  ┬                  ------------------------->
 T10 │ 1-3 minutes                                    Maintenance staff alerted
CCR  ┴                  ------------------------->
Check tone              --------------------------------------|
                                        --------------
```

TEST DESCRIPTION

1.	Initiate the continuity test call procedure at SP A. Record the message sequence using a signal monitor.
2.	CHECK A: WAS THE SECOND CONTINUITY CHECK INITIATED WITHIN 1 TO 10 SECONDES?......
3.	CHECK B: WERE THE MAINTENANCE STAFF ALERTED ON FAILURE OF THE SECOND CONTINUITY CHECK?......
4.	CHECK C: WAS THE CHECK REPEATED AT INTERVALS OF 1 TO 3 MINUTES?......
5.	CHECK D: WAS THE MESSAGE SEQUENCE AS ABOVE?......
	Note 1 – The repeated check will only finish when continuity is detected.
	Note 2 – On failure of the COT an automatic repeat attempt will be made – see test No. 6.2.5.

TEST NUMBER: 6.1.7		
REFERENCE: Q.724 § 7.3		
TITLE: Continuity check call		
SUBTITLE: COT received on an incoming circuit		
PURPOSE: To verify that a call can be set up on an incoming circuit requiring a continuity check		
PRE-TEST CONDITIONS: Arrange the data in signalling point such that a continuity check is required on this circuit		
CONFIGURATION: 1	TYPE OF TEST: VAT and CPT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

SP A		SP B
	<-------------------------	IAM
	|-------------------------------------	Check tone

	<-------------------------	COT
ACM	------------------------->	
Ringing tone	-------------------------------------	
ANC	------------------------->	
Speech	– – – – – – – – – – – – –	Speech
	<-------------------------	CLF
RLG	------------------------->	

TEST DESCRIPTION

1.	Make a call from SP B to SP A. Record the message sequence using a signal monitor.
2.	CHECK A: IS THE RINGING TONE HEARD?......
3.	The called party should answer the call.
4.	CHECK B: IS SPEECH POSSIBLE?......
5.	The calling party should clear the call.
6.	CHECK C: IS THE CIRCUIT IDLE?......
7.	CHECK D: WAS THE MESSAGE SEQUENCE AS ABOVE?......
8.	For validation testing repeat this test in the reverse direction.

TEST NUMBER: 6.2.1

REFERENCE: Q.724 § 3

TITLE: Automatic repeat attempt

SUBTITLE: Dual seizure

PURPOSE: To verify that an automatic repeat attempt will be made on detection of a dual seizure

PRE-TEST CONDITIONS: Arrange the signalling point data such that SP B is the controlling exchange

CONFIGURATION: 1	TYPE OF TEST: VAT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

SP A		SP B
IAM (cic=x)	---------> <---------	IAM (cic=x)
ACM (cic=x)	-------------------------->	
Ringing tone	--	
ANC (cic=x)	-------------------------->	
Speech	– – – – – – – – – – – – –	Speech
IAM (cic=y)	-------------------------->	
	<--------------------------	ACM (cic=y)
	--	Ringing tone
	<--------------------------	ANC (cic=y)
Speech	– – – – – – – – – – – – –	Speech
CLF (cic=y)	-------------------------->	
	<--------------------------	RLG (cic=y)
	<--------------------------	CLF (cic=x)
RLG (cic=x)	-------------------------->	

TEST DESCRIPTION

1.	Simultaneously transmit an IAM (containing the same value of cic) from each end of the link for a both way circuit. Record the message sequence using a signal monitor
2.	CHECK A: IS RINGING TONE HEARD ON THE CALL ORIGINATED FROM SP B?......
3.	The called party at SP A should answer the call.
4.	CHECK B: IS SPEECH POSSIBLE?......
5.	CHECK C: WAS A REPEAT ATTEMPT MADE BY SP A, WITH A DIFFERENT VALUE OF CIC IN THE IAM?......
6.	CHECK D: IS RINGING TONE HEARD ON THE CALL ORIGINATED FROM SP A?......
7.	The called party at SP B should answer the call.
8.	CHECK E: IS SPEECH POSSIBLE?......
9.	Clear both calls down.
10.	CHECK F: ARE THE CIRCUITS IDLE?......
11.	CHECK G: WAS THE MESSAGE SEQUENCE AS ABOVE?...... *Note* – The message sequence may not be as shown above.

TEST NUMBER: 6.2.2		
REFERENCE: Q.724 § 3		
TITLE: Automatic repeat attempt		
SUBTITLE: Circuit reset		
PURPOSE: To verify that an automatic repeat attempt will be made on receipt of circuit reset after sending of an initial address message and before a backward signal has been received		
PRE-TEST CONDITIONS: a) Arrange the data in signalling point B such that a circuit reset signal is sent in response to the initial address message of the first call request b) The called termination should be free		
CONFIGURATION: 1	TYPE OF TEST: VAT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

SP A		SP B
IAM	------------------------->	
	<-------------------------	RSC
CLF	------------------------->	
	<-------------------------	RLG
IAM	------------------------->	
	<-------------------------	ACM
	-------------------------------------	Ringing tone
	<-------------------------	ANC
Speech	– – – – – – – – – – – – –	Speech
CLR	------------------------->	
	<-------------------------	RLG

TEST DESCRIPTION

1.	Make a call for SP A to SP B. Record the message sequence using a signal monitor.
2.	CHECK A: IS RINGING TONE HEARD?......
3.	The called party should answer the call.
4.	CHECK B: IS SPEECH POSSIBLE?......
5.	The calling party should clear the call.
6.	CHECK C: IS THE CIRCUIT IDLE?......
7.	CHECK D: WAS THE MESSAGE SEQUENCE AS ABOVE?......
	Note – The message sequence may not be as shown above.

TEST NUMBER: 6.2.3

REFERENCE: Q.724 § 3

TITLE: Automatic repeat attempt

SUBTITLE: Reception of unreasonable signalling information

PURPOSE: To verify that a repeat attempt will be made on receipt of unreasonable signalling information after sending the initial address message and before one of the backward signals has been received

PRE-TEST CONDITIONS:

a) Arrange the data in signalling point B such that unreasonable signalling information (see note below) is returned in response to the initial address message of the first call request

b) The called termination should be free

CONFIGURATION: 1	TYPE OF TEST: VAT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

SP A		SP B
IAM	------------------------->	
	<-------------------------	see Note 1 below
RSC	------------------------->	
	<-------------------------	RLG
IAM	------------------------->	
	<-------------------------	ACM
	--------------------------------------	Ringing tone
	<-------------------------	ANC
Speech	– – – – – – – – – – – – –	Speech
CLF	------------------------->	
	<-------------------------	RLG

TEST DESCRIPTION

1.	Make a call for SP A to SP B. Record the message sequence using a signal monitor.
2.	CHECK A: IS RINGING TONE HEARD?......
3.	The called party should answer the call.
4.	CHECK B: IS SPEECH POSSIBLE?......
5.	The calling party should clear the call.
6.	CHECK C: IS THE CIRCUIT IDLE?......
7.	CHECK D: WAS THE MESSAGE SEQUENCE AS ABOVE?......
	Note 1 – This may be any message that if received at this point would be either ambiguous or inappropriate. *Note 2* – The message sequence may not be as shown above.

TEST NUMBER: 6.2.4

REFERENCE: Q.724 § 3

TITLE: Automatic repeat attempt

SUBTITLE: Blocking of a circuit

PURPOSE: To verify that an automatic repeat attempt will be made on receipt of the blocking signal after sending an initial address message and before any backward messages have been received

PRE-TEST CONDITIONS: Arrange the data in signalling point B such that a blocking signal is returned in response to the initial address message of the first call request

CONFIGURATION: 1	TYPE OF TEST: VAT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

SP A		SP B
IAM	------------------------->	
	<-------------------------	BLO
BLA	------------------------->	
CLF	------------------------->	
	<-------------------------	RLG
IAM	------------------------->	
	<-------------------------	ACM
	---------------------------------------	Ringing tone
	<-------------------------	ANC
Speech	– – – – – – – – – – – – –	Speech
CLF	------------------------->	
	<-------------------------	RLG

TEST DESCRIPTION

1.	Make a call for SP A to SP B. Record the message sequence using a signal monitor.
2.	CHECK A: IS RINGING TONE HEARD?......
3.	The called party should answer the call.
4.	CHECK B: IS SPEECH POSSIBLE?......
5.	The calling party should clear the call.
6.	CHECK C: IS THE CIRCUIT IDLE?......
7.	CHECK D: WAS THE MESSAGE SEQUENCE AS ABOVE?......
	Note – The message sequence may not be as shown above.

TEST NUMBER: 6.2.5

REFERENCE: Q.724 § 6

TITLE: Automatic repeat attempt

SUBTITLE: Continuity check failure

PURPOSE: To verify that an automatic repeat attempt will be made if on continuity check failure

PRE-TEST CONDITIONS: Arrange the data in signalling point B such that check tone is not returned within the specified limits to the first call request

CONFIGURATION: 1	TYPE OF TEST: VAT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

```
SP   A                                                        SP   B

IAM                  ------------------------->
Check tone           ---------------------------|
                                     -----------
CCF                  ------------------------->

   A repeat of the continuity check of the failed circuit will be made within 1-10 seconds see Q.724 Section 7.3

IAM                  ------------------------->
Check tone           ---------------------------|
                     ---------------------------
                     <-------------------------               ACM
                     ---------------------------              Ringing tone
                     <-------------------------               ANC

Speech               - - - - - - - - - - - - -                Speech

CLF                  ------------------------->
                     <-------------------------               RLG
```

TEST DESCRIPTION

1.	Make a call for SP A to SP B. Record the message sequence using a signal monitor.
2.	CHECK A: IS RINGING TONE HEARD?......
3.	The called party should answer the call.
4.	CHECK B: IS SPEECH POSSIBLE?......
5.	The calling party should clear the call.
6.	CHECK C: IS THE CIRCUIT IDLE?......
7.	CHECK D: WAS THE MESSAGE SEQUENCE AS ABOVE?...... *Note* – The message sequence may not be as shown above.

TEST NUMBER: 6.3.1		
REFERENCE: Q.724 § 2.5		
TITLE: Dual seizure		
SUBTITLE: Dual seizure for controlling side		
PURPOSE: To verify that on detection of dual seizure, the call initiated by the controlling signalling point is completed		
PRE-TEST CONDITIONS: Arrange the signalling point data such that SP B is the controlling signalling point		
CONFIGURATION: 1	TYPE OF TEST: VAT	TYPE OF SP: SP

EXPECTED MESSAGE SEQUENCE:

SP A		SP B
IAM	---------> <---------	IAM
ACM	------------------------->	
	--	Ringing tone
ANC	------------------------->	
Speech	– – – – – – – – – – – –	Speech
CLF	------------------------->	
	<-------------------------	RLG

TEST DESCRIPTION

1.	Simultaneously transmit an IAM (containing the same value of cic) from each end of the link for a both way circuit. Record the message sequence using a signal monitor.
2.	CHECK A: IS RINGING TONE HEARD ON THE CALL ORIGINATED FROM SP B?......
3.	The called party at SP A should answer the call.
4.	CHECK B: IS SPEECH POSSIBLE?......
5.	The calling party at SP B should clear the call.
6.	CHECK C: IS THE CIRCUIT IDLE?......
7.	CHECK D: WAS THE MESSAGE SEQUENCE AS ABOVE?......
8.	CHECK E: WAS A REPEAT ATTEMPT MADE BY SP A ON ANOTHER CIRCUIT?......
9.	Repeat this test in the reverse direction.

SECTION 3

MONITORING AND MEASUREMENTS

Recommendation Q.791

MONITORING AND MEASUREMENTS FOR SIGNALLING SYSTEM No. 7 NETWORKS

1 General

1.1 *Introduction*

1.1.1 In order to effectively manage the resources provided by a Signalling System No. 7 network, it is necessary to monitor and measure the present and estimate the future performance, utilization, and availability of these resources. Recommendation Q.791 is limited to measurements and monitoring of the MTP and SCCP. The principles and scope of this Recommendation are:

- measurements made on the signalling network resources are known as "raw" or primitive measurements and in general only these measurements are identified in this Recommendation;
- the recommended primitive measurements and at times, other derived measurements, whose computation using the primitive measurements is described, are those required for the effective management of the signalling network resources;
- a basic subset of signalling network measurements is recommended for international networks, but it is intended that this subset also be useful for national networks, which, however, may need additional measurements;
- monitoring and measuring are considered to be passive processes and although the results of monitoring and measuring may be used to invoke test and maintenance actions and procedures, it is left to other Recommendations, e.g. Recommendation Q.795, to provide details of such actions and procedures;
- Recommendation Q.791 is not intended to provide signalling network testing and maintenance procedures; it is left to other Recommendations to provide such procedures, e.g. Recommendations Q.707, Q.795 etc.

1.2 *Local and global view*

1.2.1 The signalling network measurements can provide both a local view and global network view of the performance of the signalling network. The primitive measurements which provide the two views are not necessarily different. Rather the global view is a result of a summary of measurements from more than a single signalling point so that the behaviour of the signalling network is centrally observable. A global view of the performance of the signalling network, in general, becomes more useful as the network becomes larger (i.e. more signalling points or multiple users).

1.3 *Grouping of measurements*

1.3.1 Each primitive measurement is classified for the purpose of guidance into one or more categories, called operations, maintenance and administration which will indicate its general area of use (see §§ 2 and 5).

1.3.2 A tabular listing of the primitive measurements according to the resource being measured is provided (see § 3). The tabular listing of the primitive measurements includes for each measurement an indication of the appropriate categories (operations, administration and maintenance) and reference to the pertinent Recommendations.

1.4 *Guidelines for uses of measurements*

1.4.1 The measurements may be used singly, or in conjunction with other measurements. It is not the intent of the Recommendation to specify the computations and algorithms to be applied to the primitive measurements. Guidelines, however, are provided (see § 5) for some uses of measurements so that, for example, the view at both ends of an international link is consistent.

2 Definition of terms

2.1 **Operations (O)**

2.1.1 The operation of network resources utilizes measurements that are used in real time, or are retained for short time intervals. Operations activities include signalling network surveillance.

2.1.2 Signalling network management "on occurrence" events and measurements include those which monitor and measure the signalling network response to abnormal conditions. (Requires further study.)

2.1.3 Signalling network surveillance measurements include those which monitor and measure the signalling network resources to ensure that the appropriate network performance is maintained.

2.2 **maintenance (M)**

2.2.1 Maintenance of the signalling network resources may involve the monitoring of the facility and equipment resources and maintaining network performance by expediting preventive and corrective effort when the measurements indicate a problem.

2.3 **administration (A)**

2.3.1 The administration of the signalling network resources involves measurements that are used on a long-term basis and are in general retained external to the signalling network resources (see Recommendation Q.795, § 2.6).

2.3.2 Administration activities include planning and dimensioning (engineering) the signalling network resources, including determination of the resource quantities, e.g. number of links set, and resource configuration, e.g. routing.

3 Listing of measurements

3.1 *General*

3.1.1 The recommended measurements are presented in the Tables 1/Q.791 to 9/Q.791. Explanatory notes relating to the contents of these tables are given below.

3.1.2 The obligatory column is used to indicate those measurements which must be provided at a signalling point. The additional ACT/PERM column indicates whether these measurements are permanently activated, or activated on demand. In non-obligatory cases, if the measurement is provided, the administration must also decide whether the measurement will be activated on demand or be permanently active.

3.1.3 The count items in the tables, identified in the units column as "events/SP", "MSUs/SL" etc., implies the total count of events in the specified period and implicitly indicates the identity of what is being counted i.e. "events/SP" identifies the Signalling Point, "MSUs/SL" identifies the Signalling Link, etc.

3.1.4 The event items in the tables which are recorded "on occurence" are intended to be recorded with a time stamp, giving the unique network time when the event indicator was generated (see Recommendation Q.795, § 2.7). The resolution and accuracy of the time stamp should be as high as possible, to increase the ability to resolve complex and rapid sequences of events.

3.1.5 The periods of measurement are specified in the Duration of Measurement column.

3.2 *Table 1/Q.791*

3.2.1 The measurement of Signalling Link (SL) failure is recommended (Item 1.2). However, the specific cause for the failure (Items 1.3-1.6) is an additional optional measurement.

3.2.2 The measurement of "number of Signal Units received in error" contains the number of items (not necessarily the number of Signal Units) between what are perceived as "Flags" plus the number of sets of 16 octets received in the "octet counting" mode.

3.3 *Table 2/Q.791*

3.3.1 Local busy is defined as the period during which busy LSSUs are transmitted.

3.4 *Table 3/Q.791*

3.4.1 The notation "3/2" in the Level column indicates that the measured octets are those transferred across the Level 3/Level 2 boundary in the appropriate direction.

3.4.2 The opening flag and the check bits are included in Item 3.2

3.4.3 The signalling link congestion (Items 3.6-3.11) refers to link status "congested" at Level 3. A link is marked at Level 3 as congested when a congestion threshold is reached at the transmit side (see Recommendation Q.704, § 3.6 on Signalling Network Congestion and § 11 on Signalling Traffic Flow Control). These measurements should be kept as "thresholds 1, 2 and 3 separately" if that national option is selected.

3.5 *Table 4/Q.791*

3.5.1 Measurements 4.9 through 4.12 are required at Signalling Points in international networks if measurements 5.1 through 5.4 are not available to an RPOA. In other networks, measurements 5.1 through 5.4 at consecutive Signalling Points from origination to destination of a call might be used to derive measurements 4.9 through 4.12, consequently real time collection of the latter may not be necessary.

3.5.2 Measurements 4.9 and 4.10 are only obligatory in international networks.

3.5.3 Measurements 4.5 and 4.6 are only required at Signalling Transfer Points.

3.6 *Table 5/Q.791*

3.6.1 Measurement 5.5, the number of MSUs discarded due to a routing data error, can be used to trigger the MTP Route Verification Test (MRVT) described in Q.795, § 2.3.

3.7 *Table 6/Q.791*

3.7.1 Activation of the measurements in Table 6/Q.791 is recommended on a per Point Code (PC) or set of Point Codes and/or Service Information Octet (SIO) basis. The measurements are not obligatory.

3.7.2 Some of the measurements in Table 6/Q.791 may be of interest for accounting purposes.

3.8 *Table 7/Q.791*

3.8.1 Routing failure measurements (Items 7.1 through 7.7, and 7.9) refer to all possible failures (both local and remote) detected by SCCP Routing Control, and counts all SCCP messages which encounter transport problems, regardless of whether or not a unit data service message or N-NOTICE primitive is returned to the originator. Receipt of unit data service message is not included in this case of measurements.

3.9 *Table 8/Q.791*

3.9.1 Coordinated State Change Control measurements (Items 8.6 and 8.7) are to be taken at the signalling point of the sub-system requesting to go out of service. These measurements are only applicable at nodes with replicated sub-systems.

3.9.2 Unavailability measurements 8.1, 8.2, 8.3, 8.4 and 8.5 are architecturally dependent.

TABLE 1/Q.791

Monitoring and measurements for Signalling System No. 7 networks MTP – signalling link performance

Description of measurements	Units	Usage O	Usage A	Usage M	Duration of measurement	Level	Obligatory [a]	Act. perm.	References
1.1 Duration of Link in the In-Service State	secs/SL [b]	O	A	M	30 min.	2	Yes	perm.	
1.2 SL Failure-All Reasons	event/SL			M	on occur.	2	Yes	perm.	
1.3 SL Failure-Abnormal – FIBR/BSNR	event/SL			M	on occur.	2	No		Q.703, § 5.3
1.4 SL Failure-Excessive delay of ack.	event/SL			M	on occur.	2	No		Q.703, § 5.3.1
1.5 SL Failure-Excessive error rate	event/SL			M	on occur.	2	No		Q.703, § 11.2.2
1.6 SL Failure-Excessive duration of congestion	event/SL			M	on occur.	2	No		Q.703
1.7 SL alignment failure	events/SL			M	30 min.	2	No		Q.703, § 11.3
1.8 Number of Signal Units in error [c]	events/SL			M	30 min.	2	Yes	perm.	Q.703, § 4
1.9 Number of negative ack. received	events/SL			M	30 min.	2	No		
1.10 Local Automatic changeover	events/SL			M	30 min.	3	No		Q.704, § 5
	event/SL	O			on occur.	3	No		
1.11 Local Automatic changeback	event/SL	O		M	on occur.	3	No		Q.704, § 6
1.12 SL Restoration	event/SL			M	on occur.	3	No		Q.703, § 3.2.3

[a] See § 3.1.2 (applies to all tables).

[b] SL = Signalling Link.

[c] The interpretation of this count is implementation dependant.

TABLE 2/Q.791

Monitoring and measurements for Signalling System No. 7 networks – MTP signalling link availability

Description of measurements	Units	Usage			Duration of measurement	Level	Obligatory	Act. perm.	References
		O	A	M					
2.1 Duration of SL unavailability (for any reason)	secs/SL	O	A	M	30 min.	3	Yes	perm.	
2.2-2.4 Deleted									
2.5 Duration of SL inhibition due to local management actions	secs/SL			M	30 min.	3	No		Q.704, § 3.2.8
2.6 Duration of SL inhibition due to remote management actions	secs/SL			M	30 min.	3	No		Q.704, § 3.2.8
2.7 Duration of SL unavailability due to link failure	secs/SL			M	30 min.	3	No		Q.704, § 3.2.2
2.8 Deleted.									
2.9 Duration of SL unavailability due to remote processor outage	secs/SL	O		M	30 min.	3	No		Q.704, § 3.2.6
2.10 Start of remote processor outage	event/SL	O		M	on occur.	3	No		Q.704, § 3.2.6
2.11 Stop of remote processor outage	event/SL	O		M	on occur.	3	No		Q.704, § 3.2.7
2.12 Deleted									
2.13 Local Management Inhibit	events/SL			M	30 min.	3	No		Q.704, § 10.2
	events/SL	O			5 min.	3	No		
2.14 Local Management Uninhibit	events/SL			M	30 min.	3	No		Q.704, § 10.3
	events/SL	O			5 min.	3	No		
2.15 Duration of Local Busy	secs/SL	O			30 min.	2	No		Q.704, § 9.3

TABLE 3/Q.791

Monitoring and measurements for Signalling System No. 7 networks
MTP signalling link utilization

Description of measurements	Units	Usage O	Usage A	Usage M	Duration of measurement	Level	Obligatory	Act. perm.	References
3.1 Number of SIF and SIO octets transmitted	octets/SL	O	A	M	30 min.	3/2	Yes	act.	Q.703, § 2.3.8
3.2 Octets retransmitted	octets/SL		A		30 min.	2	No		Q.703, § 5
3.3 Number of message signal units transmitted	MSUs/S		A		30 min.	3/2	No		
3.4 Number of SIF and SIO octets received	octets/SL	O	A	M	30 min.	3/2	Yes	act.	
3.5 Number of message signal units received	MSUs/SL		A		30 min.	3/2	No		
3.6 SL congestion indications	events/SL events/SL event/SL	 O O	A	M	30 min. 5 min. on occur.		No No No		Q.704, § 3.8
3.7 Cumulative duration of SL congestion	secs/SL	O	A	M	30 min.	3	No		
3.8 Deleted									
3.9 Stop of SL congestion	event/SL	O			on occur.	3	No		
3.10 MSUs discarded due to SL congestion	MSUs/SL	O			30 min.	3	Yes	perm.	
3.11 Number of congestion events resulting in loss of MSUs	events/SL event/SL	 O		M 	30 min. on occur.	3 3	No No		

TABLE 4/Q.791

Monitoring and measurements for Signalling System No. 7 networks
MTP signalling link set and route set availability

Description of measurements	Units	Usage O	Usage A	Usage M	Duration of measurement	Level	Obligatory [a]	Act. perm.	References
4.1 Deleted									
4.2 Duration of unavailability of signalling linkset	secs/linkset	O		M	30 min.	3	No		
4.3 Start of linkset failure	event/linkset	O		M	on occur.	3	No		
4.4 Stop of linkset failure	event/linkset	O		M	on occur.	3	No		
4.5 Initiation of broadcast TFP due to failure of measured linkset [a]	event/linkset	O		M	on occur.	3	No		Q.704, § 13
4.6 Initiation of broadcast TFA for recovery of measured linkset [a]	event/linkset	O		M	on occur.	3	No		Q.704, § 13
4.7 - 4.8 Deleted									
4.9 Unavailability of route set to a given destination of set of destinations	events/destination(s)	O	A	M	30 min.	3	[b]	perm.	Q.704, § 11.2.1
4.10 Duration of unavailability in 4.9	secs/destination(s)	O	A	M	30 min.	3	[b]	perm.	Q.704, § 11.2.2
4.11 Start of unavailability in 4.9	event/destination(s)	O		M	on occur.	3	No		Q.704, § 11.2.1
4.12 Stop of unavailability in 4.9	event/destination(s)	O		M	on occur.	3	No		Q.704, § 11.2.2

[a] These measurements only apply to Signal Transfer Points.

[b] These measurements are only obligatory in the international network.

TABLE 5/Q.791

Monitoring and measurements for Signalling System No. 7 networks
MTP adjacent signalling point status accessibility

Description of measurements	Units	Usage O	Usage A	Usage M	Duration of measurement	Level	Obligatory	Act. perm.	References
5.1 Adjacent SP inaccessible	event/SP	O		M	on occur.	3	Yes	perm.	
				M	30 min.				
	events/SP	O			5 min.				
5.2 Duration of adjacent SP inaccessible	secs/SP	O			5 min.	3	Yes	perm.	
				M	30 min.				
5.3 Deleted									
5.4 Stop of adjacent SP inaccessible	event/SP	O		M	on occur.	3	No		
5.5 MSU discarded due to a routing data error [a]	MSUs/SP		A		30 min.		Yes	perm.	Q.795
		O		M	5 min.		No	perm.	

[a] The number of MSUs discarded can be used to trigger the MTP Route Verification Test (MVRT) described in Recommendation Q.795, § 2.3.

TABLE 6/Q.791

Monitoring and measurements for Signalling System No. 7 networks
MTP signalling link traffic distribution (Signalling route utilization)

Description of measurements	Units	Usage			Duration of measurement	Level	Obligatory	Act. perm.	References
		O	A	M					
6.1 Number of SIF and SIO octets received with given OPC	octets/OPC		A		30 min.	3	No		
6.2 Number of SIF and SIO octets transmitted with given DPC	octets/DPC		A		30 min.	3	No		
6.3 Number of SIF and SIO octets handled with given SIO	octets/SIO		A		30 min.	3	No		
6.4 Number of SIF and SIO octets received with given OPC and SIO	octets/SIO/OPC		A		30 min.	3	No		
6.5 Number of SIF and SIO octets transmitted with given DPC and SIO	octets/SIO/DPC		A		30 min.	3	No		
6.6 Number of SIF and SIO octets handled with given OPC, DPC and SIO	octets/SIO/ OPC/DPC		A		30 min.	3	No		

Note 1 – Activation of these measurements is recommended on per point code or sets of point codes and/or SIO.

Note 2 – Some of these measurements may be of interest for accounting purposes.

TABLE 7/Q.791

Monitoring and measurements for Signalling System No. 7 networks
SCCP performance

Description of measurements	Units	Usage O	Usage A	Usage M	Duration of measurement	Level	Obligatory	Act. perm.	References
7.1 Routing Failure – No translation for address of such nature [a]	event msgs	O	 A	 M	on occur. 30 min.	SCCP SCCP	Yes	act. perm.	Q.714, § 2.4
7.2 Routing Failure – No translation for this specific address [a]	event msgs	O	 A	 M	on occur. 30 min.	SCCP SCCP	Yes	act. perm.	Q.714, § 2.4
7.3 Routing Failure – Network Failure (Point Code not available)	event msgs	O	 A	 M	on occur. 30 min.	SCCP SCCP	Yes	act. perm.	Q.714, § 2.4
7.4 Routing Failure – Network Congestion	event msgs	O	 A	 M	on occur. 30 min.	SCCP SCCP	Yes	act. perm.	Q.714, § 2.4
7.5 Routing Failure – Subsystem Failure (unavailable)	event msgs	O	 A	 M	on occur. 30 min.	SCCP SCCP	Yes	act. perm.	Q.714, § 2.4
7.6 Routing Failure – Subsystem Congestion [b]	event msgs	O	 A	 M	on occur. 30 min.	SCCP SCCP	Yes	act. perm.	Q.714, § 2.4
7.7 Routing Failure – Unequipped user (Subsystem)	event msgs	O	 A	 M	on occur. 30 min.	SCCP SCCP	Yes	act. perm.	Q.714, § 2.4
7.8 Syntax error detected	event msgs			M M	on occur. 30 min.	SCCP SCCP	Yes	act. perm.	Q.714, § 4.3
7.9 Routing Failure – Reason unknown	event msgs	O	 A	 M	on occur. 30 min.	SCCP SCCP	Yes	act. perm.	Q.714, § 2.4

[a] These measurements only required at SCCP nodes with global title translation capabilities.

[b] For further study.

TABLE 8/Q.791

Monitoring and measurements for Signalling System No. 7 networks sub-system availability

Description of measurements	Units	Usage O	Usage A	Usage M	Duration of measurement	Level	Obligatory	Act. perm.	References
8.1 Start of local SCCP unavailable failure [a]	event	O			on occur.	SCCP	No	perm.	
8.2 Start of local SCCP unavailable – maintenance made busy [a]	event	O			on occur.	SCCP	No	perm.	
8.3 Start of local SCCP unavailable – congestion [a]	event	O			on occur.	SCCP	No	perm.	
8.4 Stop of local SCCP unavailable – (all reasons) [a]	event	O			on occur.	SCCP	No	perm.	
8.5 Duration of local SCCP unavailable – (all reasons) [a]	secs		A		30 min.	SCCP	No	perm.	
8.6 Subsystem out-of-service request granted	event			M	on occur.	SCCP	[b]	perm.	Q.714, § 5.3.5.3
8.7 Subsystem out-of-service request denied	event			M	on occur.	SCCP	[b]	perm.	Q.714, § 5.3.5.3

[a] These measurements are system architecture dependent.

[b] These measurements are obligatory for replicated systems.

TABLE 9/Q.791

Monitoring and measurements for Signalling System No. 7 networks
SCCP – Utilization

Description of measurements	Units	Usage			Duration of measurement	Level	Obligatory	Act. perm.	References
		O	A	M					
9.1 UDTS message sent	msgs	O	A		30 min.	SCCP	No	perm.	Q.714, § 4.2
9.2 UDTS message received	msgs	O	A		30 min.	SCCP	No	perm.	Q.714, § 4.2
9.3 Total messages handled (from local or remote subsystems)	msgs		A		30 min.	SCCP	No	perm.	Q.714, § 2.3
9.4 Total messages intended for local subsystems	msgs		A		30 min.	SCCP	No	perm.	Q.714, § 2.3
9.5 Messages requiring global title translation [a]	msgs		A		30 min.	SCCP	No	perm.	Q.714, § 2.2
9.6 Total messages sent (for connectionless only) (by class 0, 1)	msgs/class		A		30 min.	SCCP	Yes	perm.	Q.714, § 1.1.2
9.7 Total messages received (for connectionless only) (by class 0, 1)	msgs/class		A		30 min.	SCCP	Yes	perm.	Q.714, § 1.1.2
9.8 Messages sent to a backup subsystem	msgs/SS		A		30 min.	SCCP	Note [b]	perm.	Q.714, § 5.3.2

[a] This measurement is only required at SCCP nodes with global title translation capabilities.

[b] This measurement is obligatory for replicated systems.

3.10 *Table 9/Q.791*

3.10.1 SCCP management messages are included in the totals of items 9.3, 9.4, 9.6 and 9.7.

3.10.2 SCCP utilization measurements, items 9.3 and 9.4, refers to all messages processed by SCCP Routing Control, whether or not the message is processed or delivered successfully.

3.10.3 Measurement 9.5 measures the utilization of the translation function within SCCP Routing Control and is a count of all messages for which global title translation is attempted. The measurement is only applicable at nodes with translation capabilities.

3.10.4 Measurement 9.8 refers only to those messages which would normally have been routed to a sub-system but because of a change in the translation process (e.g. due to a routing failure towards that sub-system), are directed to a backup sub-system. The measurement is only applicable at replicated nodes with translation capabilities.

4 Operations and maintenance part support

4.1 The measurements defined in this Recommendation are intended to be controlled through the use of the operations and maintenance application part defined in Recommendation Q.795. Recommendation Q.795 defines the functions needed to initiate and stop the measurements and the procedures to handle the transfer of data after collection. Long-term measurement collection procedures are defined in § 2.6 of Recommendation Q.795 and on-occurrence measurement reporting procedures in § 2.7.

5 Uses of measurements

5.1 *Introduction*

5.1.1 This section provides a context for the measurements listed in the Tables 1/Q.791 to 9/Q.791. It describes briefly the operational, maintenance and administrative activities likely to be associated with a Signalling System No. 7 network and how the measurements may be used to support these activities.

5.1.2 A list of supporting measurements (if any) follows each description. Each measurement is identified by its table number followed by a decimal point and the sequence number of the measurement within the table (e.g., Item 1.2 is the second measurement of Table 1/Q.791).

5.2 *Operational uses*

5.2.1 *Message Transfer Part (MTP)*

5.2.1.1 *Surveillance of network status*

This activity is concerned with surveillance of the network as a whole in order to coordinate and assign priorities to maintenance actions. The information to support this activity will come from indicators of the operational and congestion status. These indicators may be found in the tables designated as Usage "O" and duration of measurement "on-occurrence".

Measurements to survey network status:

- local automatic changeover (Item 1.10);
- local automatic changeback (Item 1.11);
- start of remote processor outage (Item 2.10);
- stop of remote processor outage (Item 2.11);
- SL congestion indications (Item 3.6);
- stop of SL congestion (Item 3.9);
- number of congestion events resulting in loss of MSUs (Item 3.11);
- start of linkset failure (Item 4.3);
- stop of linkset failure (Item 4.4);

- initiation of Broadcast TFP due to failure of measured linkset (Item 4.5);
- initiation of Broadcast TFA for recovery of measured linkset (Item 4.6);
- start of unavailability in measurement 4.9 (Item 4.11);
- stop of unavailability in measurement 4.9 (Item 4.12);
- adjacent signalling point inaccessible (Item 5.1);
- stop of adjacent signalling point inaccessible (Item 5.4).

Additional measurement may be provided to the operations user for determining the integrity of the network. These measurements will be provided on a five or thirty minute basis.

Measurements:

- duration of link in the in-service state (Item 1.1);
- duration of SL unavailability (for any reason) (Item 2.1);
- local management inhibit (Item 2.13);
- local management uninhibit (Item 2.14);
- duration of local busy (Item 2.15);
- number of SIF and SIO octets received (Item 3.4);
- unavailability of route set to a given destination or set of destinations (Item 4.9);
- duration of adjacent signalling point inaccessible (Item 5.2).

5.2.1.2 *Monitoring of link and network traffic performance*

This activity is concerned with ensuring that congestion thresholds and the numbers of discarded messages are within specification. If, for example, the number of Message Signal Units (MSUs) discarded due to a routing data error exceeds limits, the Routing Verification Test described in Recommendation Q.795 could be initiated to identify the source and type of routing data error.

Discarded message counts may be gathered signalling point by signalling point and added together to a give a total network performance measure.

One aspect of traffic performance can be monitored by measuring the amount of time that a given link is congested. The link loading or congestion duration must match the criteria upon which provisioning of links has been based.

Measurements to monitor links:

- number of Signalling Information Field (SIF) and Service Information Octet (SIO) octets transmitted (Item 3.1);
- SL congestion indications (Item 3.6);
- cumulative duration of SL congestion (Item 3.7).

Measurements of MSUs discarded:

- due to SL congestion (Item 3.10);
- due to routing data error (Item 5.5).

Duration measurements measure the effects of signalling link set and route set availability, by individual link set and route set. These measurements identify the effects of congestion or failure upon the surrounding network.

Measurements:

- duration of link in the in-service state (Item 1.1);
- duration of SL unavailability (for any reason) (Item 2.1);
- duration of SL unavailability due to remote processor outage (Item 2.9);
- duration of local busy (Item 2.15);
- cumulative duration of SL congestion (Item 3.7);
- duration of unavailability of signalling linkset (Item 4.2);
- duration of unavailability in measurement 4.9 (Item 4.10);
- duration of adjacent signalling point inaccessible (Item 5.2).

5.2.2 *Signalling Connection Control Part (SCCP)*

5.2.2.1 *SCCP Routing Performance*

The monitoring of routing failures allows SCCP Routing and Translation function to detect any abnormal number of messages which cannot be routed, independent of the originator being informed through message return.

Measurements:

Routing Failure due to:

- no translation for address of such nature (Item 7.1);
- no translation for this specific address (Item 7.2);
- network failure (point code not available) (Item 7.3);
- network congestion (Item 7.4);
- sub-system failure (unavailable) (Item 7.5);
- sub-system congestion (Item 7.6);
- unequipped user (sub-system) (Item 7.7);
- reason unknown (Item 7.9).

In addition, the following measurements can be used as a consistency check or a network protection mechanism:

- UDTS messages sent (Item 9.1);
- UDTS messages received (Item 9.2);

5.2.2.2 *SCCP unavailability*

The monitoring of SCCP unavailability may prove useful in the activation/deactivation of other network measurements.

Measurements:

Start of Local SCCP unavailable due to:

- failure (Item 8.1);
- maintenance made busy (Item 8.2);
- congestion (Item 8.3),

Stop of local SCCP unavailable;

- all reasons (Item 8.4).

5.2.3 *Telephony User Part*

For further study.

5.2.4 *Integrated Services Digital Network User Part (ISDN-UP)*

For further study.

5.2.5 *Transaction Capabilities Application Part (TCAP)*

For further study.

5.3 *Maintenance uses*

The activities described in this section relate basically to the detection of degraded performance and to the maintenance of a particular signalling point and the signalling links associated with that signalling point. They may be used on a near real time basis, or may be monitored over a period of days or weeks to detect unfavourable trends. They are designed so that one signalling point can monitor its own status without relying on measurements from adjacent signalling points.

5.3.1 *Message Transfer Part (MTP)*

5.3.1.1 *Detection of increases in link SU error rates*

This activity ensures that the signalling data link error rate is not rising beyond specification. The SU Error Rate Monitor is the basic instrument for monitoring signalling data link performance. Basic traffic counts are used to normalize performance measurements in order to compare system performance measurements.

Measurements:

- number of SIF and SIO octets transmitted (Item 3.1);
- number of SIF and SIO octets received (Item 3.4).

Operational measurements counting error events provide supplementary information to warn of impending failures or give a running assessment of signalling data link quality.

Measurements:

- number of Signal Units (SUs) in error (monitors incoming performance) (Item 1.8);
- number of Negative Acknowledgements (NACKs) received (monitors outgoing performance) (Item 1.9).

Counting total Signal Unit errors allows the estimation of Signalling Data Link bit error rates (see Recommendation Q.706, § 3.1) assuming that errors are random. The estimate uses measurements 1.1 duration of link in the in-service state, multiplied by the link transmission rate.

Measurements:

- duration of link in the in-service state (Item 1.1);
- duration of link unavailability (any reason) (Item 2.1).

5.3.1.2 *Detection of marginal links performance*

The SU Error Rate Monitor applies to lost alignment as well as corrupted data. Usually both conditions are caused by degraded performance of the transmission facility. Alignment and proving failures often indicate a marginally performing link.

Measurements:

- SL alignment failure (Item 1.7)

This activity is concerned with detecting routing instabilities caused by marginal link performance.

Measurements:

- local automatic changeover (Item 1.10);
- local automatic changeback (Item 1.11);
- SL congestion indications (Item 3.6);
- cumulative duration of SL congestion (Item 3.7);
- number of congestion events resulting in loss of MSUs (Item 3.11).

5.3.1.3 *Detection of link failure events in either direction*

By "link failure" is meant an event which causes a particular link to be unavailable for signalling (i.e. a failure at Level 1 or Level 2). Signalling link failures are detected in order to require preventive and corrective maintenance actions to restore the network capabilities. This maintenance action can be required on a single failure event or when the number of signalling links in failure for a link set or across different link sets exceeds a threshold.

Signalling link failure measurements are summarized not only for specific links sets, but also across many different link sets, where these may involve common transmission systems or signalling points. The distribution of failure and degradation sources may be randomly located, but if specific network elements appear to be common to a large number of the failures, then they are suspect as a significant failure source requiring further maintenance action.

Measurements:

- number of link failures:

  all reasons (Item 1.2);
  abnormal FIBR/BSNR (Item 1.3);
  excessive delay of acknowledgement (Item 1.4);
  excessive error rate (Item 1.5);
  excessive duration of congestion (Item 1.6);

- signalling link restoration (Item 1.12).

5.3.1.4 *Detection of routing and distribution table errors*

In operation, the Signalling System No. 7 routing data will be updated frequently as the network changes. It is necessary to keep track of signalling point status and routing problems on a routine basis (see Recommendation Q.795, § 2.1)

Measurements:

- duration of unavailability of signalling linkset (Item 4.2);
- start of linkset failure (Item 4.3);
- stop of linkset failure (Item 4.4);
- initiation of Broadcast TFP due to failure of measured linkset (Item 4.5);
- initiation of Broadcast TFA for recovery of measured linkset (Item 4.6);
- unavailability of route set to a given destination or set of destinations (Item 4.9);
- duration of unavailability in measurement 4.9 (Item 4.10);
- start of unavailability in measurement 4.9 (Item 4.11);
- stop of unavailability in measurement 4.9. (Item 4.12);
- adjacent SP inaccessible (Item 5.1);
- duration of adjacent SP inaccessible (Item 5.2);
- stop of adjacent SP inaccessible (Item 5.4);
- MSUs discarded due to a routing data error (Item 5.5).

5.3.1.5 *Component reliability and maintainability studies*

These studies are concerned with calculating the mean time between failures (MTBF) and mean time to repair (MTTR) for each type of component in the Signalling System No. 7 network. It may be useful for some purposes to have MTBF and MTTR data by Signalling System No. 7 function with which to correlate associated maintenance action.

Measurements:

- number of link failures;

  all reasons (Item 1.2);
  abnormal FTBR/BSNR (Item 1.3);
  excessive delay of acknowledgement (Item 1.4);
  excessive error rate (Item 1.5);
  excessive duration of congestion (Item 1.6);
- duration of SL inhibition due to local management actions (Item 2.5);
- duration of SL inhibition due to remote management actions (Item 2.6);
- duration of SL unavailability due to link failure (Item 2.7);
- duration of SL unavailability due to remote processor outage (Item 2.9);
- start of remote processor outage (Item 2.10);
- stop of remote processor outage (Item 2.11);
- local management inhibit (Item 2.13);
- local management uninhibit (Item 2.14).

5.3.2 *Signalling connection control part (SCCP)*

5.3.2.1 *SCCP routing performance*

Degraded SCCP performance may be detected from abnormal or excessive counts of measurements of routing failure, SCCP unavailability or protocol interworking difficulties.

Measurements:

Routing failures:

- no translation for address of such nature (Item 7.1);
- no translation for this specific address (Item 7.2);
- network failure (point code not available) (Item 7.3);

- network congestion (Item 7.4);
- sub-system failure (unavailable) (Item 7.5);
- sub-system congestion (Item 7.6);
- unequipped user (sub-system) (Item 7.7);
- reason unknown (Item 7.9).

Protocol interworking:

- syntax error detected (Item 7.8).

5.3.2.2 *SCCP availability*

It is useful to monitor the effectiveness of Coordinated State Change Control.

Measurements:

- sub-system out of service request granted (Item 8.6);
- sub-system out of service request denied (Item 8.7).

5.3.3 *Telephony user part*

For further study.

5.3.4 *Integrated services digital network user part (ISDN-UP)*

For further study.

5.3.5 *Transaction capabilities application part (TCAP)*

For further study.

5.4 *Administrative uses*

5.4.1 *Message transfer part (MTP)*

5.4.1.1 *Monitoring of link and signalling point utilization*

MTP utilization measurement is concerned with evaluating message flows to ensure that they are not beginning to exceed stated link and signalling point capacities. It also ensures that existing routing is resulting in proportionate utilization of available capacity.

Measurements by link:

- duration of link in the in-service state (Item 1.1);
- duration of SL unavailable (for any reason) (Item 2.1);
- number of SIF and SIO octets transmitted (Item 3.1);
- octets retransmitted (Item 3.2);
- number of message signal units transmitted (Item 3.3);
- number of SIF and SIO octets received (Item 3.4);
- number of message signal units received (Item 3.5);
- SL congestion indications (Item 3.6);
- cumulative duration of SL congestions (Item 3.7).

Measurements by signalling point:

- number of SIF and SIO octets received:

  with given Origination Point Code (OPC) (Item 6.1);
  with given OPC and SIO (Item 6.4);

- number of SIF and SIO octets transmitted:

  with given Destination Point Code (OPC) (Item 6.2);
  with given DPC and SIO (Item 6.5);

- number of SIF and SIO octets handled:

  with given SIO (Item 6.3);
  with given OPC, DPC, and SIO (item 6.6).

Measurements by signalling route set:

- unavailability of route set to a given destination or set of destinations (Item 4.9);
- duration of unavailability in measurement 4.9 (Item 4.10);
- MSUs discarded due to routing data error (Item 5.5).

5.4.2 *Signalling connection control part (SCCP)*

5.4.2.1 *SCCP utilization*

Network administration is interested in monitoring SCCP utilization for use in analyzing the current network and designing future network configurations. One way to monitor SCCP utilization is to measure the amount of SCCP traffic.

Measurements:

SCCP traffic received:

UDTS messages (Item 9.2);
total messages (for connectionless only)
(classes 0 & 1) (Item 9.7).

SCCP traffic sent:

UDTS messages (Item 9.1);
total messages (for connectionless only)
(classes 0 & 1) (Item 9.6).

General:

- total messages handled (from local or remote sub-systems) (Item 9.3);
- total messages intended for local sub-systems (Item 9.4);
- total messages requiring global title translation (Item 9.5);
- messages sent to a backup sub-system (Item 9.8).

5.4.2.2 *SCCP routing performance*

Network Administration is also interested in tracking long-term message routing performance of the SCCP. This can be obtained from the following measurements or their sum.

Measurements:

SCCP Routing failures:

- no translation for address of such nature (Item 7.1);
- no translation for this specific address (Item 7.2);
- network failure (point code not available) (Item 7.3);
- network congestion (Item 7.4);
- sub-system failure (unavailable) (Item 7.5);
- sub-system congestion (Item 7.6);
- unequipped user (sub-system) (Item 7.7);
- reason unknown (Item 7.9).

SCCP unavailability:

- duration of local SCCP unavailable (all reasons) (Ref. 8.5).

5.4.3 *Telephony user part*

For further study.

5.4.4 *Integrated services digital network user part (ISDN-UP)*

For further study.

5.4.5 *Transaction capabilities application part (TCAP)*

For further study.

5.5 *Preparation of traffic forecasts*

5.5.1 This activity is concerned with the calculation of values which will be entered into provisioning tables to determine future equipment quantities required. The data to be used are those already collected to support activities mentioned in §§ 5.2.1.2 and 5.4.1.1. Depending upon implementation, more detailed measurements may be required to provision such items as internal buffers or number of processors where these may vary.

5.6 *Network planning*

5.6.1 This activity requires longer-term traffic forecasts, based as much upon marketing intentions as upon extrapolations of existing patterns. Nevertheless, to understand existing patterns, planners need knowledge of traffic origins and destinations.

5.6.2 The measurements in Table 6/Q.791 and Table 9/Q.791 indicate how much traffic is being originated at the measured signalling point, and how much traffic has that signalling point as a destination. These measurements are useful for calculating traffic flows by origination/destination pair.

5.6.3 In reality, however, traffic flows do not spread randomly through a network. For each origin, distance and other factors result in a concentration of flows to favoured destinations. As a result, it will be necessary to measure flows on the network by destination.

5.6.4 Given the large potential number of destinations, measurements may have to be grouped (see explanatory notes for Table 6/Q.791 and Table 9/Q.791 in § 3).

5.7 *Evaluation of maintenance force effectiveness*

This activity consists of managerial control of the maintenance function, through examination of failure trends, equipment availabilities and the amount of outage due to manual as opposed to automatic busying of components. The activity is usually carried out with the aid of indices based upon data listed in § 5.3.

SECTION 4

OPERATIONS, MAINTENANCE AND ADMINISTRATION PART (OMAP)

Recommendation Q.795

OPERATIONS, MAINTENANCE AND ADMINISTRATION PART (OMAP)

1 Introduction

The purpose of this Recommendation is to provide procedures and protocols related to operations and maintenance information. These procedures and protocols are associated with the application layer of the Open Systems Interconnection model, as well as the System Management Application Process (SMAP) residing above the application layer. In addition, the procedures and protocols related to operations and maintenance information use other procedures and protocols specified by CCITT in the framework of the OSI model. [1)]

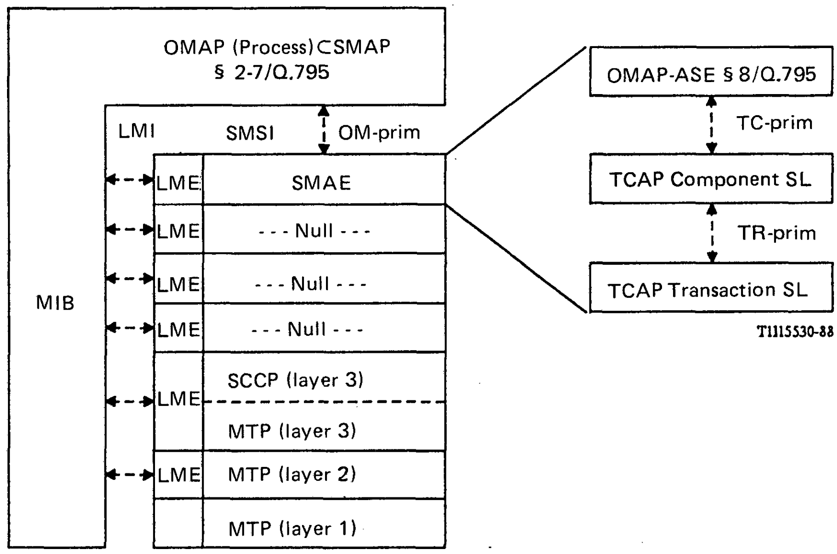
The operations and maintenance procedures described are generally associated with two types of signalling points. The controlled signalling point(s) are the signalling point(s) to which controls are applied and about which information is collected. The controlling signalling point(s) are the signalling point(s) which are initiating the controls and to which information from the controlled signalling point(s) are directed.

This Recommendation is divided into eight sections. The first, is the introduction. The second describes those procedures in OMAP which are currently defined for the signalling network. The third describes those operations and maintenance procedures associated with the exchanges. The fourth describes those common operations and maintenance procedures that are associated with the signalling network and exchanges and the fifth section describes those capabilities required by OMAP from other layers of the OSI and gives examples of why the capabilities are required. The sixth section defines timers, timer values and performance timers. The seventh section provides state transition diagrams for the currently defined OMAP procedures. The eighth section defines the OMAP ASEs.

1.1 *Description of management model*

The Signalling System No. 7 Management model is concerned with the control, coordination, and monitoring of the resources which allow SS No. 7 based communication to take place. More specifically, activities relate to the way various SS No. 7 entities obtain data and cooperate in relation to maintaining these resources. Figure 1/Q.795 presents a graphical description of the SS No. 7 Management model in relation to the OSI Management model.

[1)] The compatibility of OMAP with OSI management protocols [i.e.Common Management Information Protocol (CMIP)] is for further study.



SMSI: Systems Management Service Interface
LMI : Layer Management Interface
LME : Layer Management Entity

Note – The LMI and the interface between the user of OMAP and OMAP are implementation dependent and are not subject to standardization.

FIGURE 1/Q.795

Signalling System No. 7 management model

1.1.1 *Management categories*

In order to achieve the functionality described above, three categories of management are identified: Systems Management, (N)-Layer Management, and (N)-Protocol Management. As previously described, Systems management monitors, controls, and coordinates resources through the application layer protocols. The collection of these functions is known as the Systems Management Application Process (SMAP). (N)-Layer Management functions are performed within the corresponding (N)-Layer by a local system. Examples of (N)-Layer functions are measurements and the maintenance of network routing tables. (N)-Protocol Management is concerned with a single instance of communication within the (N)-Layer. It is the responsibility of the (N)-protocol to distinguish between management information carried within the (N)-protocol and other information. OMAP is generally concerned with Systems Management and (N)-Layer Management functions each of which may be considered a sub-set of Systems Management.

1.1.2 *Management information base*

All management information which exists in an open system and which may be transferred or affected through the use of management protocols comprises the Management Information Base (MIB). This information may be provided or accessed by remote systems using OMAP. The exchange of data may be in the form of either monitoring information or exercise of control. The internal structure of the MIB is not specified.

1.2 *Application layer model*

The set of functions above the application layer which collectively encompass systems management is termed Systems Management Application Process (SMAP). The aspect of the SMAP which is then involved with communications is the Systems Management Application Entity (SMAE). The SMAE is also known as the OMAP AE. The OMAP AE consists of a set of one or more Application Service Elements (ASEs). Currently, two ASEs are defined in the OMAP AE, the Transaction Capabilities Application Part (TCAP Recommendations Q.771-775), and the MTP Routing Verification Test (MRVT) (§ 8). The MRVT ASE uses the services of the TCAP ASE.

The SMAP communicates with the OMAP AE via a set of OM-Primitives at the Systems Management Service Interface (SMSI). Currently, two primitives are defined for OMAP: OM-Confirmed-Action, and OM-Event-Report. These Primitives are defined in § 8. These OM-Primitives are based on the M-Primitives used in the Common Management Information Protocol (CMIP) defined in ISO 9595/6.

1.2.1 *Transfer categories*

There are two categories of data transfer which are of concern to SMAP and management. These are connectionless service and a connection-oriented service.

1.2.1.1 *Connectionless service*

OMAP as currently defined in this Recommendation uses the services of connectionless TCAP as currently specified in Recommendations Q.771-774. This service is generally used for those functions which require only a few messages, e.g. MRVT (see § 2.1) see Figure 2/Q.795.

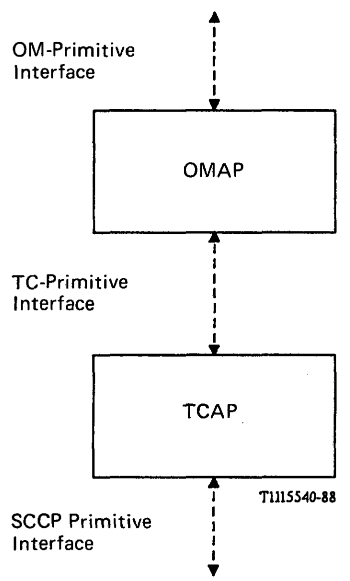


FIGURE 2/Q.795

Connectionless service

1.2.1.2 *Connection-oriented service*

OMAP as currently defined does not offer a connection-oriented service, however this is an item for further study. This service would generally be used for those functions which require a number of messages. See Figure 3/Q.795.

2 Operations, maintenance and administration procedures for the signalling network

2.1 *Management of routing data*

These procedures deal with the creation, modification, deletion, interrogation, activation and deactivation of routing data. This capability is provided in two basic modes: *multiple* and *single. Multiple mode* provides the capability of dealing with many routing relations, while *single mode* deals with a single routing relation.

2.1.1 *Functions*

2.1.1.1 *Creation*

This function provides a means of adding new routing data associated with routing relations to a node in the network. It could cause additional information to be added to an existing table or it may involve adding a completely new table.

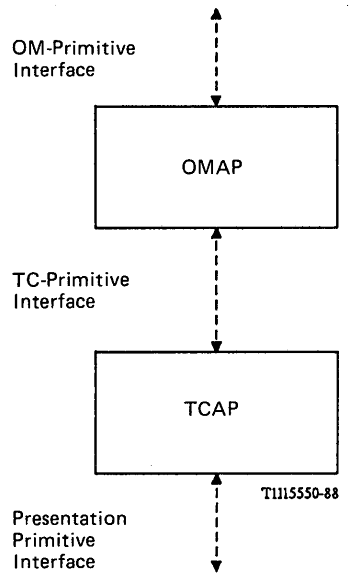


FIGURE 3/Q.795

Connection-oriented service
(for further study)

2.1.1.2 *Modification*

This function allows for the modification of existing routing data associated with routing relations within a particular node.

2.1.1.3 *Deletion*

This function is the inverse of creation, in that routing data associated with routing relations will be deleted from the routing tables.

2.1.1.4 *Interrogation*

This function provides a means for requesting the routing data in a specified signalling point.

For example the user can query a signalling point and the signalling point will respond with the respective data. This data can then be compared with the set of data which is expected to be in the signalling point.

2.1.1.5 *Activation*

Activation initiates the use of specified routing data.

The activation of routing relations implies that the new data is actually being used for routing purposes. It may be instantaneous or scheduled for a later time. Activation is accomplished via the activation procedure alone or may be a part of the creation, modification and deletion procedures.

2.1.1.6 *Deactivation*

Deactivation discontinues the use of specified routing data.

If a routing table is erroneously changed, another modification must be made to correct the data in order to continue routing in a sane manner. If a previous version of the table has been retained, the deactivation function may cause this table to be used. Deactivation can be either automatic or may require manual intervention.

2.1.1.7 *Rearrangement*

Rearrangement deals with the coordinated change of a set of routing relations within the signalling network (e.g. when an application is moved from one signalling point to another). This may be handled by requiring that the activation of routing relations in the various signalling points be made (e.g. by an operations and maintenance centre) in a particular order.

2.1.2 *Information elements*

The specification of information elements is left for further study.

2.2 *Circuit validation test (CVT)*

Note – The encoding of the CVT messages is for further study.

2.2.1 *General procedures*

The purpose of a CVT is to ensure that the two exchanges have sufficient and consistent translation data for placing a call on a specific circuit of an interexchange circuit group. A CVT may be initiated by either exchange on demand by maintenance or operations personnel. The test is to be performed before a continuity test while turning up a circuit, so that if a continuity failure is experienced it may be uniquely attributed to a circuit hardware trouble. Before a test is performed, it is necessary to ensure that messages are capable of being routed to that exchange.

2.2.2 *Translations tested*

Both the near end and far end checks are required to perform a complete CVT. The initiating end starts the test by accessing the circuit to be tested when stimulated by a local implementation dependent request. The circuit is identified by an identification code agreed upon by the two exchanges at either end of the circuit.

The translation check at the initiating end must perform adequate tests to ensure that translation data exists for:

1) deriving a physical appearance for the circuit so that a transceiver may be connected to it, and

2) deriving a circuit identification code (CIC) and routing label so that a CCS circuit-related message may be generated.

If the near end test fails, the local maintenance personnel is notified with the reason for the near end failure (e.g. failure reason – circuit unequipped). The test is terminated and a CVT request message is not generated for the circuit under test.

The far end receiving the CVT request message will check to see if the CIC indicated in the message is assigned. If the CIC is unassigned, a failure indication is explicitly returned to the near end via a CVT response message (rather than via an unequipped CIC message). If the CIC is assigned, the far end must perform adequate tests to ensure that translation data exists for deriving a physical circuit appearance from the received routing lable and the CIC so that a loop or transceiver may be connected to the physical circuit appearance. Additionally, the far end must also check that an identification code for the circuit exists for the physical circuit appearance. If the far end checks fail, the CVT response message will contain the reason for failure and will include an identification code of the failing exchange as agreed upon by the two exchanges. If the far end checks pass, the CVT response message will contain the far end derived identification code for the circuit. At the near end, a comparison of the near end and the far end circuit identification codes are made. If they match, an identification of a successful CVT is given to the maintenance personnel at the initiating end. If the comparison fails, a CVT failure indication with all the relevant data is given to the maintenance personnel for the purpose of isolating the problem.

The CVT response message will also contain data about the circuit with respect to the characteristics of the interexchange circuit group that it is part of. The interexchange circuit group characteristics will include whether:

- odd or even CICs are in control in the case of double seizing;
- the blocked circuit group is classified as "Block, immediately release the call" or "Block, as soon as the call is normally released";
- whether the interexchange circuit group contains analogue, digital or a mix of analogue and digital circuits in order to determine if continuity checks should be performed.

If the group characteristics are unavailable, the CVT response must explicitly indicate this with an unavailable indication. Inconsistencies between the interexchange circuit group characteristics between the two exchanges must be reported to the initiating end maintenance personnel for corrective action.

2.3 *MTP routing verification test (MRVT)*

The MTP routing verification test requirements are as follows:

a) Independence of MTP routing policy.

b) Independence of link set failures.

c) Use the existing MTP without modifications.

d) Response at all tests (positive or negative).

e) Independence of the network structure.

f) The procedure must:

- detect loops in the signalling network;
- detect excessive length routes;
- detect unknown destinations;
- check the bidirectionality of the signalling relations (i.e. if SP A can reach SP B, can SP B reach SP A?).

2.3.1 *General procedure considerations*

The object of the MTP routing verification test is to determine if the data of the MTP routing tables in the network are consistent. It is based on a decentralized test procedure using test messages. It will follow all possible routes to reach the test destination, while tracking the identities of STPs crossed. The procedure is independent of signalling link set availability status. The test is started in any point (SP or STP) for any destination which is in the MTP routing tables and is stopped at the test destination or any intermediate SP at which an error is detected. The test will check the complete routing tables in the network only if all intermediate signalling points know the initiator.

When an inconsistency or failure is detected, local actions are to be specified. The initiator of the test is alerted. The MRVT procedure is applied to individual MTP routing tables. If the MTP is to use structured routing tables (e.g. some or all of the entries in the routing tables may refer to sets of point codes) then the procedure (and/or its initiation) is for further study.

If an MRVA, MRVR, or MRVT message received in an SP contains information extra to that defined in § 2.3, the extra information is ignored unless it is contained as spare subfields within defined fields, and then it will be sent onwards.

2.3.2 *The MRVT messages*

The MTP routing verification test procedure uses three Operations, Maintenance, and Administration Part (OMAP) messages.

2.3.2.1 *The MTP Routing Verification Test (MRVT) message*

The routing verification test message (MRVT) is sent from an SP to an adjacent SP. The MRVT message may use any available signalling route to reach its destination. It contains:

a) information indicating MRVT;

b) the point code of the test destination;

c) the initiator point code;

d) the threshold N of the maximum allowed number of STPs crossed (including the initiator if it is an STP); [2)]

e) the information indicating that a trace is requested; the possible values are:

   i) for all routes which may be used to reach the test destination the MRVR messages are returned regardless of the result of the test;

   ii) no detailed information requested (the MRVR messages sent only if a failure or inconsistency is detected);

f) the list of STPs crossed together with the initiator point code if this point has the STP function.

2.3.2.2 *The MTP Routing Verification Acknowledgment (MRVA) message*

The routing verification acknowledgment (MRVA) message is sent from the SP receiving an MRVT message to the SP which has sent the MRVT message. The MRVA message may use any available signalling routes to reach its destination. It contains:

a) information indicating MRVA;

b) information indicating that an MRVR has been sent;

c) the reason for any failure (partial or complete). If any failure has occurred, one or more of the following indications is present:

   i) detected loop;

   ii) detected excessive length route;

   iii) unknown destination point code;

   iv) MRTV not sent due to inaccessibility (e.g. network blockage or network congestion);

   v) timer expired (MRVA not received);

   vi) unknown initiator point code (this result means that the test destination or an intermediate point does not know the initiator of the test);

   vii) test cannot be run due to local conditions (e.g. unavailability of processing resources).

Note that in the case of success, only a) will be present; in the cases of partial success and failure, a), b) and c) will be present.

2.3.2.3 *The MTP Routing Verification Result (MRVR) message*

The MRVR message is sent from an SP to the initiator of the MTP routing verification test. It contains:

a) information indicating MRVR;

b) the test destination point code;

c) the result of the test;

d) the information field.

The content of this information field depends on the result of the test. It contains:

i) if the result of the test is "success":
   the point codes of the STPs crossed contained in the MRVT message;

ii) if the result of the test is "detected loop":
   the point codes of the STPs which are in the loop;

iii) if the result of the test is "detected excessive length route":
   the point codes of STPs crossed contained in the MRVT message;

iv) if the result of the test is "unknown destination point code":
   no additional information;

v) if the result of the test is "MRVT not sent due to inaccessibility":
   the point code of the inaccessible SP;

vi) if the result of the test is "MRVA not received":
   the identity of the SP(s) from which an MRVA was not received when expected;

vii) if the result of the test is "unknown initiator point code":
   the point code of the SP returning an MRVA to cause the MRVR to be sent;

viii) if the result of the test is "test cannot be run due to local conditions":
   no additional information.

[2)] Determined by System Management Application Process (SMAP)

2.3.3 *Initiation of the MRVT procedure at a Signalling Point*

The procedure is started when:

a) New MTP routing data is introduced. It is mandatory that each signalling relation should pass the MRVT procedure successfully before being opened to traffic.

b) MTP routing data is changed.

c) On reception of an unexpected MRVR (due to unknown Signalling Point).

d) On receipt of an MRVT message.

e) On demand from local maintenance staff or an operations and maintenance centre.

f) Periodically at a Signalling Point (having the STP function) to detect cases of mutilation of routing data. (The period is network dependent and should be such that the load on the network is not seriously increased.)

In cases c) and f) above, the "expected result type" field of the MRVT message should be set to indicate no trace is requested. See § 2.3.2.1.

2.3.4 *The MRVT procedure*

2.3.4.1 *At the point initiating the procedure*

2.3.4.1.1 *Initial actions*

When a signalling point initiates an MRVT procedure, it sends an MRVT message for each signalling route which is contained in the MTP routing table to reach the test destination. The destination (DPC) of each of these messages is the adjacent signalling point within the particular route under test. If the test destination is an adjacent signalling point, operated in the associated mode, an MRVT message is not sent to the tested destination itself.

When the MRVT procedure is initiated, a timer T1 (see § 6) is started. An SP cannot initiate an MRVT procedure for a test destination until any previous MRVT procedure for that destination has completed.

2.3.4.1.2 *Subsequent actions*

2.3.4.1.2.1 *Reception of an MRVA message*

An MRVA message acknowledges an MRVT message previously sent.

The reception of the last expected MRVA message stops T1. When an MRVA message is received after T1, it is ignored. When all MRVA messages expected have been received or when T1 expires, the test is complete and results are given to SMAP.

The possible test results at this point in the procedure are listed in § 2.3.2.2 c).

The result "unknown initiator point code" could be a positive result (e.g. when installing a new SP). A test is positive when all expected MRVA messages have been received inside T1 without fault indications.

2.3.4.1.2.2 *Reception of an MRVR message*

The reception of an MRVR message regardless of whether the receiving SP was the initiator causes the information contained in the message to be given to SMAP (see § 2.3.2.3).

2.3.4.2 *In an intermediate point*

2.3.4.2.1 *Initial actions (on reception of an MRVT message)*

If the test cannot be run due to local conditions, an MRVR message is sent to the initiating point, if the initiating point is known to the intermediate SP, and an MRVA message is sent to the sender of the MRVT. The MRVR message contents are as described in § 2.3.2.3. The MRVA message contains the indication "test cannot be run due to local conditions". The test is stopped after informing SMAP.

If the test can be run, looking at the contained fields in the received MRVT message, the point determines if the initiating SP is known, and if the test destination is known in the MTP routing tables. Then:

a) If the initiating SP is unknown, an MRVA message is returned with result "unknown initiating SP" and the value of the "MRVR sent" indicator denotes that the MRVR message was not sent. The test is then stopped, after informing SMAP.

b) If the destination is unknown, the point acknowledges the received MRVT message by an MRVA message with indication "unknown destination point code", and MRVR message is sent to the initiating point. An indication is given to SMAP and the test stopped.

c) If the initiating SP of the test as well as the test destination exist within the SPs routing tables, the SP makes a list "A" of the following adjacent SPs:

   i) STPs used to route to the destination (according to the MTP routing tables), excluding the SP from which the MRVT message was received,

   ii) the tested destination, if this is adjacent.

The SP then compares the list of STPs crossed contained in the MRVT message with its own list "A" for the following conditions:

i) If the point code of an SP is already in the list of STPs crossed contained in the MRVT message, a loop is detected. An MRVR message is sent to the initiator of the test with the indications described in § 2.3.2.3, then an MRVA message is sent to the point which has sent the MRVT message with the indication "detected loop". The test is stopped (MRVT messages are not regenerated), after SMAP is informed.

ii) If the point code of an SP is not in the list of STPs crossed contained in the MRVT message and if the size of the list is equal to a threshold N in the MRVT message, an excessive length route is detected. An MRVR message is sent to the initiator of the test with the indications described in § 2.3.2.3, then an MRVA message is sent to the point which has sent the MRVT message with the indication "detected excessive length route". The test is stopped (MRVT messages are not regenerated), after SMAP is informed.

iii) If it is impossible to route an MRVT message, an MRVR message is sent to the initiator of the test with the indications described in § 2.3.2.3, then an MRVA message containing the indication "MRVT not sent due to inaccessibility" is sent to the point which has sent the MRVT message. The test is stopped (no MRVT messages are regenerated), after SMAP is informed.

iv) In other cases a timer T1 is started, and MRVT messages are sent to all the SPs in list "A". When an MRVT message is sent by an STP, the STP adds its identity in the MRVT message sent.

2.3.4.2.2 *Subsequent actions (on reception of an MRVA message)*

The reception of an MRVA message acknowledges the corresponding MRVT message previously sent. The timer is stopped when all the expected MRVA messages have been received.

MRVA message is sent when all expected MRVA messages have been received. The result of the test contains the different results from the MRVAs received.

If any MRVA message contained both the result "unknown initiating SP" and the value of the "MRVR sent" indicator denotes that the MRVR was not sent, an MRVR is returned to the initiator.

If one (or several) MRVA message is not received before T1 expires, an MRVA message is sent and an MRVR message is sent to the initiator of the test with the indications described in § 2.3.2.3.

If an MRVA message cannot be sent, no action is taken.

If an MRVA message is received after T1 expires, it is ignored.

2.3.4.3 *At the test destination receiving an MRVT message*

On reception of an MRVT message, the test destination checks that the initiator of the test is known.

If the initiator is unknown, an MRVA message is sent to the point which had sent the MRVT message. This MRVA message contains the result "unknown initiator point code" and the "MRVR sent" indicator set to denote that the MRVR was not sent.

If the initiator of the test is known, the test is finished with success and the following actions are taken:

a) If the MRVT message received contains the indication that a trace is expected, (see § 2.3.2.1) an MRVR message is sent to the initiator of the test with the indications described in § 2.3.2.3. An MRVA message is then sent to the point which had sent the MRVT message.

b) If the MRVT message received contains the indication that a trace is not expected, (see § 2.3.2.1), an MRVA message is sent to the point which had sent the MRVT message. No MRVR message is sent.

If an MRVA message cannot be sent, no action is taken.

2.4 *Reception of a message for an unknown destination*

When an indication is received from the MTP due to the reception of a message for an unknown destination, an MRVR message is sent to the point which has sent the messages with the indications described in § 2.3.2.3.

When a point receives such an unexpected MRVR message, an indication is given to SMAP and an MRVT is started.

2.5 *SCCP routing verification test (SRVT)*

The SCCP routing verification test requirements are as follows:

a) No modification should be needed to the SCCP protocol specification.

b) The SRVT should be independent of the SCCP routing policy.

c) The SRVT should be independent from the network structure, considering the SCCP routing points.

d) The SRVT is not required to verify MTP routing correctness (the MRVT is expected to do this).

e) A response (either positive or negative) is to be given to all tests.

f) The procedure should:

   – Be able to check all possible SCCP routes, including:

      i) parallel SCCP routing points (this is understood to mean multiple translation points);

      ii) serial SCCP routing points (this is understood to mean multiple translation points);

      iii) multiple destinations corresponding to the tested Global title (this is understood to be multiple signalling points/subsystem numbers where SCCP permits a maximum of two destinations to be derived from a Global title).

   – Detect loops in the SCCP routing.

   – Detect unknown destination (a destination corresponds to the tested Global title).

   – Verify Global Title Translation data for accuracy, completeness, and inconsistency.

2.5.1 *General procedure considerations*

The general procedure considerations of the SRVT are left for further study.

2.5.2 *The SRVT messages*

The SRVT mesages are left for further study.

2.5.3 *Initiation of the SRVT procedure*

Initiation of the SRVT procedure is left for further study.

2.5.4 *The SRVT procedure*

The specification of the SRVT procedure is left for further study.

2.6 *Long-term measurement collection*

The measurements to be taken are given in Recommendation Q.791.

Periodically, at the same time, every signalling point collects the required data. The data collected may be transferred toward the appropriate signalling point(s) (e.g. an operations and maintenance centre) either on demand or on a scheduled basis.

The procedures and means used for transfer of data are for further study.

2.6.1 *Functions*

2.6.1.1 *Parameter intialization*

This function initializes, in a signalling point, the destination address(es) to which measurements will be transferred, sets up default parameters describing which indications should be reported and, if scheduled, when the measurements should be transferred.

2.6.1.2 *Parameter modification*

This function allows modifications to the default measurements which are collected in a signalling point. It may not be used to modify the measurements duration nor to remove those measurements described as being obligatory in Recommendation Q.791. The following list represents the set of modifications currently available and the information elements that must be provided at the controlled signalling point. Other modifications have been left for further study.

a) *Allow measurement collection* is used to indicate that a particular measurement(s) should be collected for a particular controlling signalling point.

   Command, controlling address, measurement 1, measurement 2, etc.

b) *Inhibit measurement collection* is used to indicate that a particular measurement(s) should not be collected for a particular controlling signalling point.

   Command, controlling address, measurement 1, measurement 2, etc.

2.6.2 *Information elements*

2.6.2.1 *Command indicates the function to be performed*

2.6.2.2 *Controlling address* is the address of the signalling point from which commands are sent and to which the measurements are transferred.

2.6.2.3 *Measurement* is the name of a particular measurement which should (not) be collected.

2.7 *On-occurrence measurement reporting*

These procedures deal with the transfer and control of the measurements described in Recommendation Q.791 (Monitoring and measurements for Signalling System No. 7 networks) as being reported on occurrence. The record of an on-occurrence measurement is referred to as an *event indicator* or *indicator.*

2.7.1 *Functions*

2.7.1.1 *Parameter initialization*

This function initializes, in a signalling point, the destination address(es) to which reporting should be made (e.g. an OMC), sets up default parameters describing which indicators should be reported, what thresholds are associated with the indicators and which indicators should be logged along with the establishment of logging files (see § 2.7.1.4).

2.7.1.2 *Parameter modification*

Parameter modification allows modifications to be made to the default indicators which are to be logged and transmitted. In addition, it allows the modification of the destination addresses that are associated with particular indicators. The following list represents the set of modifications available and the information elements that must be provided at the controlled signalling point. Other modificaitons have been left for further study.

a) *Create a logging file* is used to create a logging file and set the number of event indicators to be logged before overwriting old indicators:

   command, controlling address, file name, size.

b) *Change a controlling address* is used to modify a controlling address (e.g. of an OMC) to which reports should be made:

   command, old controlling address, new controlling address.

c) *Allow event logging* is used to indicate that a particular indicator(s) should be logged and optionally assign a threshold to the indicator:

command, controlling address, event indicator 1, threshold 1, etc.

d) *Inhibit event logging* is used to indicate that a particular indicator(s) should not be logged:

command, controlling address, event indicator 1, event indicator 2, etc.

e) *Change event logging threshold* is used to modify a threshold associated with a particular indicator(s) to be logged:

command, controlling address, event indicator 1, threshold 1, etc.

f) *Allow event reporting* is used to indicate that a particular indicator(s) should be reported to a controlling address and optionally assign a threshold to the indicator:

command, controlling address, event indicator 1, threshold 1, etc.

g) *Inhibit event reporting* is used to indicate that a particular indicator(s) should not be reported:

command, controlling address, event indicator 1, event indicator 2, etc.

h) *Change event reporting threshold* is used to modify a threshold associated with a particular indicator(s) to be reported:

command, controlling address, event indicator 1, threshold 1, etc.

2.7.1.3 *Event indicator reporting*

This function notifies a specified controlling address of on-occurrence measurements by the transfer of an event indicator. The following information elements are included in each message that is sent for reporting purposes:

event type, controlled address, affected address, time stamp, additional information.

2.7.1.4 *Recovery of recent on-occurrence measurement history*

In the event of failure of a controlling signalling point (e.g. an operations maintenance centre) or a signalling relation to that controlling signalling point, a recovery procedure is required to allow the controlling signalling point to recover a recent history of on-occurrence measurements in the signalling network. This is accomplished by maintaining a log of the last N event indicators, at the signalling point, which may be requested by the controlling signalling point after recovery.

The logging file may also be used to store event indicators which have not been requested for reporting by the controlling signalling point, for example, measurements with lower thresholds for logging than for reporting.

The maximum number of event indicators logged (N) is for further study.

2.7.2 *Information elements*

2.7.2.1 *Controlling address* is the address of the signalling point from which commands are sent and to which the event indicators are reported.

2.7.2.2 *Controlled address* is the address of the signalling point which is being controlled and from which measurements are being reported.

2.7.2.3 *Affected address* is the address of the signalling point about which an event indicator pertains.

2.7.2.4 *Command* indicates a function to be performed.

2.7.2.5 *File name* is the name of a file at the signalling point where logging is to be performed.

2.7.2.6 *Size (N)* is the maximum number of event indicators that may be recorded in an event log.

2.7.2.7 *Event type* describes the on-occurrence measurement associated with an event indicator.

2.7.2.8 *Threshold* represents some threshold associated with an on-occurrence measurement before its associated event indicator is reported or logged.

2.7.2.9 *Time stamp* represents the unique network time when the event indicator was generated.

2.7.2.10 *Additional information* is any additional information associated with the on-occurrence measurement being indicated (e.g. the link ID of a signalling link experiencing a failure).

2.8 *Delay measurements*

These procedures deal with measuring delays across the signalling network, whether these delays are measured point-to-point or round trip.

2.8.1 *Functions*

The specifications of functions is left for further study.

2.8.2 *Information elements*

The specification of information elements is left for further study.

2.9 *Clock initialization*

The clock initialization procedures provide a means for setting clocks in a signalling point for operations and maintenance and for other purposes. Its main function allows clocks in the network to be set up to a unique network time.

2.9.1 *Functions*

The specification of specific functions has been left for further study.

2.9.2 *Information elements*

The specification of information elements is left for further study.

2.10 *Real-time control*

These procedures allow for automatic or manual controls to be taken in a controlled signalling point based on input from a controlling signalling point. The controlling signalling point may initiate these procedures based on input from procedures like the *on-occurrence measurement reporting* procedures.

2.10.1 *Functions*

The specification of functions is left for further study.

2.10.2 *Information elements*

The specification of information elements is left for further study.

2.11 *Operations*

These procedures provide a capability to perform operations, such as activation of links, within the signalling network.

2.11.1 *Functions*

The specification of functions is left for further study.

2.11.2 *Information elements*

The specification of information elements is left for further study.

3 Operations and maintenance procedures for the exchanges

This paragraph deals with those procedures associated with the operations and maintenance of exchanges and remains as a topic for further study. A basis for the definition of this paragraph will be Recommendations Q.511, Q.512, Q.542 and Q.544, Supplement 6 of Fascicle II.3 and Recommendation Z.318.

4 Operations and maintenance procedures for both the Signalling Network and Exchanges

This section deals with those procedures associated with operations and maintenance that are found in common with both the Signalling Network and the Exchanges. See OMAP procedures and protocols in this document and also Recommendations Q.541, Q.543, Q.544 and M.30. The contents of this paragraph remains as a topic for further study.

5 Requirements on the protocols used to support the operations and maintenance procedures

It is assumed that the procedures defined in the previous paragraphs will make use of the protocols defined by CCITT in the various functional layers of the OSI model. This paragraph describes the capabilities required from these layers. No attempt is made to allocate the requirements to specific functional layers of the OSI model. See OMAP procedures and protocols in this document and also Recommendations Q.541, Q.543, Q.544 and M.30.

5.1 *Addressing capability*

This capability allows the user of the OMAP to address applications in nodes in the signalling network or to applications in nodes that may exist in any interconnected network.

5.2 *Distribution capability*

This capability is responsible for delivering information to the appropriate operations and maintenance application within the destination node.

5.3 *Connection-oriented communication capability*

This capability establishes a connection, whether physical or logical, for the purposes of transporting operations and maintenance information between two signalling points. This is required, for example, for the interactions between a controlling signalling point where MML commands are entered and a controlled signalling point where the functions controlled by the MML commands exist.

5.4 *Connectionless communication capability*

The capability allows the transfer of operations and maintenance information between two signalling points without the establishment of a connection. This is required, for example, to transfer event indicators used in the *on-occurrence measurement reporting.*

5.5 *File transfer capability*

This capability provides the means for communications between operations and maintenance applications which require file transfers. This is required, for example, to transport files generated by *long-term measurement collection.*

5.6 *Other capabilities*

Other capabilities which may be required are for further study.

6 Timer definitions and values, and performance time definitions and values

6.1 *Timer definitions and values*

T1 at a signalling point (Near End Signalling Point) initiating an MRVT is the guard time waiting for all MRVA messages in response to the MRVT messages sent from the Near End SP.

$$\text{T1 (Near End SP)} = D(N+1)$$

where N is defined in § 2.3.2.1 d), and D is defined in § 6.2 below.

T1 at an intermediate signalling point is the guard time associated with a received MRVT message, waiting for all MRVA messages in response to all MRVT messages sent.

$$\text{T1 (Intermediate SP)} = \text{T1 deduced from the received MRVT message} - D$$

6.2 *Performance time definitions and values*

$$D = Max(d1) + Max(d2) + Max(d3) + Max(d4)$$

where

d1: time to transfer an MRVT message.

d2: time to take into account an MRVT message received.

- In an Intermediate SP, performance time d2 is the time between the reception of an MRVT message and the sending of the MRVT messages to the concerned SPs (or the sending of the MRVA message to the point which has sent the MRVT message when a problem is detected).
- In the tested destination, performance time d2 is the time between the reception of an MRVT message and the sending of the MRVA message to the point which has sent the MRVT message.

d3: time to transfer an MRVA message.

d4: time to take into account an MRVA received.

- In an Intermediate SP, performance time d4 is the time between the reception of the last MRVA message and the sending of the MRVA message to the point which has sent the MRVT message.

Performance time	Estimated maximum value
d1	2 seconds (provisional)
d2	3 seconds (provisional)
d3	2 seconds (provisional)
d4	1 second (provisional)
D	8 seconds (provisional)

7 State transition diagrams

7.1 *General*

Paragraph 7 contains the description of the test functions described in §§ 2.2 and 2.3 in the form of state transition diagrams according to the CCITT Specification and Description Language (SDL).

A set of diagrams is provided for each of the following tests:

a) Circuit Validation Test (CVT), described in § 2.2;

b) MTP Routing Verification Test (MRVT), described in § 2.3.

7.2 *Abbreviations used in Figures 4/Q.795 to 5/Q.795*

CVT	Circuit validation test;
CKT	Circuit;
MRVT MTP	Routing verification test;
MRVA MTP	Routing verification acknowledgement;
MRVR MTP	Routing verification result;
PC	Point code;
REQ	Request;
RESP	Response;
SMAP	System management application process.

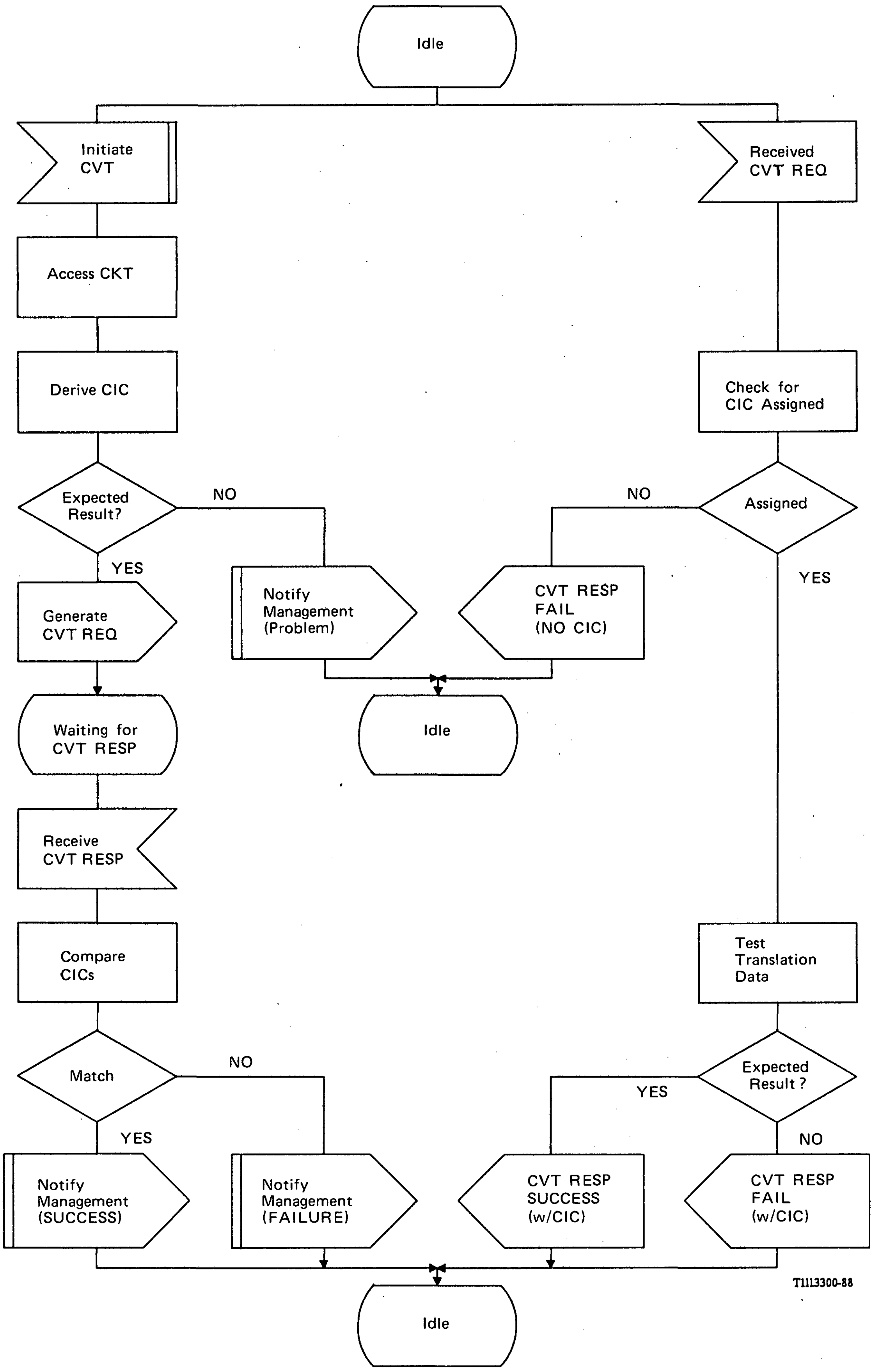
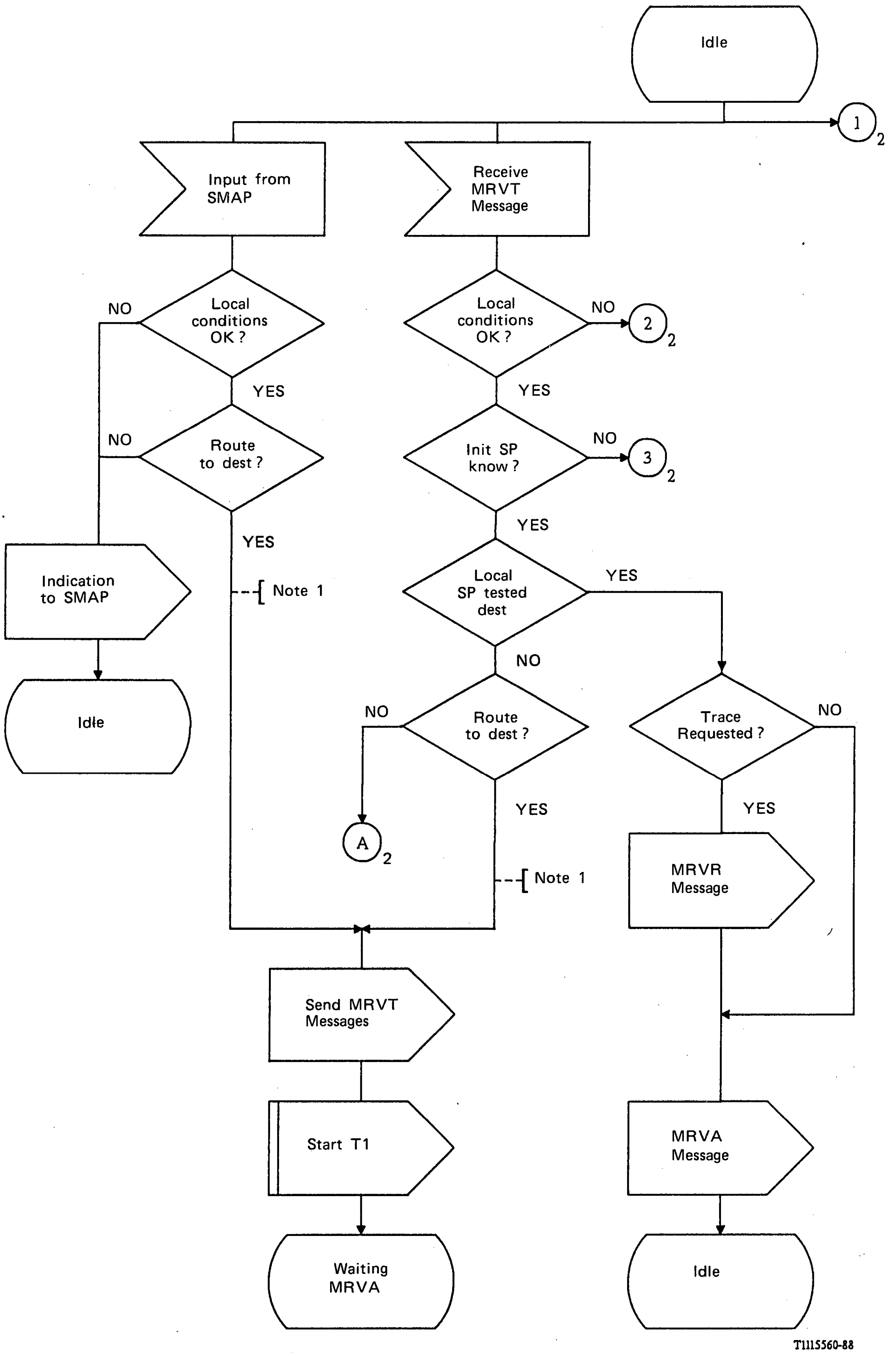


FIGURE 4/Q.795

Circuit validation test (CVT)

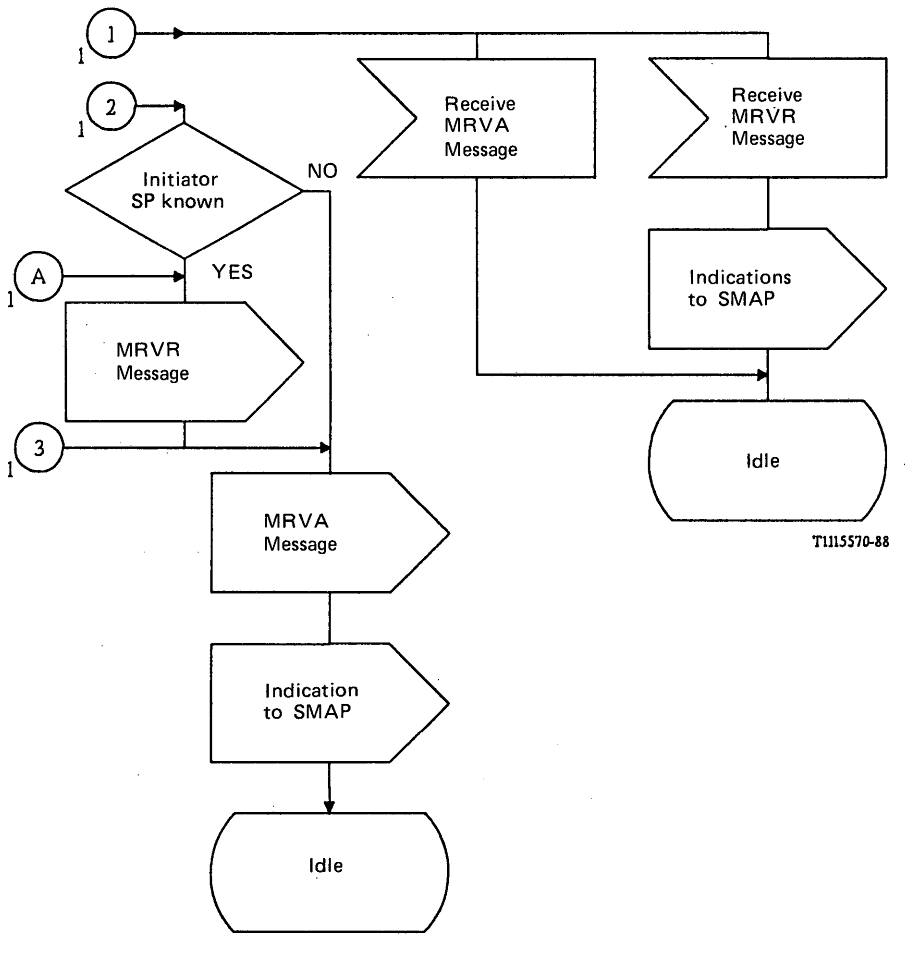


Note 1 – No Loops; no excessive length routes; able to send MRVT messages.

Note 2 – This SDL is for an SP taking part in an MTP routing verification test.

FIGURE 5/Q.795 (Sheet 1 of 3)

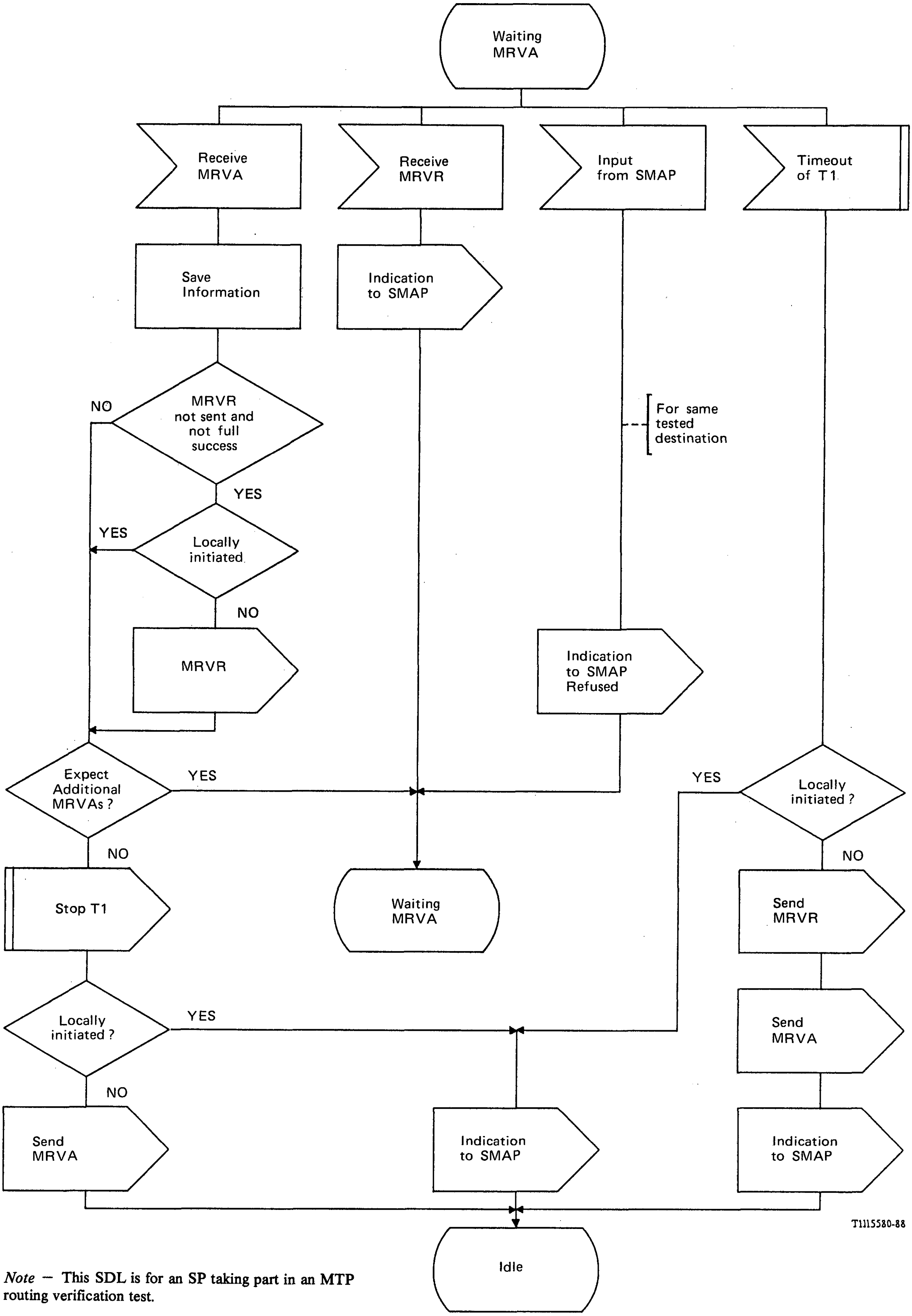
MTP routing verification test (MRVT)



Note – This SDL is for an SP taking part in an MTP routing verification test.

FIGURE 5/Q.795 (Sheet 2 of 3)

MTP routing verification test (MRVT)



Note – This SDL is for an SP taking part in an MTP routing verification test.

FIGURE 5/Q.795 (Sheet 3 of 3)

MTP routing verification test (MRVT)

8 ASEs

In the event of a conflict between § 2 and § 8, then § 2 will take precedence.

8. *MRVT ASE*[3]

The MRVT ASE provides the services accessed via the two OM-primitives OM-CONFIRMED-ACTION and OM-EVENT-REPORT. These are described in Figure 6/Q.795[4]. MRVT uses a particular instance of each primitive. testRoute is the CnfActionType of the OM-CONFIRMED-ACTION primitive, while routeTrace is the EventType of the OM-EVENT-REPORT primitive. Each is described below with the appopriate arguments (ActionArg for testRoute and EventInfo for routeTrace) and, for testRoute, the appropriate ActionResults and ActionErrors. For both OM-primitives in Figure 6/Q.795, the InvokeID in the respective primitives is the InvokeID passed to TCAP, the ResourceClass indicates MTP Routing Tables, and the ResourceInstance contains the point code of the test destination. In addition, the accessControl argument in OM-CONFIRMED-ACTION is absent. The testRoute Action makes use of the BEGIN message with result (MRVA) returning in an END. The routeTrace Event (MRVR) uses a BEGIN message with pre-arranged end.

8.1.1 *testRoute Action*

The testRoute Action is invoked to initiate an MTP routing verification test. At the initiator node, this invocation is requested by the local SMAP. At subsequent nodes, the Action is requested implicitly by the receipt of a testRoute Action invocation. A successful reply indicates successful completion of the test at the point it was invoked and, implicitly, at all subsequent points where the test was invoked. A failure indication is returned to indicate that the test failed in this or a subsequent node.

testRoute CNF-ACTION	*Timer* = T1	*Class* = 1	*Code* = 00000001
ActionArg		*Opt/Man*	*Reference*
initiating SP		M	8.1.1.1.1
traceRequested		M	8.1.1.1.2
threshold		M	8.1.1.1.3
pointCodesTraversed		M	8.1.1.1.4
ActionResult			
empty			
Linked Operations			
N/A			
Specific Errors			*Reference*
failure			8.1.1.3.1
partialSuccess			8.1.1.3.2

[3] See X.208 and X.209 for description of formal notation.

[4] Derived from ISO 9596.

```
testRoute CNF-ACTION

ACTIONARG SEQUENCE {

                    initiating SP [0] IMPLICIT PointCode,
                    traceRequested [1] IMPLICIT BOOLEAN,
                    threshold [2] IMPLICIT INTEGER,
                    pointCodesTraversed [3] IMPLICIT PointCodeList

        }

ACTIONRESULT        empty
SPECIFICERRORS      {failure, partialSuccess}

::=1
```

8.1.1.1 *testRoute Action Arguments*

8.1.1.1.1 *initiating SP*

The initiating SP identifies the original requestor of the test. It is of type PointCode, defined as an octet string.

Parameter	*Code*
initiating SP	10000000
Contents	
Bit 0 contains the first bit of the point code, Bit 1 contains the second bit of the point code, etc.	

```
PointCode ::= OCTET STRING
```

8.1.1.1.2 *traceRequested*

traceRequested indicates that a trace of all routes used to reach the destination should be reported to the originator (the routeTrace Event is described in § 8.1.2). It is of type BOOLEAN.

Parameter	*Code*
traceRequested	10000001
Contents	*Meaning*
TRUE (=1)	trace was requested, return trace information on success and failure.
FALSE (=0)	trace not requested, return trace information only on failure.

8.1.1.1.3 *threshold*

The originator sets a maximum threshold level of signalling points (SP) which are allowed to be crossed in the course of the test (including the initiator if it is an STP). This aids in detecting overly long routes. This threshold is an integral number of SPs, thus it is of type INTEGER.

Parameter	*Code*
threshold	10000010
Contents	
Integer number represented in binary.	

8.1.1.1.4 *pointCodesTraversed*

As each SP is crossed, it adds its own point code to the list of point codes traversed. This aids in detecting loops and is also useful information in case of a failure or if a route trace is requested. It is a list of point codes thus of type PointCodeList. This PointCodeList could be empty.

Parameter	*Code*
pointCodesTraversed	10100011
Contents	
Sequence of PointCodes, tagged as 'PointCode' with the contents indicating the exact point code.	

```
PointCodeList ::= SEQUENCE OF PointCode
```

8.1.1.2 *Action Results*

There are no contents in a successful return indication.

8.1.1.3 *Action Errors*

SpecificErrors are possible errors which can occur during this test which are unique to this test. These specific errors are in addition to the errors already identified in the OM-ACTION service and appear as parameters to the Processing Failure Error.

8.1.1.3.1 *failure*

failure indicates a condition of total failure, where no route worked correctly. Most often this will be used as a failure indication from the point which detects the error and does not invoke any further testRoute Actions. The failure SpecificError has with it a parameter to indicate the error condition causing the failure. This parameter failureType is represented as a big string. In addition, the second parameter is to be used when failureType indicates the error Unknown initiating SP. traceSent indicates whether or not a routeTrace Event has been invoked to report trace information. It is necessary to indicate this for this error since the node detecting the error cannot send the routeTrace, thus the previous node must. traceSent is a type of BOOLEAN.

Specific Error	*Code*
failure	00000001
Parameters	*References*
failureType traceSent	8.1.1.3.1 8.1.1.3.1

Parameter	*Code*
failureType	10000000
Bit	*Meaning*
0	detectedLoop
1	excessiveLengthRoute
2	unknownResourceInstance
3	routeInaccessible
4	processingFailure
5	unknown Initiating SP
6	timerExpired

Parameter	*Code*
traceSent	10000001
Contents	*Meaning*
TRUE FALSE	the trace information was sent the trace information was not sent

```
failure SPECIFICERROR
        PARAMETER SEQUENCE  {failureType [0] IMPLICIT FailureString,
                             traceSent [1] IMPLICIT BOOLEAN}

        ::=1
```

```
FailureString ::= BITSTRING
                       detectedLoop [0],
                       excessiveLengthRoute [1],
                       unknownResourceInstance [2],
                       routeInaccessible [3],
                       processingFailure [4],
                       unknown Initiating SP [5],
                       timerExpired [6]
```

8.1.1.3.2 *Partial Success*

This indication is given when at least one routeTest Action invocation failed and at least one succeeded (at least partially). In this case, each type of error that occurred will be noted and sent in the final reply. The format and contents of partial success are the same as failure.

Specific Error	*Code*
partialSuccess	00000010
Parameters	*References*
failureType traceSent	8.1.1.3.1 8.1.1.3.1

```
partialSuccess   SPECIFICERROR
      PARAMETER SEQUENCE   {failureType [0] IMPLICIT FailureString,
                            traceSent [1] IMPLICIT BOOLEAN}
      ::=2
```

8.1.2 *routeTrace Event*

The routeTrace Event reports trace information. Trace information consists of zero, one or more point codes, such as the point code detecting an error or the entire list of point codes traversed along a route. This event is invoked either at the explicit request of the originating node (indicated by traceRequested, see § 8.1.1.1.2) or by failure at any point along the route. This event is not confirmed, therefore no replies to this invocation are expected (no error or succes indications are expected).

routeTrace Event	*Timer* = 0	*Class* = 4	*Code* = 00000010
EventInfo		*Opt/Man* (see Note)	*Reference*
success		O	8.1.2.1.1
detectedLoop		O	8.1.2.1.2
excessiveLengthRoute		O	8.1.2.1.3
unknownResource Instance		O	8.1.2.1.4
routeInaccessible		O	8.1.2.1.5
processingFailure		O	8.1.2.1.6
unknown Initiating SP		O	8.1.2.1.7
timerExpired		O	8.1.2.1.8

Note – One and only one of these parameters must be present.

```
routeTrace EVENT
    EVENTINFO CHOICE [
        success [0] IMPLICIT PointCodeList,
        detectedLoop [1] IMPLICIT PointCodeList,
        excessiveLengthRoute [2] IMPLICIT PointCodeList,
        unknownResourceInstance [3] IMPLICIT NULL,
        routeInaccessible [4] IMPLICIT PointCode,
        processingFailure [5] IMPLICIT NULL,
        unknown Initiating SP [6] IMPLICIT PointCode,
        timerExpired [7] IMPLICIT PointCodeList]
    ::=2
```

8.1.2.1 *Event Information*

8.1.2.1.1 *success*

On successful completion, the trace of the point codes (one or more) of the crossed SPs are included.

Parameter	*Code*
success	10100000
Contents	*References*
Sequence of Point Codes, Tagged as "Point Code", with contents indicating the exact point code.	8.1.1.1.4

8.1.2.1.2 *detectedLoop*

When a loop is detected, the point codes (three or more) contained in the loop are included.

Parameter	*Code*
detectedLoop	10100001
Contents	*References*
Sequence of Point Codes, Tagged as "Point Code", with contents indicating the exact point code.	8.1.1.1.4

8.1.2.1.3 *excesiveLengthRoute*

When an excessively long route is found (threshold exceeded), the entire route is included.

Parameter	*Code*
excessiveLengthRoute	10100010
Contents	*References*
Sequence of Point Codes, Tagged as "Point Code", with contents indicating the exact point code.	8.1.1.1.4

8.1.2.1.4 *unknownResource*

If the resource instance is unknown, no additional information is required.

Parameter	*Code*
unknownResourceInstance	10000011
Contents	*References*
empty	–

8.1.2.1.5 *routeInaccessible*

The point code of the node where the route was inaccessible is included.

Parameter	*Code*
routeInaccessible	10000100
Contents	*References*
Bit 0 contains the first bit of the Point Code, Bit 1 contains the second bit of the Point Code, etc.	8.1.1.1.1

8.1.2.1.6 *processingFailure*

If a processing failure occurs, no additional information is required.

Parameter	*Code*
processingFailure	10000101
Contents	*References*
empty	–

8.1.2.1.7 *unknownInitiating SP*

The point code of the node detecting the unknown Initiating SP is included.

Parameter	*Code*
unknown Initiating SP	10000110
Contents	*References*
Bit 0 contains the first bit of the Point Code, Bit 1 contains the second bit of the Point Code, etc.	8.1.1.1.1

8.1.2.1.8 *timerExpired*

The point code(s) of the node(s) from where no result for the testRoute Action was received is included.

Parameter	*Code*
timerExpired	10100111
Contents	*References*
Sequence of one or more Point Codes tagged as "Point Code", with contents indicating the exact point code.	–

OMAP runs tests on resources such as the MTP and SCCP routing tables. These resources are here described as "Resource Classes" and are identified by an object identifier which specifies the CCITT, the study period Q.795, and the type of resource. This structure is shown below for the OMAP object identifiers mtp-Routing-Tables and sccp-Routing-Tables.

omap OBJECT IDENTIFIER ::= { CCITT, Q.795 }
mtp-Routing-Tables-1988 OBJECT IDENTIFIER ::= { omap 0 }
sccp-Routing-Tables-1988 OBJECT IDENTIFIER ::= { omap 1 } [unused]

The Resource Class of MTP Routing Tables is 0011861B00 (hexadecimal), and for SCCP Routing Tables is 0011631B01 (hexadecimal). See Recommendation X.208, Annex C.

```
Currently Defined Operations

     0  eventReport
     7  confirmedAction

other operations are for further study
```

FIGURE 6/Q.795 (Sheet 1 of 8)

Formal definition of the OM-Services used in the ASEs

OM-EVENT-REPORT

The OM-EVENT-REPORT service as given in Table 1/Q.795 provides a user with the capability to report the occurrence of an event concerning a management resource to a user in another open system. The specific event that occurred is interpreted in the context of the resource class specified.

TABLE 1/Q.795

OM-EVENT-REPORT Parameters

Parameter Name	Req/Ind
InvokeID	M
ResourceClass	M
ResourceInstance	M
EventValue	M
EventTime	O
EventInfo	O

Parameters Definitions:

InvokeID: as defined in Recommendation Q.772.

ResourceClass: identifies the class of resources for which this event is defined.

ResourceInstance: identifies the resource instance on which the event is to be performed.

EventValue: specifies the particular event that is being reported by the resource instance.

EventTime: specifies the time at which the event was generated.

EventInfo: provides additional event specific information.

The eventReport operation is defined, using the TCAP OPERATION MACRO, as in Figure 6/Q.795, Sheet 2.

```
eventReport OPERATION
   PARAMETER SEQUENCE {
      resourceClass          ResourceClass,
      resourceInstance       ResourceInstance,
      eventValue         [0] IMPLICIT EVENT,
      eventTime          [1] TimeStamp OPTIONAL,
      eventInfo          [2] ANY DEFINED BY eventValue OPTIONAL}
   ::=0
```

FIGURE 6/Q.795 (Sheet 2 of 8)

Formal definition of the OM-services used in the ASEs

Specific event reports are categorized by resource class. The protocol uses may be described by the EVENT Macro in Figure 6/Q.795, Sheet 3.

```
EVENT MACRO ::=
BEGIN
   TYPE Notation      ::=EventInfo
   VALUE Notation     ::=value (VALUE INTEGER)
   EventInfo          ::="EVENTINFO" NamedType | empty
   NamedType          ::=identifier type | type
END
```

FIGURE 6/Q.795 (Sheet 3 of 8)

Formal definition of the OM-services used in the ASEs

OM-CONFIRMED-ACTION

The OM-CONFIRMED-ACTION service as shown in Table 2/Q.795 provides a user with the capability to request that a management action be performed on a resource instance by a user in another open system. The specific action to be performed is interpreted in the context of the resource class specified. This service is a confirmed service (a report of success or failure is always sent).

TABLE 2/Q.795

OM-CONFIRMED-ACTION Service

Parameter Name	Req/Ind	Res/Con
InvokeID	M	M=
AccessControl	O	–
ResourceClass	M	–
ResourceInstance	M	–
CnfAction Value	M	–
ActionArg	O	–
ActionResult	–	M [a]
ActionError	–	M [b]

[a] Mandatory in Return Result component (may be empty).

[b] Mandatory in Return Error component.

Parameter Definitions:

InvokeID:	as defined in Recommendation Q.772.
AccessControl:	information to be used as input to access control functions.
ResourceClass:	identifies the class of resources for which this action is defined.
ResourceInstance:	identifies the resource instance on which the action is to be performed.
ActionValue:	specifies a particular action that is to be performed on the resource instance.
ActionArg:	contains the argument for the particular action being invoked.
ActionResult:	this field contains the result of the successful action performed, as appropriate.
ActionError:	this field indicates error or problem status information if the action did not successfully complete.

The confirmedAction operation is defined, using the TCAP OPERATION MACRO, as shown in Figure 6/Q.795, Sheet 4.

```
confirmedAction OPERATION
PARAMETER SEQUENCE {
   resourceClass                  ResourceClass,
   resourceInstance               ResourceInstance,
   accessControl              [0] AccessControl OPTIONAL,
   cnfAction Value            [1] IMPLICIT CNF_ACTION,
   actionArg                  [2] ANY DEFINED BY cnfAction Value OPTIONAL}
RESULT actionResult               ANY DEFINED BY cnfAction Value
ERRORS {noSuchResourceClass,
   noSuchResource, accessDenied,
   noSuchAction, noSuchAttribute,
   invalidAttributeValue, processingFailure}
::=7
```

FIGURE 6/Q.795 (Sheet 4 of 8)

Formal definition of the OM-services used in the ASEs

Specific Actions are categorized by resource class. The protocol uses may be described by the ACTION Macro as shown in Figure 6/Q.795, Sheet 5.

```
CNF_ACTION MACRO ::=
BEGIN
   TYPE NOTATION      ::=ActionArg ActionResult SpecificErrors
   VALUE NOTATION     ::=value (VALUE INTEGER)
   ActionArg          ::="ACTIONARG" NamedType | empty
   ActionResult       ::="ACTIONRESULT" NamedType | empty
   SpecificErrors     ::="SPECIFICERRORS" "{" SpecificErrorList "}" | empty
   NamedType          ::=identifier type | type
   SpecificErrorList  ::=SpecificError | SpecificErrorList "," SpecificError
   SpecificError      ::=value(SPECIFIC_ERROR)
END
```

FIGURE 6/Q.795 (Sheet 5 of 8)

Formal definition of the OM-services used in the ASEs

ERROR DEFINITIONS

A number of error codes have been referred to in the definition of the two OM-Services. These error situations are defined in this section.

Definitions:

noSuchResourceClass:	the resource class in the Invoke APDU is not recognized by the receiving end.
noSuchResource:	while the resource class in the Invoke APDU is recognized, there is no corresponding resource instance of that class at the receiving end.
accessDenied:	access to the resource is denied.
processingFailure:	a failure occurred while processing a specific action or event. The failure indicators and parameters are action or event specific.
noSuchEvent:	the event type specified is not supported by or known to the receiving end.
noSuchAction:	the action type specified is not supported by or known to the receiving end.
noSuchAttribute:	the attribute specified is not supported by or known to the receiving end.
invalidAttributeValue:	the attribute value is out of range.

```
noSuchResourceClass        ERROR
    PARAMETER resourceClass ResourceClass
    ::=0

noSuchResource ERROR
    PARAMETER SEQUENCE {
        resourceClass ResourceClass,
        resource ResourceInstance}
    ::=1

accessDenied ERROR
    PARAMETER accessGranted BIT STRING {
        none(0), get(1), set(2), action(3), log(4)}
    ::=2

processingFailure ERROR
    PARAMETER SEQUENCE {
        errorType [0] SpecificError,
        errorParm [1] ANY OPTIONAL} OPTIONAL
    ::=3
```

FIGURE 6/Q.795 (Sheet 6 of 8)

Formal definition of the OM-services used in the ASEs

```
noSuchAttribute ERROR
    PARAMETER attributeID Attribute ID
    ::=4
invalidAttributeValue ERROR
    PARAMETER attribute Attribute
    ::=5
noSuchAction ERROR
    PARAMETER actionType CNF_Action
    ::=6
```

```
– Errors that are ACTION or EVENT specific are specified in
– SPECIFIC_ERROR macros. The general error type "Processing_Failure is
– used to report the specific error information.
SPECIFIC_ERROR MACRO     ::=
BEGIN
TYPE NOTATION            ::=ProcessingErrorParm
VALUE NOTATION           ::=value(VALUE INTEGER)
ProcessingErrorParm      ::="PARAMETER" NamedType | empty
NamedType                ::=identifier type | type
END
```

FIGURE 6/Q.795 (Sheet 7 of 8)

Formal definition of the OM-services used in the ASEs

OTHER TYPE DEFINITIONS

```
ResourceClass      ::=OBJECT IDENTIFIER
ResourceInstance   ::=OCTET STRING

AttributeID        ::=ANY
Attribute          ::=ANY

AccessControl      ::=ANY -- use for further study
TimeStamp          ::=ANY -- use for further study
```

FIGURE 6/Q.795 (Sheet 8 of 8)

Formal definition of the OM-services used in the ASEs

ANNEX A

(to the Recommendation Q.795)

Example MRVT message as delivered to the SCCP

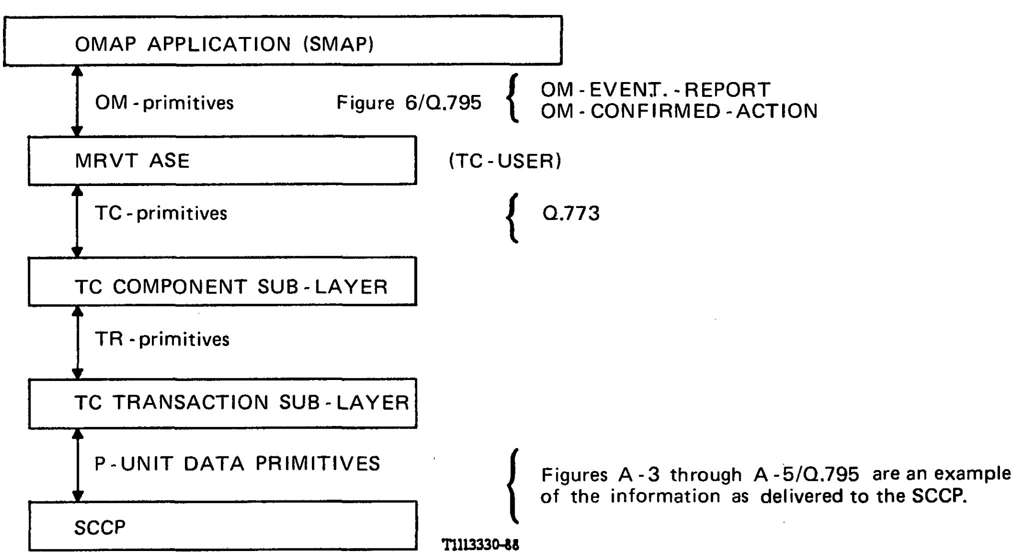
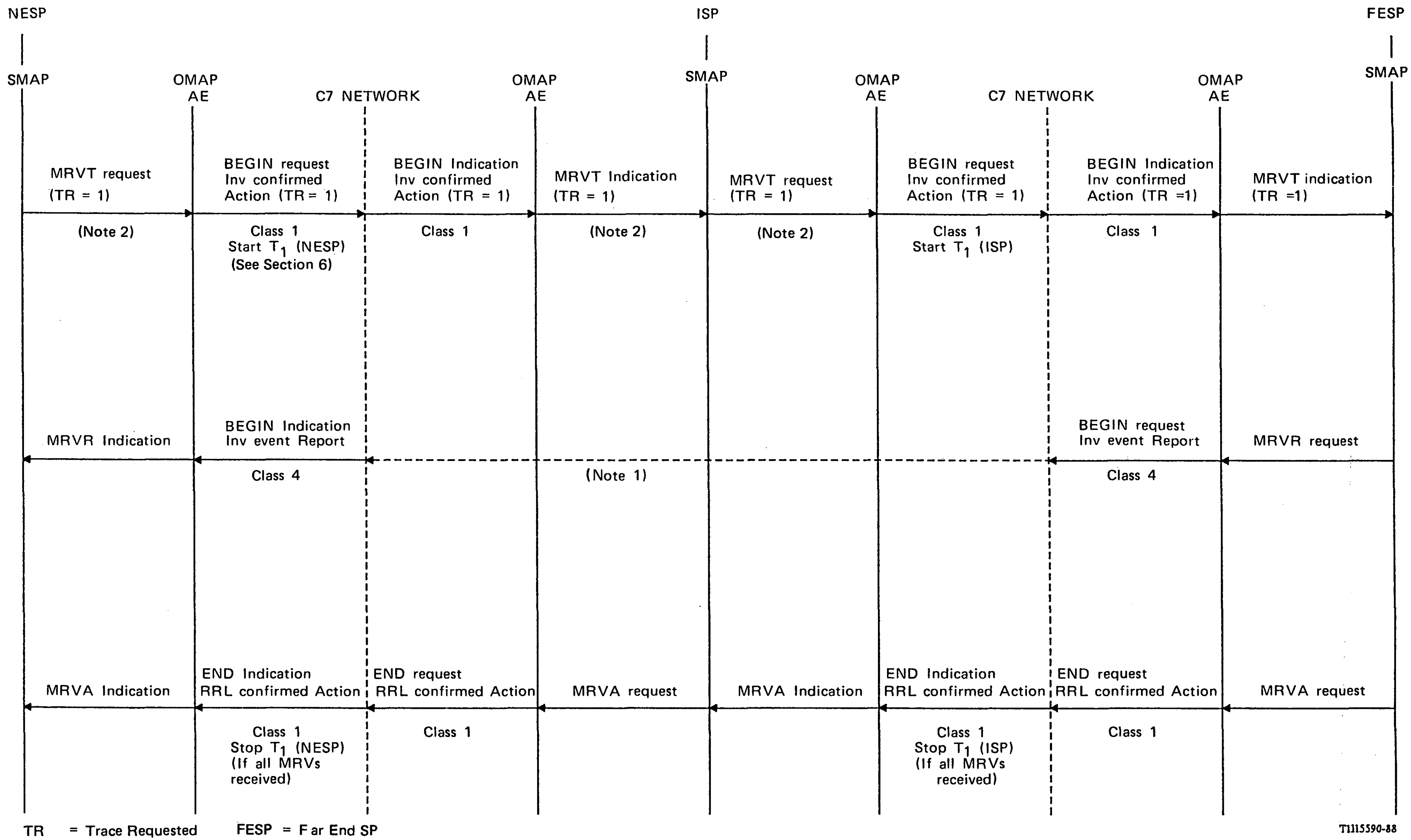


FIGURE A-1/Q.795

Primitive interface



TR = Trace Requested
RRL = Return Result Last
INV = Invoke
FESP = Far End SP
NESP = Near End SP
ISP = Intermediate SP

Note 1 – Routed by the MTP to the NESP.

Note 2 – Send MRVT to all adjacent nodes that can be used by the originator to route to the test destination.

FIGURE A-2/Q.795

Example of a MRVT information flow

Field Name	Bit Encoding	Reference/Explanation
Message Type Tag	01100010	= Begin (Table 9/Q.773)
Message Length	00110000	48 octets following TC part
Transaction ID Tag	01001000	= Originating (Table 11/Q.773)
Length	00000100	4 octets
Transaction ID Value	xxxxxxxx	SMAP based on a dialogue at the
	xxxxxxxx	user level
	xxxxxxxx	
	xxxxxxxx	
Component Portion Tag	01101100	(Table 15/Q.773)
Length	00101000	All 40 octets below here
Component Type Tag	10100001	= Invoke (Table 20/Q.773)
Length	00100110	All 38 octets below here
Component ID Tag	00000010	= Invoke ID (Table 21/Q.773)
Length	00000001	1 octet
Invoke ID Value	xxxxxxxx	SMAP PROVIDED
Operation Code Tag	00000010	= Local (Table 23/Q.773)
Length	00000001	1 octet
Operation Code	00000111	= Confirmed Action (Fig. 6/Q.795)
Parameter Sequence Tag	00110000	= Sequence Tag (Table 24/Q.773)
Length	00011110	All 30 octets below here
Resource Class Tag	00000110	= OBJECT ID (Fig. 6/Q.795 and X.209)
Length	00000101	5 octets
Value-MTP Routing Tables	00000000	CCITT, Rec.
	00010001	Q
	10000110	86 = > 795
	00011011	1B
	00000000	MTP Routing Tables 1988
Resource Instance Tag	00000100	= OCTET STRING (Fig. 6/Q.795)
Length	00000010	2 octets
Resource Instance Value	xxxxxxxx	(SMAP) Test destination
	xxxxxxxx	
Confirmed Action Type Tag	10000001	Fig. 6/Q.795
Length	00000001	1 octet
Confirmed Action Type	00000001	= testRoute (Fig. 6/Q.795)
Action Arg Tag	10100010	Fig. 6/Q.795
Length	00001110	All 14 octets below here
Parameter sequence tag	00110000	Sequence Tag (Table 24/Q.773)
Length	00001100	All 12 octets below here
Initiating SP Tag (octet)	10000000	Q.795 § 8.1.1.1, X.209
Length	00000010	2 octets
Initiating SP Value	xxxxxxxx	(SMAP) test initiator
	xxxxxxxx	
Trace Req. Tag	10000001	Q.795 § 8.1.1.1.2, X.209
Length	00000001	1 octet
Value	00000001	= TRUE
Threshold Tag	10000010	= threshold Q.795 § 8.1.1.1.3
Length	00000001	1 octet
Value of threshold	xxxxxxxx	SMAP PROVIDED
Point Code Trav. Tag	10100011	Q.795 § 8.1.1.1.4
Length	00000000	empty point code list

FIGURE A-3/Q.795

Example of an MRVT message delivered to the SCCP

Field Name	Bit Encoding	Reference/Explanation
Message Type Tag	01100010	= Begin (Table 9/Q.773)
Message Length	00101100	44 octets following TC part
Transaction ID Tag	01001000	= Originating (Table 11/Q.773)
Length	00000100	4 octets
Transaction ID Value	xxxxxxxx	SMAP based on a dialogue at the
	xxxxxxxx	user level
	xxxxxxxx	
	xxxxxxxx	
Component Portion Tag	01101100	(Table 15/Q.773)
Length	00100100	All 36 octets below here
Component Type Tag	10100001	= Invoke (Table 20/Q.773)
Length	00100010	All 34 octets below here
Component ID Tag	00000010	= Invoke ID (Table 21/Q.773)
Length	00000001	1 octet
Invoke ID Value	xxxxxxxx	SMAP
Operation Code Tag	00000010	= Local (Table 23/Q.773)
Length	00000001	1 octet
Operation Code	00000000	= Event Report (Fig. 6/Q.795)
Parameter Sequence Tag	00110000	= Sequence Tag (Table 24/Q.773)
Length	00011010	All 26 octets below here
Resource Class Tag	00000110	= OBJECT ID (Fig. 6/Q.795)
Length	00000101	5 octets
Value-MTP Routing Tables	00000000	CCITT, Rec.
	00010001	Q.
	10000110	86 = > 795
	00011011	1B
	00000000	MTP Routing Tables 1988
Resource Instance Tag	00000100	= OCTET STRING (Fig. 6/Q.795)
Length	00000010	2 octets
Resource Instance Value	xxxxxxxx	(SMAP)
	xxxxxxxx	Test Destination
Event Type Tag	10000000	Fig. 6/Q.795
Length	00000001	1 octet
Event Type	00000010	= route Trace (Fig. 6/Q.795)
Event Info Type Tag	10100010	Fig. 6/Q.795
Length	00001010	All 10 octets
Success Identifier	10100000	Q.795 § 8.1.2.1
Length	00001000	All 8 octets below here
Point Code Tag	00000100	= OCTET STRING (Fig. 6/Q.795)
Length	00000010	2 octets
Point Code	xxxxxxxx	
	xxxxxxxx	
Point Code Tag	00000100	= OCTET STRING (Fig.6/Q.795)
Length	00000010	2 octets
Point Code	xxxxxxxx	
	xxxxxxxx	

FIGURE A-4/Q.795

Example of an MRVR (success) message delivered to the SCCP

Field Name	Bit Encoding	Reference/Explanation
Message Type Tag	01100100	=End (Table 9/Q.773)
Message Length	00111110	30 octets following in TC part
Transaction ID Tag	01001001	=Destination (Table 11/Q.773)
Length	00000100	4 octets
Transaction ID Value	xxxxxxxx	Same as in Begin (MRVT message)
	xxxxxxxx	
	xxxxxxxx	
	xxxxxxxx	
Component Portion Tag	01101100	(Table 15/Q.773)
Length	00010110	All 22 octets below here
Component Type Tag	10100011	=Ret. Error (Table 20/Q.773)
Length	00010100	All 20 octets below here
Component ID Tag	00000010	=Invoke ID (Table 21/Q.773)
Length	00000001	1 octet
Invoke ID Value	xxxxxxxx	Same as MRVT message (Invoke)
Error Code Tag	00000010	Table 23/Q.773
Length	00001111	All 15 octets below here
Processing Failure	00000011	Fig. 6/Q.795
Parameter Sequence Tag	00110000	=Sequence Tag (Table 24/Q.773)
Length	00001100	All 12 octets below here
Error Type Tag	10000000	Fig. 6/Q.795
Length	00001010	All 10 octets below here
Failure	00000001	8.1.1.3.1
Error Parameters	10100001	Fig. 6/Q.795
Length	00000111	All 7 octets below here
Failure Type Tag	10000000	8.1.1.3.1
Length	00000010	2 octets
Unused bits	00000001	1 bit
Failure String	xxxxxxx0	Depends on type failure (4.1.3.1)
Trace Sent Tag	10000001	8.1.1.3.1
Length	00000001	1 octet
Trace Sent Value	0000000x	True = 1, False = 0 (4.1.3.1)

FIGURE A-5/Q.795

Example of an MRVA (Failure) message delivered to the SCCP

ANNEX B

(to Recommendation Q.795)

SCCP Routing Verification Test (SRVT)

B.1 *Introduction*

This annex describes an SCCP Routing Verification Test (SRVT). The procedure described covers the case of a single MTP network. Enhancements of this procedure are required to ensure that:

- the procedure works for multiple MTP networks;
- the procedure tests the change of Gobal Title at an SCCP relay node;
- the procedure is signalling network structure independent.

B.2 *SRVT*

B.2.1 *General*

The SCCP Routing Verification Test (SRVT) is the means of testing the global title translation service of the Signalling Connection Control Part (SCCP). The test is designed to verify the accuracy and completeness of the global title translation data in global title translation service points. This test is only meant for the case of a single MTP network. An SRVT for multiple MTP networks is for further study. The test will be used after a recent translation data change, when a translation problem is suspected, or on a periodic basis to detect cases of mutilation of translation data.

When an inconsistency or failure is detected, local actions are to be specified. The initiator of the test is alerted.

B.2.2 *Messages*

The SCCP Routing Verification Test uses three OMAP messages which are specified by the OMAP Application Service Element.

B.2.2.1 *SCCP Routing Verification Test (SRVT) message*

The SRVT message is sent from a Signalling Point (SP) initiating the appropriate part of the SRVT procedure based on the function of the respective SP. The message serves three different functions, depending upon the nature of the SP sending it. In coding, both Verify and Request are delineated by the No Compare setting of the From Indicator parameter.

The request form of the SRVT message is sent by a Signalling Point (SP) to request an SRVT global title translation within the SRVT procedure. The originating SP may be the Near End Signalling Point (NESP), or an Intermediate Translation Signalling Point (ITSP). The destination of the message is a Translation Signalling Point (TSP) which is to perform a global title translation on the Global Title contained in the message. Hence, the Translation Point Code (TPC) is the Destination Point Code (DPC) in the routing label.

The Verify form of the SRVT message is sent by a Final Translation Signalling Point (FTSP), i.e. the last SP that performs the global title translation service, to both the Primary Point Code (PPC) and the Secondary Point Code (SCP, if any) derived from the global title translation. Hence, the PPC and SPC are used as the Destination Point Codes (DPC) in the routing labels.

The Compare form of the SRVT message is sent by a Translation Signalling Point (TSP) to a point performing the duplex global title translation. The message is sent so the results of both tanslations can be compared. This message is mandatory only in networks that have duplex global title translation service (i.e. the identical translation is duplicated at a mate signalling point). The point code of the Duplex Translation Signalling Point (DTSP) is the Destination Point Code (DPC) in the routing label.

The message contains:

a) Information Indicating SRVT;

b) Form Indicator (Compare or No Compare);

c) GTI + GT – Global Title Indicator + Global Title (Destination);

d) MTP Backward Routing Required Indicator for SRVA and SRVR;

e) NEPC – Near End Point Code from which test was initiated;

f) GTI + NEGT – Global Title Indicator + Near End Global Title;

g) DPC – Destination Point Code (Translation PC or Primary PC);

h) Destination SSN – Optional Subsystem Number based on DPC;

i) Backup DPC – Backup Destination Point Code (Translation PC or Secondary PC);

j) Backup SSN – Optional Subsystem Number based on Backup DPC;

k) Threshold N of maximum allowed number of crossed translation points;

l) Additional Trace Information Requested Indicator (SRVR Requested);

m) List of Translation Points – used to check for translation loops and whether or not the threshold number of translations is exceeded.

B.2.2.2 *SCCP Routing Verification Acknowledgement (SRVA) Message*

The SRVA message is the standard message sent in response to an associated SRVT message. It carries the results of the test and is sent back using either direct routing on the Originating Point Code (OPC) or by global title translation on the Near End Global Title. Both addresses are found from the original message to which the SRVA is responding. The Destination Point Code (DPC) in the routing label may be dependent upon a global title translation if the MTP Backward Routing Indicator in the SRVT message is not set.

The message contains:

a) Information Indicating SRVA;

b) SRVR sent indicator;

c) Result of test.

This last field contains the following information:

– Success (no error indication);

– Partial Success (at least one SRVA indicating success or partial success); or

– Failure.

In the case of partial success or failure, some or all of the following failure reasons are provided:

i) No translation data exists for the GTI + GT at Translation Signalling Point.

ii) Incorrect translation for PPC + SSN at Translation Signalling Point.

iii) Incorrect translation for SPC + SSN at Translation Signalling Point.

iv) Incorrect intermediate translation for next translation point at Translation Signalling Point.

v) SRVT message arrived at wrong Signalling Point (Not duplicate or mated).

vi) The primary destination of the GT address does not serve GTI + GT as the primary destination.

vii) The secondary destination of the GT address does not serve GTI + GT as the secondary destination.

viii) The primary destination of the GT address does not recognize the SPC + SSN as the secondary destination for the GTI + GT.

ix) The secondary destination of the GT address does not recognize the PPC + SSN as the primary destination for the GTI + GT.

x) Timeout waiting for SRVA message.

xi) Inability to send message due to inaccessibility (network congestion or blockage).

xii) Detected loop at signalling point.

xiii) Exceeded threshold of N translations at signalling point.

xiv) Routing problem – Run MRVT.

xv) Unknown Initiator – NEGT (reverse routing to be done using OPC).

xvi) Test cannot be run due to local conditions.

B.2.2.3 *SCCP Routing Verification result (SRVR) message*

The SRVR message is sent from a terminating SP to the initiator of the test when "Additional Trace Information Requested" indicator is set. It carries the results of the test with additional information on a failure. It is sent back using either direct routing on the Near End Point Code (NEPC) or by global title translation on the Near End Global Title (NEGT).

The message contains:

a) Information Indicating SRVR;

b) Result of test;

c) Information field.

The content of this information field depends on the result of the test. It contains:

i) If the result of the test is "success":

– the point codes of the crossed SCCP Relay Nodes contained in the SRVT message.

ii) If the result of the test is "detected loop":

– the point codes of the SCCP Relay Nodes which are in the loop.

iii) If the result of the test is "detected excessive length route":

– the point codes of crossed SCCP Relay Nodes contained in the SRVT message.

iv) If the result of the test is "unknown destination point code":

– no additional information.

v) If the result of the test is "SRVT not sent due to inaccessibility":

– the point code of the inaccessible SP.

vi) If the result of the test is "SRVA not received":

– the identity of the SP(s) from which an SRVA was not received when expected.

vii) If the result of the test is "unknown initiator point code":

– the point code of the SP returning an SRVA to cause the MRVR to be sent.

viii) If the result of the test is "test cannot be run due to local conditions":

– no additional information.

ix) If any other failure result:

– the point codes of the crossed SCCP Relay Nodes contained in the SRVT message.

B.2.3 *Test initiation*

The procedure is started when there is an input from OA&M (SMAP) resulting in the sending of an SRVT message. The test is initiated:

a) When new SCCP routing data is introduced. Each global title translation should pass the SRVT before being opened to traffic.

b) When SCCP translation data is changed.

c) On receipt of an SRVT message.

d) On demand from local maintenance staff or an operations and maintenance centre.

e) Periodically at a Signalling Point to detect cases of mutilation of translation data. The period is network dependent and should be such that the load on the network is not seriously increased.

B.2.4 *Procedures*

The capability to execute a complete SCCP Routing Verification Test (SRVT) is found in three procedures. These procedures are organized by the function of the Signalling Point in which they reside for a given test instance. The procedures are partitioned into functions at the initiating point, functions at a translation point, and functions at the tested destination. The duplex translation procedures are found in the translation points.

B.2.4.1 *Initiating point*

The procedure is started when there is an input from OA&M as defined under the conditions of § B.2.3. It is initiated at an SP with SCCP capabilities in the network, and is triggered by an SRVT request. The SRVT request must include the Global Title of the tested destination. An SCCP Node cannot initiate an SRVT procedure for a test destination until any previous SRVT procedures for that destination have completed.

B.2.4.1.1 *Initial actions*

Upon receipt of an SRVT request on a given Global Title, the Near End Signalling Point (NESP) determines the location(s) of the initial translation from its tables. The NESP then begins a guard timing period, T2, and sends SRVT messages to the Translation Point Codes (TPCs) previously determined. The NESP then waits for SRVA messages corresponding to each SRVT sent.

If the NESP was identified as a Translation Signalling Point (TSP) for the respective Global Title, it performs the Global Title Translation, and follows the procedures defined at a translation point (§ B.2.4.2), depending upon the nature of the translation (i.e. intermediate or final).

B.2.4.1.2 *Subsequent actions*

Upon receipt of all SRVA messages, the guard timer, T2, is stopped and the test is complete. The results are reported to system management (SMAP) in accordance to the structure of the Result of Test parameters (§ B.2.2.2) and proper actions are taken to fix any problems. If the timer expires before receipt of an SRVA message, the result, Time out waiting for SRVA message (§ B.2.2.2. c.x), is reported to management (SMAP) along with the Point Code of the SP. There is no penalty for not receiving an SRVR. However, it is assumed, analogous to the MRVTs MRVR message, that the SRVR will return before the final SRVA.

B.2.4.2 *Translation point*

For the SRVT, two types of Translation Points exist: intermediate and final. The procedure at the Translation point differs only in the content of the SRVT messages which emerge. An intermediate translation point is an SP with SCCP functionality that has been specified at the NESP for the translation of the Global Title originally given. However, due to the nature of the Global Title, further translation at another SP is needed to determine the PC of the tested destination.

A final translation point is an SP with SCCP functionality that has been specified at the NESP or an ITSP for the translation of the Global Title. It performs the final translation which results in a Primary Point Code + Subsystem Number (PPC + SSN) and a Secondary Point Code + Subsystem Number (SPC + SSN) (optional). Note that the NESP does not know if it sends an SRVT message to an Intermediate or Final Translation Signalling Point.

B.2.4.2.1 *Upon Receipt of an SRVT message*

When a Translation Signalling Point (TSP) receives an SRVT message, it:

a) Attempts to translate the GTI + GT to the PPC + SSN and SPC + SSN (optional):

   i) If the SP is unable to perform the translation, the Result of Test is equal to "No translation data exists". The SP sends an SRVR to the NESP, an SRVA message with SRVR sent indication and corresponding result parameter (§ B.2.2.2 c.i) to the OPC, and an indication to SMAP.

   ii) If it recognizes that further translation is needed, a Translation Point Code (TPC) and a backup Translation Point Code (optional) are derived.

   iii) If the translation is final and successful, the PPC + SSN and SPC + SSN (optional) are derived and retained for the SRVA message.

b) Checks for mated SCCP relay node:

   i) If a mated SCCP relay node exists for the current TSP, a SRVT is sent to the mate so that it may perform duplicate translation for comparison purposes.

   ii) If no mated SCCP Relay Node exists, the test proceeds with step c) below.

c) Examines the list of translation points (§ B.2.2.1 m):

   i) If the point code of the next TSP or the point code of the mated SCCP Relay Node (optional) appears in the SRVT's list of translation points, then the SP sends an SRVR to the NESP, an SRVA message with SRVR sent indication and an SCCP loop detected indication (§ B.2.2.2 c.xii) to the OPC, and an indication to SMAP. The test is stopped.

   ii) If the number of point codes in the SRVT's list of translation points exceeds a predefined threshold number of translations, then the SP sends an SRVR to the NESP, the SP an SRVA message with SRVR sent indication and the threshold exceeded indication (§ B.2.2.2 c.xiii) to the OPC, and an indication to SMAP. The test is stopped.

iii) If any point code(s) of the next TSP or the mated SCCP Relay Node (Optional) does not appear in the SRVT's list of translation points, then the TSP will add both its own point code and the point code of the mated SCCP Relay Node (if any) to the list of translation points.

d) Attempts to send an SRVT message to the next TPC or tested destination (from a) above):

   i) If the TSP is unable to send the SRVT due to inaccessability (network congestion or blockage), the TSP sends an SRVR to the NESP, an SRVA with SRVR sent indication and corresponding result parameter (§ B.2.2.2 c.xi) to the OPC and an indication to SMAP. The test is stopped.

   ii) If the TSP is unable to send the SRVT due to an MTP routing problem, the TSP sends an SRVR to the NESP, an SRVA with SRVR sent indication and the corresponding result parameter (§ B.2.2.2 c.xiv) to the OPC and an indication to SMAP. The test is stopped.

   iii) If the TSP is unable to send the SRVT due to local conditions, the TSP sends an SRVR to the NESP, an SRVA with SRVR sent indication and the corresponding result parameter (§ B.2.2.2 c.xvi) to the OCP and an indication to SMAP. The test is stopped.

   iv) If an SRVT may be sent, a guard timer, T2, is started and SRVT message(s) are sent to either the next TPC(s) or the PPC – SSN and SPC + SSN (optional) resulting from attempted translation. This timer is the guard for SRVA(s) received in response to both the Compare and No Compare SRVT messages.

B.2.4.2.2 *Subsequent actions*

Upon receipt of an SRVA message, the following actions are taken:

a) If all of the SRVA(s) in response to the SRVT(s) have not yet been received, the results are stored, waiting for pending SRVA(s).

b) If all other expected SRVA(s) have been received, the following actions are taken:

   i) The guard timer, T2, is stopped.

   ii) The reverse Global Title Translation is performed on the NEGT to determine the Originating Point Code (OPC). This may be considered optional in networks which perform reverse routing on OPC (known from e.g. Network Identifier) instead of Global Title Translation. If the NEGT is not recognized, an SRVA is retured to the previous PC with the "Unknown Initiator" indication (§ B.2.2.2 c.xv).

   iii) Results of the duplicate translation comparison are incorporated into the Result of Test parameters (§ B.2.2.2). This is optional in networks not subscribing to the concept of mated SCCP Relay Nodes and duplicate translations. If the SRVA in response to the SRVT has not yet been received, the ITSP will wait for it up to the expiration of the timer.

   iv) If the SRVR send indication is not set and an SRVR has been requested, the SP sends an SRVR message with appropriate indications from the SRVA.

   v) The SP sends an SRVA message in response to the original SRVT message. The complete result of test parameter list is retained and the SRVR sent indication is set appropriately.

c) If the timer has already expired, the message is discarded.

If the guard timer expires before receipt of the SRVA(s) responding to the SRVT(s), results of the duplicate translation comparison are incorporated into the Result of Test parameters (if available) and an SRVA is sent back with the "Timeout waiting for SRVA message" response (§ B.2.2.2 c.x). Any SRVAs received after the timer expires will be discarded. If an SRVA cannot be sent, no further action is taken.

B.2.4.2.3 *Duplex translation (optional)*

When a TSP receives an SRVT message, it:

a) Checks to determine if the originating SP is a mated SCCP Relay Node to the receiving SP. If not, an SRVA is returned with "SRVT arrived at wrong SP" (§ B.2.2.2 c.v).

b) Attempts to translate GTI + GT and compares the results with the point code information contained in the SRVT message:

   i) If the results of the duplicate translation match the data in the SRVT message from the previous translation, an SRVA message is returned with Result of Test equal to success (§ B.2.2.2 c).

   ii) If no translation data exists for the Global Title, then an SRVA message is returned with the result "No translation data exists for the GTI + GT" (§ B.2.2.2 c.i).

   iii) If the results of the duplicate translation do not match the data in the SRVT message from the previous translation, an SRVA message is returned with Result of Test equal to either "Incorrect intermediate translation" (§ B.2.2.2 c.iv), "Incorrect translation for PPC + SSN" (§ B.2.2.2 c.ii) or "Incorrect translation for SPC + SSN" (§ B.2.2.2 c.iii).

B.2.4.3 *Tested destination*

The tested destination is an SP with SCCP functionality that has been specified at the FTSP by use of Global Title Translation. The address is referred to as either the Primary Point Code (PPC) or Secondary Point Code (SPC).

B.2.4.3.1 *Primary point*

This procedure is performed at the primary destination signalling point derived from the global title translation. When the destination receives an SRVT message, it verifies the PPC + SSN serves as the primary destination for the GTI + GT. The following action should result:

a) If the test is successful, the SP sends an SRVR (if requested) with success indication to the NESP, an SRVA with SRVR sent indication and success indication to the OPC, and an indication to SMAP.

b) If the Signalling Point does not serve GTI + GT as the primary destination, the test is unsuccessful and the SP sends an SRVR to the NEPC, an SRVA with the SRVR sent indication set appropriately and the corresponding Result of Test parameter (§ B.2.2.2 c.vi) to the OPC, and an indication to SMAP.

c) If the Signalling Point does not recognize SPC + SSN as the secondary destination for GTI + GT, then the test is unsuccessful and the SP sends an SRVR to the NEPC, an SRVA with the SRVR sent indication set appropriately and the corresponding Result of Test parameter (§ B.2.2.2 c.viii) to the OPC, and an indication to SMAP.

If an SRVA cannot be sent, no further action is taken.

B.2.4.3.2 *Secondary point*

This procedure is performed at the secondary destination signalling point (optional) derived from the global title translation. When the destination receives an SRVT message, it verifies the SPC + SSN serves as the secondary destination for the GTI + GT. The following action should result:

a) If the test is successful, the SP sends an SRVR (if requested) with success indication to the NESP, an SRVA with SRVR sent indication and success indication to the OPC, and an indication to SMAP.

b) If the Signalling Point does not serve GTI + GT as the secondary destination, the test is unsuccessful and the SP sends an SRVR to the NESP, an SRVA with the SRVR sent indication set appropriately and the corresponding Result of Test parameter (§ B.2.2.2 c.vii) to the OPC, and an indication to SMAP.

c) If the Signalling Point does not recognize SPC + SSN as the primary destination for GTI + GT, then the test is unsuccessful and the SP sends an SRVR to the NESP, an SRVA with the SRVR sent indication set appropriately and the corresponding Result of Test parameter (§ B.2.2.2 c.ix) to the OPC, and an indication to SMAP.

If an SRVA cannot be sent, no further action is taken.

B.3 *State transition diagram*

Figure B-1/Q.795 shows the state transition diagram for the SRVT using SDL.

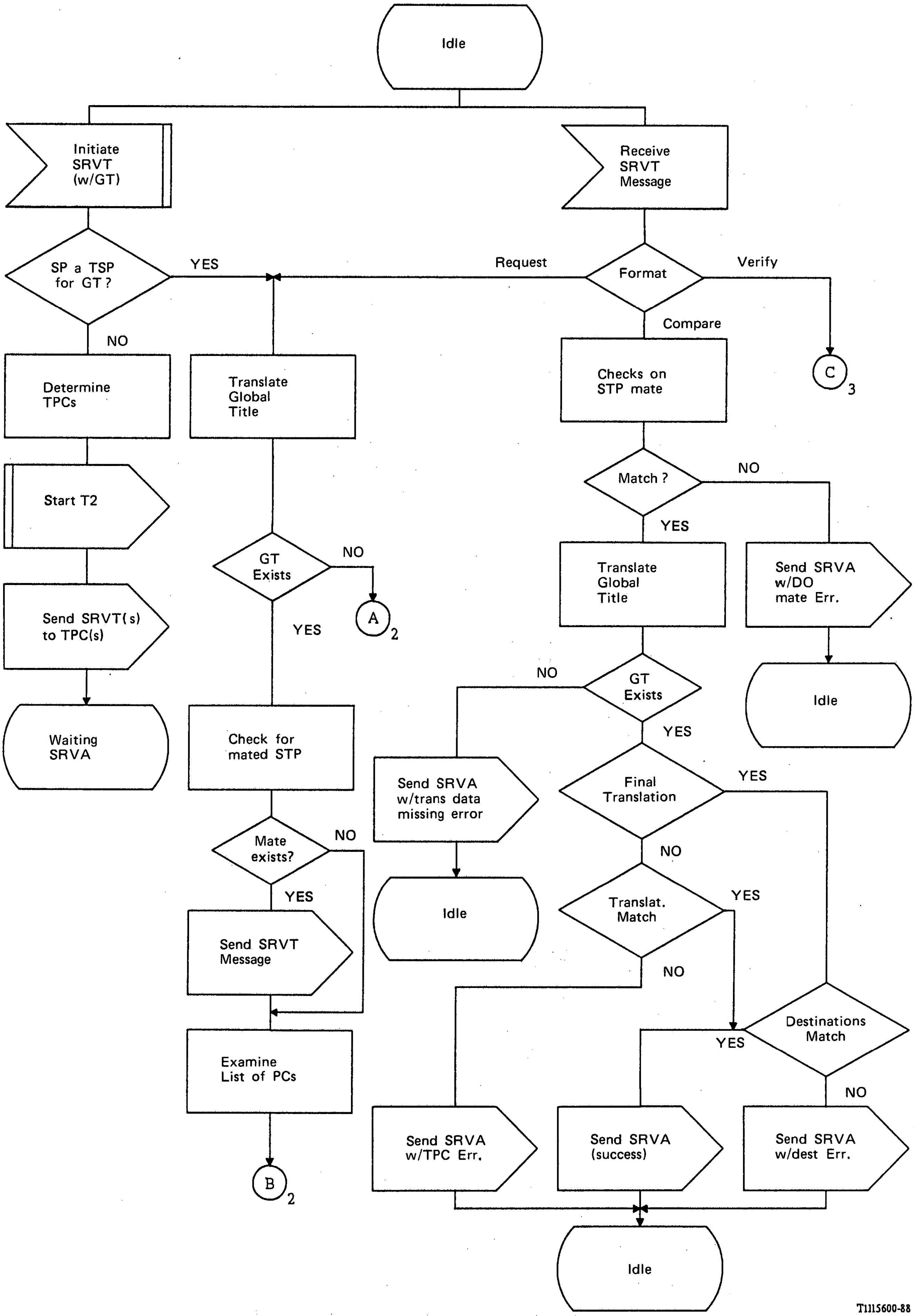


FIGURE B-1/Q.795 (Sheet 1 of 4)

State transition diagram for SRVT

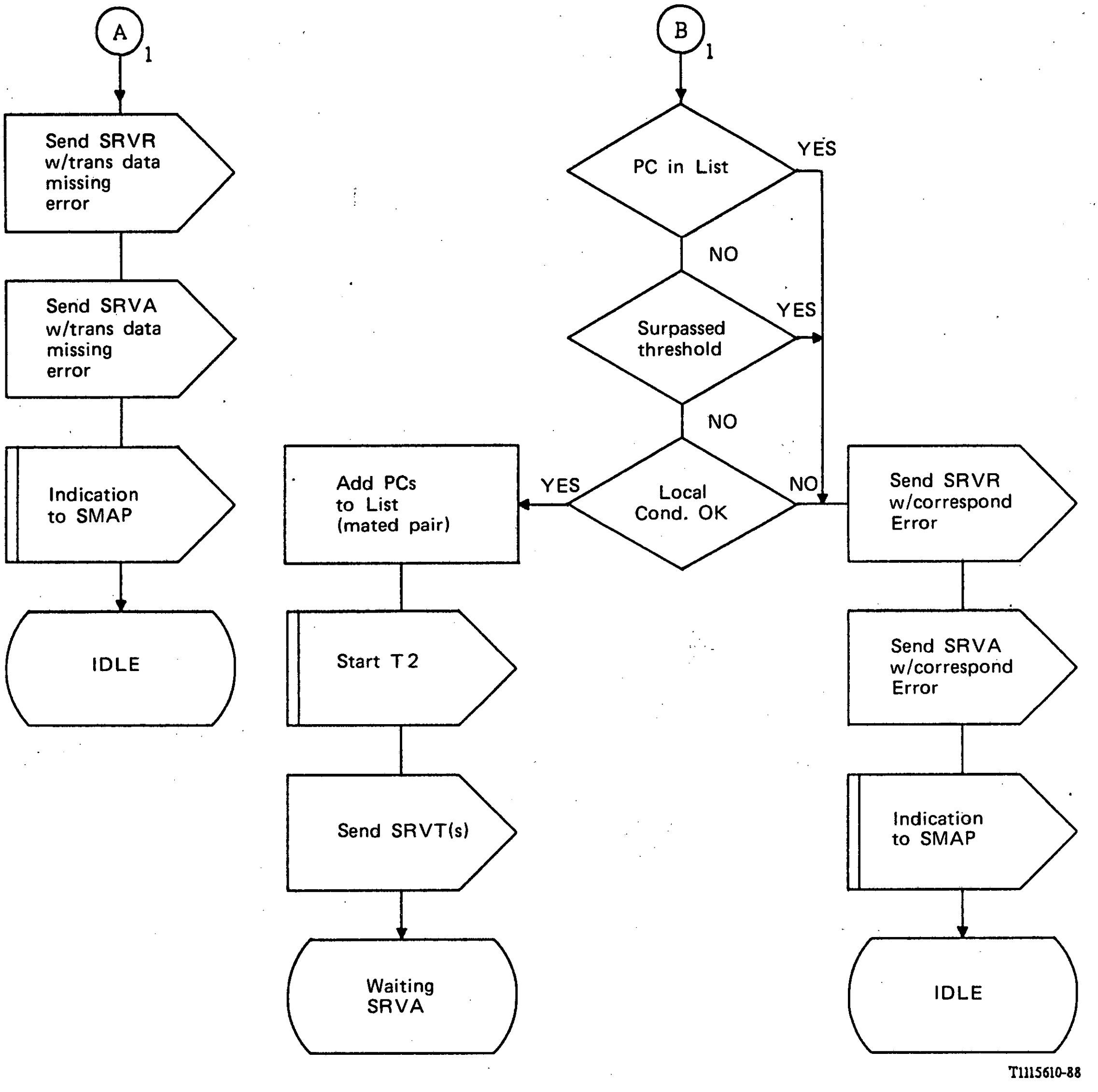


FIGURE B-1/Q.795 (Sheet 2 of 4)

State transition diagram for SRVT

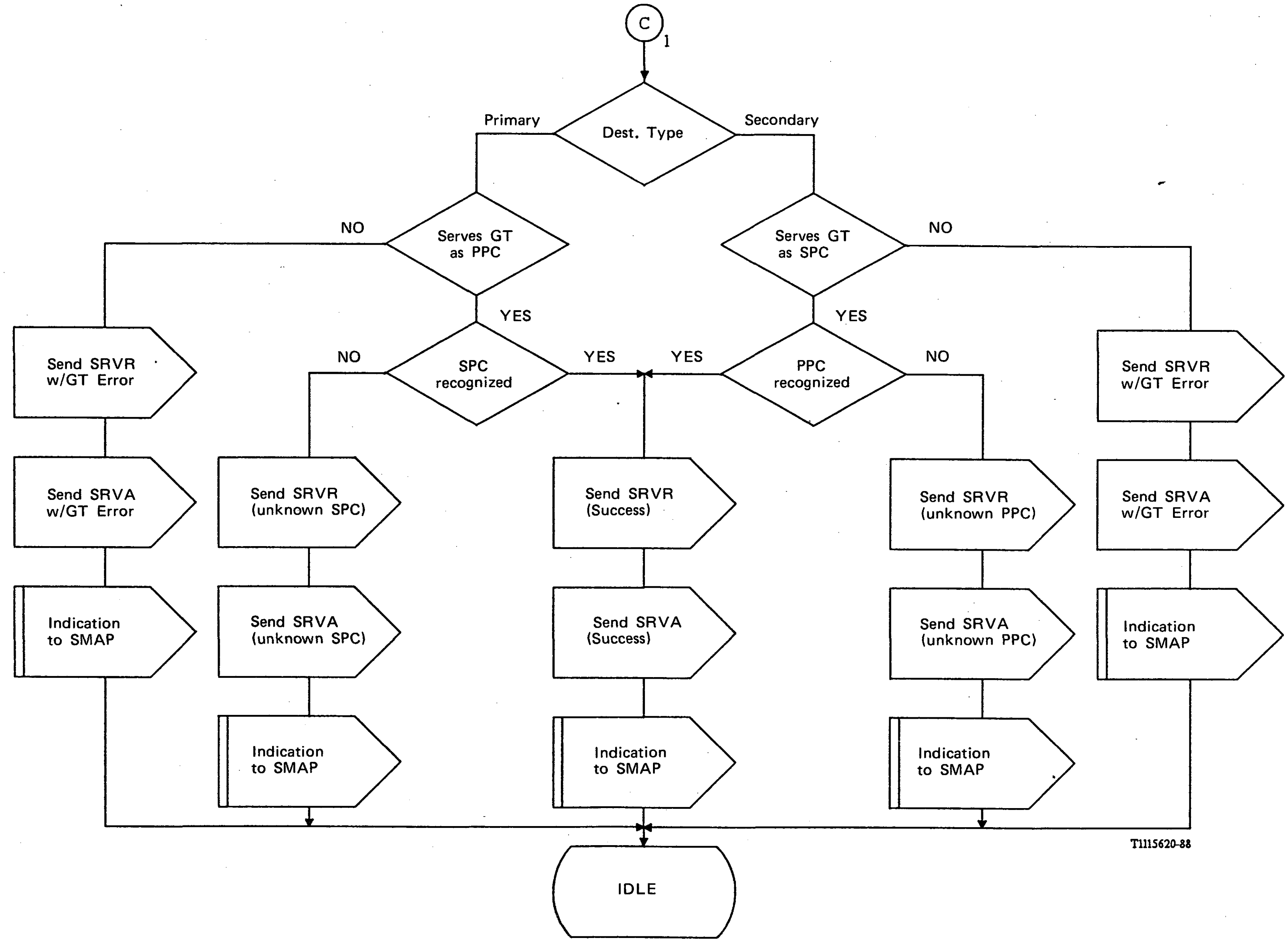


FIGURE B-1/Q.795 (Sheet 3 of 4)

State transition diagram for SRVT

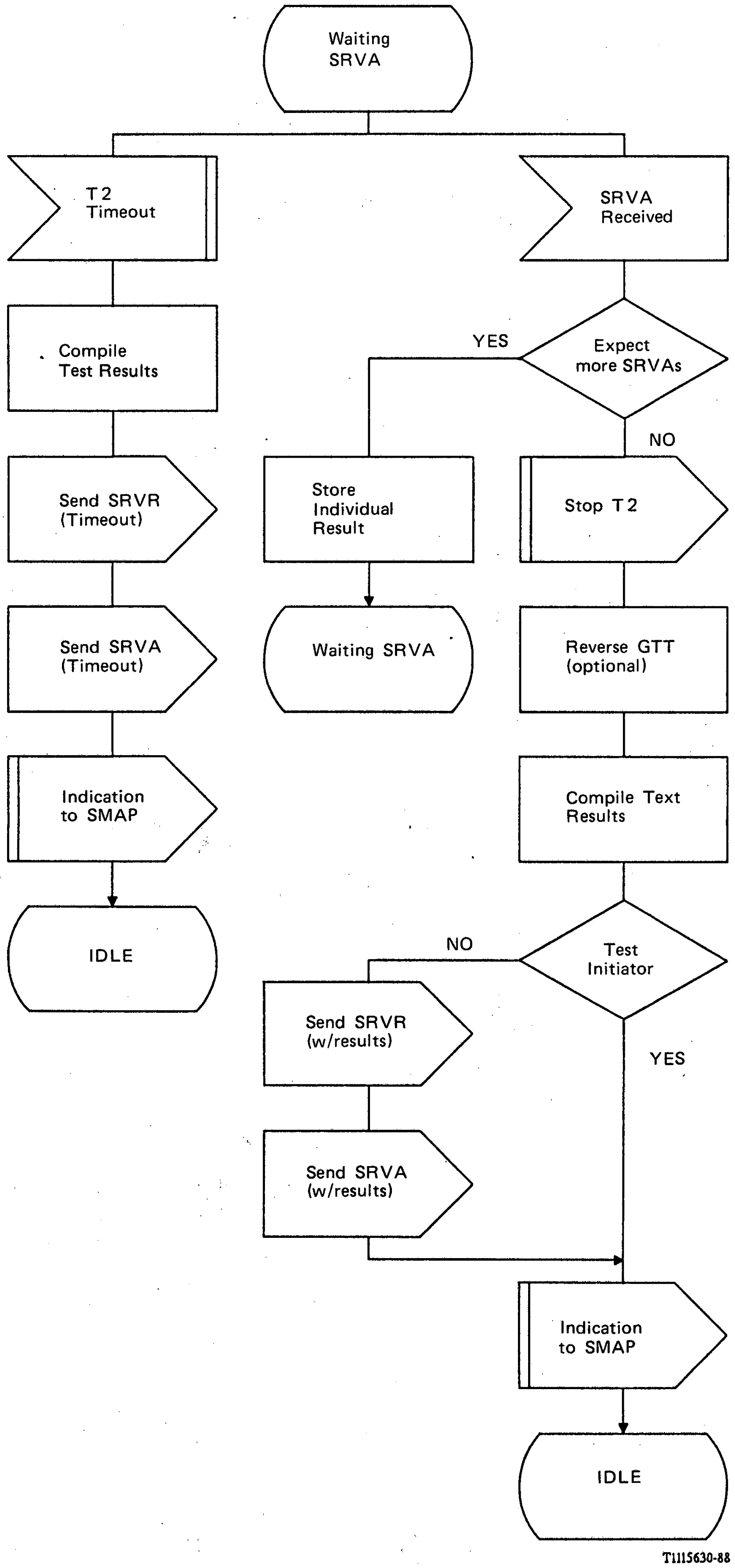
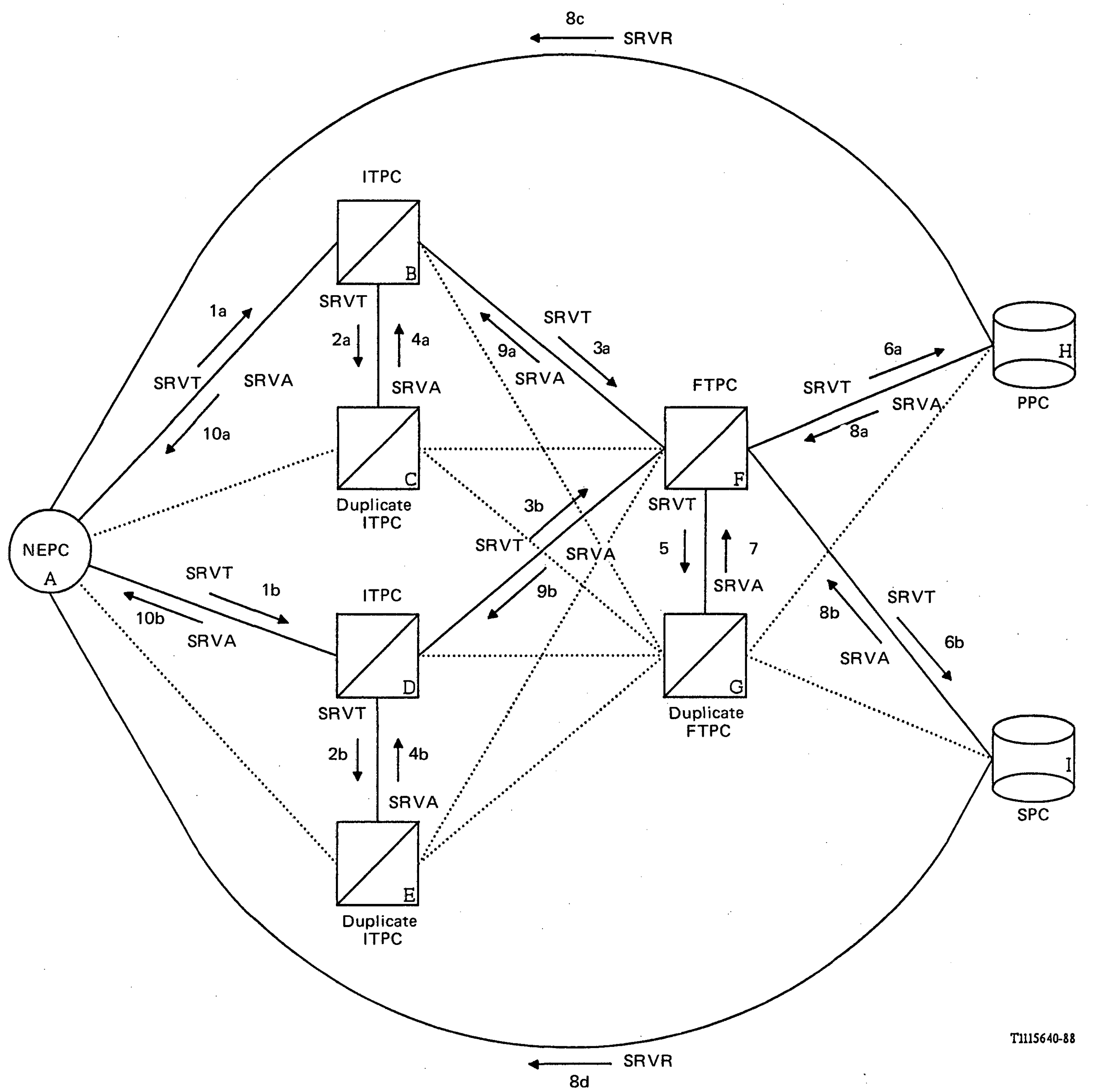


FIGURE B-1/Q.795 (Sheet 4 of 4)

State transition diagram for SRVT

B.4 *Example*

Figure B-2/Q.795 demonstrates the SRVT. It should be noted that the Signalling Points shown are assumed to be SCCP adjacent and NOT physically adjacent. Furthermore, all examples show both a primary and secondary destination. The secondary result may be considered optional.



NEPC – Near End Point Code
ITPC – Intermediate Translation Point Code
FTPC – Final Translation Point Code
PPC – Primary Translation Point Code
SPC – Secondary Translation Point Code

SRVT – SCCP Routing Verification Test Msg.
SRVA – SCCP Routing Verification Ack. Msg.
SRVR – SCCP Routing Verification Result Msg.

FIGURE B-2/Q.795

Example of SRVT procedure

GLOSSARY OF TERMS USED IN SIGNALLING SYSTEM No. 7

acknowledgement

F: accusé de réception

S: acuse de recibo

A service of the SCCP by which the receiver of the message informs the sender of the correct receipt.

available signalling link

F: canal sémaphore disponible

S: enlace de señalización disponible

A signalling link which has successfully completed the initial alignment procedures and carries (or is ready to carry) signalling traffic.

adjacent signalling points

F: points sémaphores adjacents

S: puntos de señalización adyacentes

Two signalling points that are directly interconnected by (a) signalling link(s).

alignment error rate monitoring

F: surveillance du taux d'erreur pendant la procédure d'alignement

S: monitor de tasa de errores en la alineación

A procedure by which the error rate of signalling link is measured during the initial alignment.

alternative routing (of signalling)

F: acheminement (de signalisation) de secours

S: encaminamiento alternativo (de señalización)

The routing of a given signalling traffic flow in case of failures affecting the signalling links, or routes, involved in the normal routing of that signalling traffic flow.

analogue signalling data link

F: liaison sémaphore de données analogique

S: enlace analógico de datos de señalización

The data link that provides an interface to signalling terminals and is made up of voice-frequency analogue transmission channels and modems.

application

F: application

S: aplicación

The set of user's requirements.

application entity (AE)

F: entité d'application (AE)

S: entidad de aplicación (EA)

A set of Application Service Elements which together perform all or part of the communications aspects of an application process. The Application Entity is addressed through an SCCP subsystem number.

application process

F: processus d'application

S: proceso de aplicación

An element which performs the information processing for a particular application.

application service element (ASE)

F: élément de service d'application (ASE)

S: elemento del servicio aplicación (ESA)

A coherent set of integrated functions within an application entity which provides an OSI environment capability, using underlying services where appropriate.

associated mode (of signalling)

F: mode (de signalisation) associé

S: modo (de señalización) asociado

The mode where messages for a signalling relation involving two adjacent signalling points are conveyed over a directly interconnecting signalling link.

backward indicator bit (BIB)

F: bit indicateur vers l'arrière (BIR)

S: bit indicador inverso (bit indicador hacia atrás) (BII)

A bit in a signal unit requesting, by its status change, retransmission at the remote end when a signal unit is received out of sequence.

backward sequence number (BSN)

F: numéro de séquence vers l'arrière (NSR)

S: número secuencial inverso (hacia atrás) (NSI)

A field in a signal unit sent which contains the forward sequence number of a correctly received signal unit being acknowledged.

basic (error correction) method

F: méthode (de correction d'erreur) de base

S: método básico (de corrección de errores)

A non-compelled, positive/negative acknowledgement, retransmission error control system.

called/calling party address

F: adresse du demandé/du demandeur

S: dirección de la parte llamada/llamante

An address within an SCCP message, consisting of any combination of signalling point code, global title and subsystem number.

changeback

F: retour sur canal sémaphore normal

S: retorno al enlace de servicio

The procedure of transferring signalling traffic from one or more alternative signalling links to a signalling link which has become available.

changeback code

F: code de retour sur canal sémaphore normal

S: código de retorno al enlace de servicio

A field in the signalling network management messages used in the changeback procedure; it is used to discriminate messages relating to different changeback procedures performed at the same time towards the same signalling link.

changeover

F: passage sur canal sémaphore de secours

S: paso a enlace de reserva

The procedure of transferring signalling traffic from one signalling link to one or more different signalling links, when the link in use fails or is required to be cleared of traffic.

check bit (CK)

F: bit de contrôle (CRT)

S: bit de control (BC)

A bit associated with a character or block for the purpose of checking the absence of error within the character or block.

check loop

F: boucle pour contrôle de continuité

S: bucle de pruebas de continuidad

A device which is attached to interconnect the Go and Return paths of a circuit at the incoming end of a circuit to permit the outgoing end to make a continuity check on a loop basis.

circuit identification code (CIC)

F: code d'identification de circuit (CIC)

S: código de identificación de circuito (CIC)

Information identifying a circuit between a pair of exchanges, for which signalling is being performed (14 bits in the international ISDN User Part).

circuit validation test (CVT)

F: essai de validation d'un circuit (EVC)

S: prueba de validación del circuito (PVC)

A procedure used to ensure that two exchanges have sufficient and consistent translation data for placing a call on a specific circuit.

class of operation

F: classe d'opération

S: clase de operación

A number indicating whether an operation reports success or failure, failure only, success only or neither.

class of SCCP service

F: classe de service SSCS

S: clase de servicio PCCS

A number chosen by the user of the SCCP to select 1 out of 4 network services provided by the SCCP.

combined link set

F: faisceau combiné de canaux sémaphores

S: conjunto combinado de enlaces

A load sharing collection of one or more link sets.

common channel signalling

F: signalisation par canal sémaphore

S: señalización por canal común

A signalling technique in which signalling information relating to a multiplicity of circuits, and other information such as that used for network management, is conveyed over a single channel by addressed messages.

component

F: composant

S: componente

A protocol data unit exchanged between TC-users, via the Component sublayer of Transaction Capabilities.

component correlation

F: corrélation de composants

S: correlación de componentes

The association of operation invocations and replies.

component portion

F: partie composante

S: porción componente

The part of a TC message containing the Components.

connection end-point

F: point terminal de connexion

S: punto extremo de conexión

A signalling point which may be either originating or destination.

connection identification

F: identification de connexion

S: identificación de conexión

A number which identifies unambiguously a certain connection at the interface between the SCCP and a user function.

connection-oriented network service

F: service de réseau en mode connexion

S: servicio de red con conexión

A network service that establishes logical connections between end users before transferring information.

connection section

F: section de connexion

S: sección de conexión

A section of an SCCP connection between endpoints or between an endpoint and an intermediate point or between intermediate points.

connectionless network service

F: service de réseau en mode sans connexion

S: servicio de red sin conexión

A network service that transfers information between end users without establishing a logical connection or virtual circuits.

continuity check

F: contrôle de continuité

S: prueba (verificación) de continuidad

A check made to a circuit or circuits in a connection to verify that an acceptable path (for transmission of data, speech, etc.) exists.

continuity check transponder

F: répondeur pour contrôle de continuité

S: transpondedor (transmisor-respondedor) para pruebas de continuidad

A device which is used to interconnect the Go and Return paths of a circuit at the incoming end which on detection of a check tone, returns another check tone to the originating end to permit a continuity checking of a 2-wire circuit.

controlled rerouting

F: retour sous contrôle sur route normale

S: reencaminamiento controlado

A procedure of transferring in a controlled way, signalling traffic from an alternative signalling route to the normal signalling route, when this has become available.

coupling

F: couplage

S: acoplamiento

An SCCP function which provides an association between connection sections at a relay point.

cross-office (transit) delay

F: temps (de transit) dans le commutateur

S: retardo (de tránsito) a través de la central

The time a message will take to pass through an exchange.

cross-office check

F: contrôle de continuité à travers un commutateur

S: prueba (verificación) de continuidad a través de una central

A check made of a circuit across the exchange to verify that a transmission path exists.

data channel propagation time (T_p)

F: temps de propagation sur la voie de données (T_p)

S: tiempo de propagación del canal de datos (T_p)

The period which starts when the last bit of the signal unit has entered the data channel at the sending side and ends when the last bit of the signal unit leaves the data channel at the receiving end, irrespective of whether the signal unit is disturbed or not.

Data User Part (DUP)

F: Sous-Système Utilisateur Données (SSUD)

S: parte de usuario de datos (PUD)

The User Part specified for data services.

destination point (signalling-)

F: point (sémaphore) de destination

S: punto de destino (de la señalización)

The signalling point to which a message is destined.

destination point code (DPC)

F: code du point de destination (CPD)

S: código del punto de destino (CPD)

A part of the label in a signalling message which uniquely identifies, in a signalling network, the (signalling) destination point of the message.

dialogue

F: dialogue

S: diálogo

An association established between two TC users exchanging components.

digital signalling data link

F: liaison sémaphore de données numérique

S: enlace de datos de señalización digital

The data link that provides an interface to signalling terminals and is made up of digital transmission channels and digital switches or their terminating equipment.

dual seizure

F: prise simultanée

S: doble toma (toma simultánea)

The condition which occurs when in bothway operation two exchanges attempt to seize the same circuit at approximately the same time.

emergency changeover

F: passage d'urgence sur canal sémaphore de secours

S: paso de emergencia a enlace de reserva

A modified changeover procedure to be used whenever the normal one cannot be accomplished, i.e. in case of some failures in the signalling terminal equipment or in case of inaccessibility between the two involved signalling points.

end-to-end signalling

F: signalisation de bout en bout

S: señalización de extremo a extremo

The capability to transfer signalling information of end point significance directly between signalling end points in order to provide a requesting user with a basic or supplementary service.

end-user (SCCP)

F: utilisateur terminal (SSCS)

S: usuario de extremo (PCCS)

A functional entity above the SCCP upper layer boundary indirectly using the services of the SCCP.

entity or (N) entity

F: entité ou entité (N)

S: entidad o entidad (N)

A set of functions invoked by a given layer for an instance of intersystems communications in which that system is involved. An entity may be partitioned into several sub-entities. For each instance of intersystems communications, the set of functions invoked will be a part of all the functional capability of the given system within the layer in accordance with the functionality required for that instance of inter-system communication.

expedited data

F: données exprés

S: datos acelerados (datos expeditados)

Data transferred with priority which bypasses the normal data flow control.

failure response time

F: temps de réponse à une défaillance

S: tiempo de respuesta a fallo

The elapsed time from the instant a signalling point recognises that a signalling link is unavailable, until the instant when the signalling point completes sending a changeover (or emergency changeover) order to the remote signalling point.

fill-in signal unit (FISU)

F: trame sémaphore de remplissage (TSR)

S: unidad de señalización de relleno (USR)

A signal unit containing only error control and delimitation information, which is transmitted when there are no message signal units or link status signal units to be transmitted.

flag (F)

F: fanion (F)

S: bandera (BAN)

The unique pattern on the signalling data link used to delimit a signal unit.

flow control

F: contrôle de flux

S: control de flujo

A function in a protocol used to control the flow of signalling messages between adjacent layers of a protocol, and/or between peer entities. The function permits, for example, a receiving entity to control signalling message flow from the sending entity.

forced rerouting

F: passage sous contrainte sur route de secours

S: reencaminamiento forzado

A procedure of transferring signalling traffic from one signalling route to another, when the signalling route in use fails or is required to be cleared of traffic.

forced retransmission (procedure)

F: retransmission forcée (procédure de)

S: retransmisión forzada (procedimiento de)

An error correction procedure used to complement the preventive cyclic retransmission procedure.

forward indicator bit (FIB)

F: bit indicateur vers l'avant (BIA)

S: bit indicador directo (bit indicador hacia adelante) (BID)

A bit in a signal unit which indicates the start of a retransmission cycle.

forward sequence number (FSN)

F: numéro de séquence vers l'avant (NSA)

S: número secuencial directo (hacia adelante) (NSD)

A signal unit used to identify the transmitted message signal units.

function

F: fonction

S: función

A logical object which accepts one or more inputs (arguments) and produces a single output (value) uniquely determined by the combination of the input and the formal specification of the function.

global title (GT)

F: appellation globale (AG)

S: título global (TG)

An address used by the SCCP, such as customer dialled digits which does not explicitly contain information that would allow routing in the signalling network, i.e., the SCCP translation function is required.

hypothetical signalling reference connection (HSRC)

F: communication fictive de réference pour la signalisation

S: conexión ficticia (o hipotética) de referencia para la señalización (CFRS)

A hypothetical reference model of a connection in a signalling network.

identifier (ID)

F: identificateur (ID)

S: identificador (ID)

A character, or group of characters, used to identify or name an item of data and possibly to indicate certain properties of that data.

unavailable signalling link

F: canal sémaphore indisponible

S: enlace de señalización indisponible

A signalling link which has been deactivated and cannot therefore carry signalling traffic.

information element

F: élement d'information

S: elemento de información

The basic unit of a TCAP message.

initial alignment (procedure)

F: alignement initial (procédure d')

S: alineación inicial (procedimiento de)

A procedure by which a signalling link becomes able to carry signalling traffic either for the first time or after a failure has occurred.

integrated digital network (IDN)

F: réseau numérique intégré (RNI)

S: red digital integrada (RDI)

A network in which connections established by digital switching are used for the transmission of digital signals.

integrated services digital network (ISDN)

F: réseau numérique avec intégration des services (RNIS)

S: red digital de servicios integrados (RDSI)

An integrated digital network in which the same digital switches and digital paths are used to establish connections for different services, for example, telephony, data.

Intermediate Service Part

F: Sous-Système Services Intermédiaires (SSSI)

S: parte servicio intermedio

An element of Transaction Capabilities which supports TCAP for connection-oriented messages. It represents OSI layers 4 to 6.

international signalling network

F: réseau sémaphore international

S: red de señalización internacional

A network used for signalling, consisting of international signalling points and common channel signalling links connecting them.

international signalling point

F: point sémaphore international

S: punto de señalización internacional

A signalling point which belongs to the international signalling network.

international signalling point code

F: code de point sémaphore international

S: código de punto de señalización internacional

A part of the label in a signalling message that uniquely identifies each signalling point which belongs to the international signalling network. It consists of a sub-field for the signalling area/network code (11-bit) and a sub-field which identifies a signalling point in a specific area or network (3-bit).

interruption control

F: contrôle d'interruption

S: protección contra las interrupciones

A system which monitors a pilot for interruptions on FDM systems and which transmits an indication to the switching equipment.

ISDN user part (ISDN-UP)

F: Sous-Système Utilisateur pour le RNIS (SSUR)

S: parte usuario de RDSI (PU-RDSI)

A protocol of Signalling System No. 7 which provides the signalling functions necessary to basic bearer services and supplementary services for voice and non-voice applications in the ISDN.

label

F: étiquette

S: etiqueta

Information within a signalling message used to identify typically the particular circuit, call or management transaction to which the message is related.

layer

F: couche

S: capa

A group of one or more entities contained within an upper and lower logical boundary. Layer (N) has boundaries to the layer ($N + 1$) and to the layer ($N - 1$).

layer interface

F: interface entre couches

S: interfaz de capa

The boundary between two adjacent layers of the model.

layer service

F: service de couche

S: servicio de capa

A capability of the (N) layer and the layers beneath it, which is provided to $(N + 1)$ entities, at the boundary between the (N) layer and the $(N + 1)$ layer.

layer service elements

F: elément de service de couche

S: elemento de servicio de capa

An indivisible component of the layer service made visible to the service user via layer primitives.

layer service primitives

F: primitives du service de couche

S: primitivas de servicio de capa

A means for specifying in detail the adjacent layer interactions.

length indicator (LI)

F: indicateur de longueur (INL)

S: indicador de longitud (IL)

A six-bit field which differentiates between message signal units, link status signal units and fill-in signal units and in the case that its binary value is less than 63 indicates the length of a signal unit.

link-by-link signalling

F: signalisation section par section

S: señalización enlace por enlace

A procedure for the exchange of signalling information directly between two signalling points that are either directly connected or via signalling transfer points.

link state control (LSC)

F: supervision de l'état du canal sémaphore (SET)

S: control del estado del enlace (CEE)

Coordinates functions of the signalling link including signal unit delimitation, signal unit alignment, error detection, error correction, initial alignment, signalling link error monitoring and flow control.

link status signal unit (LSSU)

F: trame sémaphore d'état du canal sémaphore (TSE)

S: unidad de señalización del estado del enlace (UEE)

A signal unit which contains status information about the signalling link in which it is transmitted.

linked operation

F: opération liée

S: operación enlazada (vinculada)

An operation invoked from one end of a dialogue that is linked to another operation previously invoked by the other end.

load sharing (general)

F: partage de la charge (en général)

S: compartición de carga (en sentido general)

A process by which signalling traffic is distributed over two or more signalling or message routes, to provide for traffic equalization or security.

local reference

F: référence locale

S: referencia local

A local number, unambiguously identifying an SCCP connection within one SCCP entity.

management inhibiting

F: inhibition par la gestion

S: inhabilitación (o inhibición) (en gestión de tráfico de señalización)

A procedure included in signalling traffic management used to keep a signalling link unavailable to User Part generated signalling traffic, except for test and maintenance traffic.

mandatory fixed part

F: partie obligatoire de longueur fixe

S: parte obligatoria fija

Part of a message that contains those parameters that are mandatory and of fixed length.

mandatory variable part

F: partie obligatoire de longueur variable

S: parte obligatoria variable

Part of a message that contains mandatory parameters of variable length.

message discrimination

F: discrimination des messages (de signalisation)

S: discriminación de mensajes

The process which decides, for each incoming message, whether the signalling point is a destination point or if it should act as a signalling transfer point for that message and accordingly, whether the message should be handed to (signalling) message distribution or to (signalling) message routing functions.

message distribution

F: distribution des messages (de signalisation)

S: distribución de mensajes

The process of determining, upon receipt of a signalling message at its destination point, to which User Part the signalling message is to be delivered.

message route (signalling-)

F: route de message (de signalisation)

S: ruta de mensaje (de señalización)

The signalling link or consecutive links connected in tandem that are used to convey a signalling message from an originating point to its destination point.

message routing (signalling-)

F: acheminement des messages (de signalisation)

S: encaminamiento de mensajes (de señalización)

The process for selecting, for each signalling message to be sent, the signalling link to be used.

message signal unit (MSU)

F: trame sémaphore de message (TSM)

S: unidad de señalización de mensaje (USM)

A signal unit containing a service information octet and a signalling information field which is retransmitted by the signalling link control if it is received in error.

Message Transfer Part (MTP)

F: Sous-Système Transport de Messages (SSTM)

S: parte transferencia de mensajes (PTM)

The functional part of a common channel signalling system which transfers signalling messages as required by all the users, and which performs the necessary subsidiary functions, for example error control and signalling security (levels 1, 2 and 3 of Signalling System No. 7).

message transfer part receiving time (T_{mr})

F: temps de réception du Sous-Système Transport de Messages (T_{mr})

S: tiempo de recepción de la parte de transferencia de mensajes (T_{mr})

The period which starts when the last bit of the signal unit leaves the signalling data link and ends when the last bit of the message has entered the User Part. It includes the handling time at level 2, the transfer time from level 2 to level 3, the handling time at level 3, the transfer time from level 3 to level 4.

message transfer part sending time (T_{ms})

F: temps d'émission du Sous-Système Transport de Messages (T_{ms})

S: tiempo de emisión de la parte de transferencia de mensajes (T_{ms})

The period which starts when the last bit of the message has left the User Part and ends when the last bit of the signal unit enters the data link for the first time. It includes the queueing delay in the absence of disturbances, the transfer time from level 4 to level 3, the handling time at level 3, the transfer time from level 3 to level 2, and handling time in level 2.

message transfer time at signalling transfer points (T_{cs})

F: temps de transfert des messages aux points de transfert sémaphores (T_{cs})

S: tiempo de transferencia de mensajes en los puntos de transferencia de señalización (T_{cs})

The period which starts when the last bit of the signal unit leaves the incoming signalling data link and ends when the last bit of the signal unit enters the outgoing signalling data link for the first time. It includes the queueing delay in the absence of disturbances, but not the additional queueing delay caused by retransmission.

Mobile Application Part (MAP)

F: Sous-Système Application Mobile (SSAM)

S: parte aplicación móvil (PAM)

The Application Entity dedicated to the communication aspects of the mobile application.

MTP routing verification test (MRVT)

F: essai pour la vérification de l'acheminement dans le SSTM (EATP)

S: prueba de verificación de encaminamiento por la PTM (PVEM)

A procedure used to determine if the data of the MTP routing tables in the signalling network are consistent.

national signalling network

F: réseau sémaphore national

S: red de señalización nacional

A network used for signalling, consisting of national signalling points and the connecting common channel signalling links, including the national signalling point of the gateway exchange connected to the internacional signalling network.

national signalling point (NSP)

F: point sémaphore national (PSN)

S: punto de señalización nacional (PSN)

A signalling point which belongs to the national signalling network.

negative acknowledgement (NACK)

F: accusé de réception négatif (ACN)

S: acuse de recibo negativo (RN)

An explicit request for retransmission of signal units, received in a corrupt form.

network indicator

F: indicateur de réseau

S: indicador de red

The part of the subservice field within the service information octet that may be used to discriminate between national and internacional signalling messages.

Network Service Part (NSP)

F: Sous-Système Service Reséau (SSSR)

S: parte servicio de red (PSR)

The combination of the Message Transfer Part and the Signalling Connection Control Part.

nonassociated mode (of signalling)

F: mode (de signalisation) non associé

S: modo (de señalización) no asociado

The mode where messages for a signalling relation involving two (nonadjacent) signalling points are conveyed, between those signalling points, over two or more signalling links in tandem passing through one or more signalling transfer points.

nonadjacent signalling points

F: points sémaphores non adjacents

S: puntos de señalización no adyacentes

Two signalling points that are not directly connected by any signalling links.

normal routing of (signalling)

F: acheminement normal (de signalisation)

S: encaminamiento normal (de señalización)

The routing of a given signalling traffic flow in normal conditions (i.e. in the absence of failures).

NSAP address (OSI-) (NSAP)

F: adresse NSAP (OSI-)

S: dirección PASR (ISA-) (PASR)

A global address as defined for OSI which is understandable over any network and can be used to address between networks.

operation (TC-)

F: opération (GT)

S: operación (CT)

The action being requested of the remote end.

Operation, Maintenance and Administration Part (OMAP)

F: Sous-Système pour l'Exploitation, la Maintenance et la gestion (SSEM)

S: parte, operaciones, mantenimiento y administración (POMA)

The Application Entity dedicated to the communications aspects of the Operation, Administration and Maintenance of the Signalling System No. 7 network and which may have an application for the Telecommunications Management Network (TMN).

optional part

F: partie facultative

S: parte opcional (facultativa)

Part of a message that contains parameters that may or may not occur in any particular message type.

originating point (signalling-)

F: point (sémaphore) d'origine

S: punto de origen (de señalización)

The signalling point in which a message is generated.

originating point code (OPC)

F: code du point d'origine (CPO)

S: código del punto de origen (CPO)

A part of the label in a signalling message which uniquely identifies, in a signalling network, the (signalling) originating point of the message.

peer entities

F: entités homologues

S: entidades pares

Entities in the same layer but in different systems (nodes) which must exchange information to achieve a common objective.

peer protocol

F: protocole homologue

S: protocolo para entidades pares

A formal language used by peer entities to exchange information.

pilot

F: onde pilote

S: piloto

Sinusoidal signal transmitted over analogue FDM links for regulation and supervision purposes.

pointer

F: pointeur

S: puntero

A single octet indicating the beginning of each mandatory variable parameter and optional part.

positive acknowledgement

F: accusé de réception positif

S: acuse de recibo positivo

A way to indicate correct transfer of message signal units.

preventive cyclic retransmission (error control) method

F: méthode (de correction d'erreur) avec retransmission cyclique préventive

S: método (de protección contra errores) por retransmisión cíclica preventiva

A noncompelled, positive acknowledgement, cyclic retransmission forward error correction system.

processor outage

F: processeur hors service

S: interrupción del procesador

A situation in which a signalling link becomes unavailable, due to factors at a functional level higher than level 2. This may be because of, for example, a central processor failure.

Public Land Mobile Network (PLMN)

F: réseau mobile terrestre publique (RMTP)

S: red móvil terrestre pública (RMTP)

A public network dedicated to the operation of mobile radio communications.

quasi-associated mode (of signalling)

F: mode (de signalisation) quasi associé

S: modo (de señalización) cuasiasociado

A nonassociated mode (of signalling) in which the (signalling) message route is determined basically, for each signalling message, by information contained in this message (namely in its routing label) and is fixed in normal operation.

reply

F: réponse

S: respuesta

Any component sent back as the consequence of an operation invocation.

reset (SCCP)

F: reinitialisation (SSCS)

S: reinicialización (PCCS)

A service of the SCCP to return a connection to a predefined state, or to recover from loss of synchronization between two SCCP users.

restart (SCCP)

F: redémarrage (SCCS)

S: rearranque (PCCS)

A recovery mechanism for signalling connection sections in the event of a node failure.

result

F: résultat

S: resultado

The component indicating the outcome (success or failure) of an operation.

retransmission buffer (RTB)

F: tampon de retransmission (TRT)

S: memoria tampón de retransmisión (MTR)

Storage in the signalling link control for signal units transmitted but not yet positively acknowledged.

retrieval

F: récupération

S: recuperación

The process of transferring all those messages in the retransmission buffer of a signalling link (A), which have not yet been positively acknowledged, to the transmission buffers of alternative signalling links.

route set congestion control

F: contrôle d'encombrement de faisceau de routes sémaphores

S: control de la congestión de un conjunto de rutas

A procedure included in the signalling route management which is used to update the congestion status of a signalling route in a given signalling point.

routing label

F: étiquette d'acheminement

S: etiqueta de encaminamiento

The part of the message label that is used for message routing in the signalling network. It includes the destination point code, the originating point code and the signalling link selection field.

SCCP relation

F: relation de SSCS

S: relación PCCS

A relationship between two SCCP users which allows them to exchange data over it. An SCCP relation can consist of one or several routes.

SCCP relay function

F: fonction relais du SSCS

S: función de relevo PCCS

A function which provides an address translation to route an SCCP message to its destination, and may include coupling of connection sections for connection-oriented protocol classes.

SCCP route

F: route du SSCS

S: ruta PCCS

A route composed of an ordered list of nodes where the SCCP is used (origin, relay(s), destination) for the transfer of SCCP messages from an originating SCCP user to the destination SCCP user.

SCCP routing

F: acheminement dans le SSCS

S: encaminamiento (por la) PCCS

A function based on the called party address information, which evaluates and translates the information, checks the addressee availability, and the need for coupling of connection sections.

SCCP routing verification test (SRVT)

F: essai pour la vérification de l'acheminement dans le SSCS (EACP)

S: prueba de verificación del encaminamiento PCCS (PVES)

A procedure used to determine if the data of the SCCP routing tables in the signalling network are consistent.

SCCP user

F: utilisateur du SSCS

S: usuario PCCS

Functional entity which uses directly the services of the SCCP.

segmenting/reassembling

F: segmentation/réassemblage

S: segmentación/reensamblado

If the size of the user data is too big to be transferred within one message, user data are segmented into a number of portions, and reassembled at the receiving end.

sequence numbering

F: numérotation des trames sémaphores

S: numeración secuencial

Each signal unit carries two sequence numbers for error correcting purpose.

sequencing

F: mise en séquence

S: secuenciación

A service of the SCCP that preserves the sequence of Network Service Data Units.

service indicator (SI)

F: indicateur de service (utilisateur) (INS)

S: indicador de servicio (IS)

Information within a signalling message identifying the user to which the message belongs.

service information (octet) (SIO)

F: octet de service (SER)

S: información de servicio (octeto de) (OIS)

Eight bits, contained in a message signal unit, comprising the service indicator and the sub-service field.

signal unit (SU)

F: trame sémaphore (TS)

S: unidad de señalización (US)

A group of bits forming a separately transferable entity used to convey information on a signalling link.

signal unit alignment

F: alignement des trames sémaphores

S: alineación de unidades de señalización

Signal unit alignment exists when flags are received at intervals which correspond to integral numbers of octets and which fall within certain upper and lower limits.

signal unit error rate monitoring

F: surveillance du taux d'erreur sur les trames sémaphores

S: monitor de tasa de errores en las unidades de señalización

A procedure by which the error rate of an active signalling link is measured on the basis of a count of correctly checking and erroneous signal units.

signal unit sequence control

F: contrôle de l'ordre des trames sémaphores

S: control de la secuencia de las unidades de señalización

Procedures used at level 2 to ensure that message signal units are transported in sequence, without loss or duplication, over a particular signalling link.

signalling area/network code (SANC)

F: code de zone/réseau sémaphore (CZRS)

S: código de área/red de señalización

The field in the international signalling point code that identifies the zone and national signalling area or network. It consists of a code for the world geographical zone (3-bit) and a code for the area or network in a specific zone (8-bit).

Signalling Connection Control Part (SCCP)

F: Sous-Système Commande des connexions Sémaphores (SSCS)

S: parte control de la conexión de señalización (PCCS)

Additional functions to the MTP to cater for both connectionless as well as connection-oriented network service and to achieve an OSI compatible network service.

signalling information

F: information de signalisation

S: información de señalización

The information content of a signal or a signalling message.

signalling information (field) (SIF)

F: information de signalisation (domaine d') (INF)

S: información de señalización (campo de) (CIS)

The bits of a message signal unit which cary information particular to a certain user transaction and always contain a label.

signalling link

F: canal sémaphore

S: enlace de señalización

A transmission means which consists of a signalling data link and its transfer control functions, used for reliable transfer of a signalling message.

signalling link activation

F: activation d'un canal sémaphore

S: activación de un enlace de señalización

The process of making a signalling link ready to carry signalling traffic.

signalling link blocking

F: blocage d'un canal sémaphore

S: bloqueo de un enlace de señalización

An event causing the unavailability of a signalling link, typically consisting in a "processor outage" condition at one end of that signalling link.

signalling link code (SLC)

F: code de canal sémaphore (COC)

S: código de enlace de señalización (CES)

A field of the label in the signalling network management messages, which indicates the particular signalling link to which the message refers among those interconnecting the two involved signalling points.

signalling link deactivation

F: désactivation d'un canal sémaphore

S: desactivación de un enlace de señalización

The procedure by which a signalling link is taken out of service.

signalling link error monitoring

F: surveillance des erreurs sur un canal sémaphore

S: monitor de errores en el enlace de señalización

This comprises two functions: initial alignment error rate monitoring and signal unit error rate monitoring.

signalling link failure

F: défaillance d'un canal sémaphore

S: avería (o fallo) del enlace de señalización

An event causing the unavailability of a signalling link, typically consisting in a failure in signalling terminal equipment or in the signalling data link.

signalling link group

F: groupe de canaux sémaphore

S: grupo de enlaces de señalización

A set of signalling links directly connecting two signalling points and having the same physical characteristics (bit rate, propagation delay, etc.).

signalling link management functions

F: fonctions de gestion des canaux sémaphores

S: funciones de gestión de enlaces de señalización

Functions that control and take actions, when required, to preserve integrity of locally connected signalling links, e.g. by reconfiguration of the signalling link sets.

signalling link restoration

F: rétablissement d'un canal sémaphore

S: restauración (o restablecimiento) de enlaces de señalización

An event consisting in the initial alignment procedure on a signalling link following the removal of the previous causes of failure; if no other causes of unavailability exist (i.e. a signalling link blocked condition) then the signalling link becomes available.

signalling link selection field

F: domaine de sélection du canal sémaphore

S: campo de selección de enlace de señalización

A field of the routing label which is typically used by the message routing function to perform load sharing among different signalling links/link sets.

signalling link set

F: faisceau de canaux sémaphores

S: conjunto de enlaces de señalización

A set of one or more signalling links directly connecting two signalling points.

signalling link unblocking

F: déblocage d'un canal sémaphore

S: desbloqueo de un enlace de señalización

An event consisting in the removal of the previous causes of signalling link blocking; if no other causes of unavailability exist (i.e. a signalling link failed condition), then the signalling link becomes available.

Signalling Management Application Process (SMAP)

F: processus d'application de gestion de signalisation (PAGS)

S: proceso de aplicación de gestión de señalización (PAGS)

The application process associated with the operation, administration, and management of the Signalling System No. 7.

signalling message

F: message de signalisation

S: mensaje de señalización

An assembly of signalling information pertaining to a call, management transaction, etc., that is transferred as an entity.

signalling message handling functions

F: fonctions d'orientation des messages de signalisation

S: funciones de tratamiento de mensajes de señalización

Functions that, at the actual transfer of a message, direct the message to the proper signalling link or User Part.

signalling network

F: réseau sémaphore

S: red de señalización

A network used for signalling by one or more users and consisting of signalling points and connecting signalling links.

signalling network components

F: composants du réseau sémaphore

S: componentes de la red de señalización

Components which make up the signalling network, such as signalling points and common channel signalling links.

signalling network functions

F: fonctions du réseau sémaphore

S: funciones de la red de señalización

The functions which are performed by the Message Transfer Part at level 3 and are common to, and independent of, the operation of individual signalling links. They include the signalling message handling functions and the signalling network management functions.

signalling end point

F: point sémaphore terminal

S: punto extremo de señalización

A node in a signalling network associated with a call originating local exchange, terminating local exchange, or gateway exchange.

signalling network management functions

F: fonctions de gestion du réseau sémaphore

S: funciones de gestión de la red de señalización

Functions that, on the basis of predetermined data and information about the status of the signalling network, control the current message routing and configuration of signalling network facilities.

signalling point

F: point sémaphore

S: punto de señalización

A node in a signalling network which either originates and receives signalling messages, or transfers signalling messages from one signalling link to another, or both.

signalling point code

F: code d'un point sémaphore

S: código de punto de señalización

A binary code uniquely identifying a signalling point in a signalling network. This code is used, according to its position in the label, either as destination point code or as originating point code.

signalling point numbering plan

F: plan de numérotage des points sémaphores

S: plan de numeración de los puntos de señalización

A formal description of the method of translating end-user provided address information into an address understandable by the signalling network.

signalling point restart

F: redémarrage d'un point sémaphore

S: rearranque de un punto de señalización

A procedure that allows a graceful increase of traffic to a restarting node.

signalling point with SCCP relay function (SPR)

F: point sémaphore faisant fonction de relais dans le SSCS (PSR)

S: punto de señalización con funciones de relevo PCCS (PSR)

A node in a signalling network with SCCP relay functions.

signalling relation

F: relation sémaphore

S: relación de señalización

A relation between two signalling points involving the possibility of information interchange between corresponding User Part functions.

signalling route

F: route sémaphore

S: ruta de señalización

A predetermined path described by a succession of signalling points that may be traversed by signalling messages directed by a signalling point towards a specific destination point.

signalling route management functions

F: fonctions de gestion des routes sémaphores

S: funciones de gestión de rutas de señalización

Functions that transfer information about changes in the availability of signalling routes in the signalling network.

signalling route-set-test procedure

F: procédure de test de faisceau de routes sémaphores

S: procedimiento de prueba de conjunto de rutas de señalización

A procedure, included in the signalling route management which is used to test the availability of a given signalling route, previously declared unavailable.

signalling traffic management functions

F: fonctions de gestion du trafic sémaphore

S: funciones de gestión del tráfico de señalización

Functions that control and, when required, modify routing information used by the Message routing function and control the transfer of signalling traffic in a manner that avoids irregularities in the message flow.

signalling message transfer delay

F: temps de transfert d'un message sémaphore

S: retardo (tiempo) de transferencia de un mensaje de señalización

The time a message will take to pass through the signalling network.

signalling transfer point (STP)

F: point de transfert sémaphore (PTS)

S: punto de transferencia de señalización (PTS)

A signalling point with the function of transferring signalling messages from one signallig link to another and considered exclusively from the viewpoint of the transfer.

status field (SF)

F: domaine d'état (ETC)

S: campo de estado (CE)

The bits of a link status signal unit which indicate one of the major signalling link states.

subservice field (SSF)

F: domaine de sous-service (DSS)

S: campo de subservicio (CSS)

The level 3 field containing the network indicator and two spare bits.

subsystem

F: Sous-Système (utilisateur du SSCS)

S: subsistema

A direct user of the Signalling Connection Control Part (SCCP) of Signalling System No. 7.

subsystem number (SSN)

F: numéro de Sous-Système (NSS)

S: número de subsistema (NSS)

A number to identify a subsystem using the SCCP either directly, like the ISDN User Part, or indirectly (via the Transaction Capabilities) like the OMAP.

system management application entity (SMAE)

F: entité d'application de gestion du système (SMAE)

S: entidad de aplicación de gestión de sistema (EAGS)

The aspect of system Management Application Process involved with communication.

system management application process

F: processus d'application de gestion de systèmes

S: proceso de aplicación de gestión de sistema

The set of functions which collectively encompass system management.

tag (key) (label)

F: étiquette (SSGT)

S: rótulo (etiqueta)

The tag distinguishes one information element from another, and governs the interpretation of the contets.

Telephone User Part (TUP)

F: Sous-Système Utilisateur Téléphonie (SSUT)

S: parte de usuario de telefonía (PUT)

The User Part specified for telephone services.

traffic flow control (signalling-)

F: contrôle de flux de trafic (sémaphore)

S: control de flujo del tráfico (de señalización)

Actions and procedures intended to limit signalling traffic at its source in the case when the signalling network is not capable of transferring all signalling traffic offered by the User Parts, because of network failures or overload situations.

transaction

F: transaction

S: transacción

An association between two TC providers.

Transaction Capabilities (TC)

F: Gestionnaire de Transactions (GT)

S: capacidades de transacción (CT)

Functions which control information transfer between two or more nodes via a signalling network.

Transaction Capabilities Application Part (TCAP)

F: Sous-Système application pour la Gestion des Transactions (SSGT)

S: parte aplicación de capacidades de transacción (PACT)

The part of the Transaction Capabilities that resides in the application layer of the OSI protocol references model.

transaction portion

F: partie transaction

S: porción de transacción

The portion of the TCAP message that identifies whether the transaction is expected to consist of single or multiple messages and provides a means to associate these messages with a specific transaction and to terminate a transaction. The part of TCAP messages dealing with the control of transactions.

transceiver

F: émetteur-récepteur

S: transceptor (transmisor-receptor)

A tone device inserted in the outgoing end of a circuit which performs the transmitter and receiver check test through a check loop.

transfer-allowed (procedure)

F: transfert autorisé (procédure de)

S: autorización de transferencia (procedimiento de)

A procedure, included in the signalling route management, which is used to inform a signalling point that a signalling route has become available.

transfer controlled (procedure)

F: transfert sous contrôle (procédure de)

S: control de transferencia (procedimiento de)

A procedure, included in signalling route management, which does inform a signalling point of the congestion status of a signalling route.

transfer-prohibited (procedure)

F: transfert interdit (procédure de)

S: prohibición de transferencia (procedimiento de)

A procedure, included in the signalling route management, which is used to inform a signalling point of the unavailability of a signalling route.

transfer restricted (procedure)

F: transfert restreint (procédure de)

S: restricción de transferencia (procedimiento de)

A procedure, included in signalling route management, which does inform a signalling point of the restriction of a signalling route.

transmission buffer (TB)

F: tampon d'émission (TEM)

S: memoria tampón de transmisión (MT)

Storage in the signalling link control for message signal units not yet transmitted.

user (of the signalling system)

F: utilisateur du système de signalisation

S: usuario (del sistema de señalización)

A functional entity, typically a telecommunication service, which uses a signalling network to transfer information.

User Part (UP)

F: Sous-Système Utilisateur (SSU)

S: parte de usuario (o parte de usuario) (PU)

A functional part of the common channel signalling system which transfers signalling messages via the Message Transfer Part. Different types of User Parts exist (e.g. for telephone and data services), each of which is specified to a particular use of the signallig system.

ABBREVIATIONS SPECIFIC TO SIGNALLING SYSTEM No. 7[1)]

English	French	Spanish	Meaning
ACB	ACI	SAP	Access barred signal Table 3/Q.723
ACC	RAE	CAC	Automatic congestion control information message Table 3/Q.723
ACM	ACO	MDC	Address complete message Table 3/Q.723, Figure 3/Q.724
ADI	ADI	SDI	Address incomplete signal Table 3/Q.723, Figure 3/Q.724
AERM	STEA	MA	Alignment error rate monitor Figures 7-9/Q.703 and 11-17/Q.703
ANC	RAT	RCT	Answer signal, charge Table 3/Q.723, Figure 3/Q.724
ANN	RST	RST	Answer signal, no charge Table 3/Q.723
ANU	RSI	RNC	Answer signal, unqualified Table 3/Q.723
BIB	BIR	BII	Backward indicator bit Figures 3/Q.703, 13/Q.703 and 15/Q.703
BLA	BLA	ARB	Blocking-acknowledgement signal Table 3/Q.723
BLO	BLO	BLO	Blocking signal Table 3/Q.723
BSM	DE	MPE	Backward set-up message Table 3/Q.723
BSN	NSR	NSI	Backward sequence number Figures 3/Q.703, 14/Q.703 and 16/Q.703
BSNR	NSR-R	NSIR	Backward sequence number received Figures 7/Q.703, 13/Q.703, 14/Q.703, 16/Q.703
BSNT	NSR-E	NSIT	Backward sequence number of next SU to be transmitted Figures 7-9/Q.703 and 13-16/Q.703, Figures 27 and 30/Q.704.
CBA	RCA	ARS	Changeback acknowledgement signal Table 3/Q.704
CBD	RCO	ORS	Changeback declaration signal Table 3/Q.704
CBK	RAC	COL	Clear-back signal Table 3/Q.723, Figure 3/Q.724
CCF	CCN	FCO	Continuity-failure signal Table 3/Q.723

[1)] This list of abbreviations is basically the one appearing in Fascicle VI.6 of the *Yellow Book*, 1980. Study Group XI should bring this list up to date in the Study Period 1989-1992.

English	French	Spanish	Meaning
CCI	CCE	PCL	Continuity check incoming Recommendation Q.724, § 7.3, Figures 3/Q.724, 5/Q.724
CCL	RAD	LALN	Calling party clear signal Table 3/Q.723
CCM	SC	MSC	Circuit supervision message Table 3/Q.723
CCO	CCS	PCS	Continuity-check outgoing Recommendation Q.723, § 7.3, Figures 3/Q.724, 4/Q.724
CCR	CCD	PPC	Continuity-check-request signal Table 3/Q.723, Figures 2/Q.724, 3/Q.724, 6/Q.724 and 7/Q.724
CCS	CS	SCC	Common channel signalling Recommendation Q.701, § 1.1
CFL	ECH	SLI	Call-failure signal Table 3/Q.723, Figure 3/Q.724
CGC	EFC	CHC	Circuit-group-congestion Table 3/Q.723, Figure 3/Q.724
CHG	TAX	MTA	Charging message Table 3/Q.723
CHM	PR	MPA	Changeover and changeback messages Table 1/Q.704
CIC	CIC	CIC	Circuit identification code Recommendation Q.704, § 15, Recommendation Q.723, § 2.2.1
CIR	IDD	PIL	Calling-line-identity-request signal Table 3/Q.723
CK	CRT	BCE	Check bits Figure 3/Q.703
CLF	FIN	FIN	Clear-forward signal Table 3/Q.723, Figures 3/Q.724, 6/Q.724, 7/Q.724
CNM	GRC	GRC	Circuit network management message group
CNP	CLI	CIM	Connection-not-possible signal Table 1/Q.704
CNS	CLN	CIN	Connection-not-successful signal Table 1/Q.704
COA	PCA	APR	Changeover acknowledgement signal Table 1/Q.704
COO	PCO	OPR	Changeover order signal Table 1/Q.704
COT	CCP	CON	Continuity signal Table 3/Q.723, Figure 3/Q.724
CPC	STA	CTL	Call processing control Recommendation Q.724, § 10.2, Figures 1-7/Q.724
CRI	CRE	RPL	Continuity recheck incoming Recommendation Q.724, § 15.1, Figures 1/Q.724, 2/Q.724, 3/Q.724, 6/Q.724, 7/Q.724
CRO	CRS	RPS	Continuity-recheck outgoing Recommendation Q.724, § 15.1, Figures 1-3/Q.724, 6/Q.724
CSM	SA	MSL	Call supervision message Table 3/Q.723
CSS	CLR	SCF	Connection-successful signal Table 1/Q.704
DAEDR	DAD-R	DADR	Delimitation, alignment, error detection (reception) Figures 7/Q.703, 9/Q.703, 11/Q.703, 14/Q.703, 16/Q.703, 17/Q.703, 18/Q.703
DAEDT	DAD-E	DADT	Delimitation, alignment, error detection (transmitting) Figures 12/Q.703, 13/Q.703, 15/Q.703

English	French	Spanish	Meaning
DCE	ETCD	ETCD	Data circuit terminating equipment Figure 1/Q.702
DLC	CLO	CED	Signalling-data-link-connection-order signal Table 1/Q.704
DLM	CL	MED	Signalling-data-link-connection-order message Table 1/Q.704
DPC	CPD	CPD	Destination point code Recommendation Q.704, §§ 2.2.3, 13.2, Figure 3/Q.704, 14/Q.704, 26/Q.704, Recommendation Q.706, § 3, Recommendation Q.723, § 2.2.1
DPN	CNN	TDN	Digital path not provided signal Table 3/Q.723
DUP	SSUD	PUD	Data user part Recommendation Q.701, § 2.1, Figure 2/Q.701
ECA	PUA	AER	Emergency changeover acknowledgement signal Table 1/Q.704
ECM	PU	MEP	Emergency changeover message Table 1/Q.704
ECO	PUO	PER	Emergency changeover order signal Table 1/Q.704
EUM	EXT	IAL	Extended-unsuccessful-backward set-up information message indication Table 3/Q.723
F	F	BAN	Flag Figure 3/Q.703
FAM	AD	MDA	Forward-address message Table 3/Q.723
FCM	CF	MCF	Signalling traffic flow control messages Table 1/Q.704
FDM	MRF	MDF	Frequency division multiplex Recommendation Q.723, § 2.2.3, Recommendation Q.724, § 9
FIB	BIA	BID	Forward indicator bit Figures 3/Q.703, 13/Q.703, 15/Q.703
FISU	TSR	USR	Fill-in signal unit Figures 7/Q.703, 8/Q.703, 13-16/Q.703
FOT	IOP	INT	Forward-transfer signal Table 3/Q.723
FSM	EA	MEL	Forward set-up message Table 3/Q.723
FSN	NSA	NSD	Forward sequence number Figures 3/Q.703, 13/Q.703
GRA	RZA	ARG	Circuit group reset-acknowledgement message Table 3/Q.723
GRM	SGC	MSG	Circuit group supervision message Table 3/Q.723
GRQ	DEG	MPG	General request message
GRS	RZG	MRG	Circuit group reset message Table 3/Q.723
GSM	ING	MEG	General forward setup information message

English	French	Spanish	Meaning
HBA	BHA	ABGSF	Hardware failure oriented group blocking-acknowledgement message Table 3/Q.723
HGB	BLH	BGSF	Hardware failure oriented group blocking message Table 3/Q.723
HGU	DBH	DGSF	Hardware failure oriented group unblocking message Table 3/Q.723
HUA	DHA	ADGSF	Hardware failure oriented group unblocking acknowledgement message Table 3/Q.723
HMDC	ODC	HDCM	Message discrimination Recommendation Q.704, § 2, Figures 23-26/Q.704
HMDT	ODT	HDTM	Message distribution Recommendation Q.704, § 2, Figures 23-25/Q.704, 28/Q.704, 30/Q.704, 31/Q.704, 42/Q.704, 44-46/Q.704, 2/Q.707
HMRT	OAC	HENM	Message routing Recommendation Q.704, § 2, Figures 23/Q.704, 24/Q.704, 26/Q.704, 27/Q.704, 30/Q.704, 31/Q.704, 32/Q.704, 33/Q.704, 42/Q.704, 44/Q.704, 45/Q.704, 46/Q.704, 2/Q.707
HO	HO	EO	Heading code Recommendation Q.704, § 15.3, Figure 16/Q.704, Recommendation Q.707, § 5.3, Figure 1/Q.707, Recommendation Q.723, §§ 3.1 and 3.2
H1	H1	E1	Heading code Recommendation Q.704, § 15.3, Figure 16/Q.704, Recommendation Q.723, § 3.1
IAC	CAI	CAI	Initial alignment control Figures 8/Q.703, 9/Q.703, 13-17/Q.703
IAI	MIS	MIA	Initial address message with additional information Table 3/Q.723
IAM	MIA	MID	Initial address message Table 3/Q.723, Figures 3/Q.724, 6/Q.724
ISDN-UP (ISUP)	SSUR	PU-RDSI	ISDN User Part Recommendations Q.700 and Q.761 to Q.764
ISP	PSI	PSI	International signalling point Recommendation Q.705, § 3, Figure 1/Q.705
L1	N1	N1	Level 1 Figures 12/Q.703, 35/Q.704, 38-40/Q.704
L2	N2	N2	Level 2 Figures 8/Q.703, 9/Q.703, 12/Q.703, 13/Q.703, 15/Q.703, 23/Q.704, 24/Q.704, 26/Q.704, 27/Q.704, 30/Q.704, 35/Q.704, 37/Q.704
L3	N3	N3	Level 3 Figures 8/Q.703, 9/Q.704, 13/Q.703, 15/Q.703, 23/Q.704, 24/Q.704, 26/Q.704, 30/Q.704, 31/Q.704, 34/Q.704, 35/Q.704, 37/Q.704, 38/Q.704, 39/Q.704
L4	N4	N4	Level 4 Figures 23/Q.704, 25-27/Q.704, 34/Q.704
LI	INL	IL	Length indicator Recommendation Q.703, § 2.2, Figure 3/Q.703
LLSC	GCSF	CCE	Link set control Figures 29/Q.704, 35-37/Q.704
LOS	LHS	LFS	Line-out-of-service signal Table 3/Q.723, Figure 3/Q.724
LSAC	GCSA	CAE	Signalling link activity control Recommendation Q.704, § 12.6, Figures 28-30/Q.704, 35-41/Q.704
LSC	SET	CEE	Link state control Figures 7-10/Q.703, 13-18/Q.703, Recommendation Q.704, § 14.6, Figure 41/Q.704

English	French	Spanish	Meaning
LSDA	GCAL	AED	Signalling data link allocation Recommendation Q.704, § 12.6, Figures 35/Q.704, 37-40/Q.704, 42/Q.704
LSLA	GCAC	AES	Signalling link activation Recommendation Q.704, § 12.6, Figures 35/Q.704, 37/Q.704, 38/Q.704, 41/Q.704, 42/Q.704
LSLD	GCDA	DES	Signalling link deactivation Recommendation Q.704, § 12.6, Figures 35/Q.704, 37/Q.704, 40/Q.704, 41/Q.704, 42/Q.704
LSLR	GCRE	RES	Signalling link restoration Recommendation Q.704, § 12.6, Figures 35/Q.704, 37/Q.704, 39/Q.704, 41/Q.704, 42/Q.704
LSSU	TSE	UEE	Link status signal units Figures 13-16/Q.703
LSTA	GCAT	ATS	Signalling terminal allocation Recommendation Q.704, § 12.6, Figures 35/Q.704, 38/Q.704, 39/Q.704, 40/Q.704, 41/Q.704
MBA	BMA	ABGM	Maintenance oriented group-blocking-acknowledgement Table 3/Q.723
MGB	BLM	BGM	Maintenance oriented group blocking message Table 3/Q.723
MGMT	GES	SGE	Management system Figures 8/Q.703, 27/Q.704, 28/Q.704, 35-37/Q.704, 2/Q.707
MGU	DBM	DGM	Maintenance oriented group unblocking message Table 3/Q.723
MPR	INU	PIMM	Misdialled trunk prefix Table 3/Q.723
MSU	TSM	USM	Message signal unit Recommendation Q.701, § 2.3, Figures 7/Q.703, 8/Q.703, 14/Q.703, 15/Q.703, 16/Q.703
MTP	SSTM	PTM	Message transfer part Recommendation Q.701, § 2.1, Recommendation Q.721, § 1
MUA	DMA	ADGM	Maintenance oriented group unblocking-acknowledgement message Table 3/Q.723
NACK	ACN	RN	Negative acknowledgement Figures 7/Q.703, 13/Q.703, 14/Q.703
NNC	ERN	CRN	National-network-congestion signal Table 3/Q.723, Figure 3/Q.724
NSP	PSN	PSN	National signalling point Recommendation Q.705, § 3, Figure 1/Q.705
OMAP	SSEM	POMA	Operation, Administration and Maintenance Part Recommendations Q.700 and Q.795
OPC	CPO	CPO	Originating point code Recommendation Q.704, §§ 2.2.3 and 13.2, Figures 3/Q.704 and 14/Q.704, Recommendation Q.706, § 3, Recommendation Q.723, § 2.2.1
PCM	MIC	MIC	Pulse code modulation Recommendation Q.702, § 5.3
PCR	RCP	RCP	Preventive cyclic retransmission Tables 1/Q.706, 2/Q.706

English	French	Spanish	Meaning
POC	SIP	CIP	Processor outage control Figures 8/Q.703, 10/Q.703
RAN	NRP	RRE	Reanswer signal Table 3/Q.723, Figure 3/Q.724
RC	REC	CR	Reception control Figures 8/Q.703, 9/Q.703, 11/Q.703, 13-16/Q.703
RLG	LIG	LGU	Release-guard signal Table 3/Q.723, Figures 2/Q.724, 3/Q.724, 6/Q.724, 7/Q.724
RSC	RZC	RCI	Reseat-circuit signal Table 3/Q.723
RSM	TR	MPR	Signalling-route-set-test message Table 1/Q.704
RSRT	GRTF	CPC	Signalling route set test control Recommendation Q.704, § 13.5, Figures 23/Q.704, 29/Q.704, 43-46/Q.704
RST	TRS	PRS	Signalling-route-set-test signal Table 1/Q.704
RTAC	GRTA	CTA	Transfer allowed control Recommendation Q.704, § 13.3, Figures 29/Q.704, 33/Q.704, 37/Q.704, 43/Q.704, 45/Q.704, 46/Q.704
RTB	TRT	MTR	Retransmission buffer Figures 7/Q.703, 13/Q.703, 15/Q.703
RTPC	GRTI	CTP	Transfer prohibited control Recommendation Q.704, § 13.2, Figures 26/Q.704, 29/Q.704, 32/Q.704, 43/Q.704, 44/Q.704, 46/Q.704
SAM	MSA	MSD	Subsequent-address message Table 3/Q.723, Figure 3/Q.724
SAO	MSS	SDU	Subsequent-address message with one signal Table 3/Q.723
SBA	BSA	ABGSL	Software generated group blocking-acknowledgement message Table 3/Q.723
SBM	SE	MEC	Successful-backward-set-up information message Table 3/Q.723
SCCP	SSCS	PCCS	Signalling Connection Control Part Recommendations Q.700, Q.711-Q.714 and Q.716
SDL	LDS	LED	Functional specification and description language Recommendations Q.703, § 12, Q.704, § 6, Q.707, Recommendations Q.714, Q.724, Q.764, Q.774
SEC	EEC	CEC	Switching-equipment-congestion signal Table 3/Q.723, Figure 3/Q.724
SF	ETC	CE	Status field Figure 3/Q.703
SGB	BLS	BGSL	Software generated group blocking message Recommendation Q.723, Table 3/Q.723
SGU	DBS	DGSL	Software generated group unblocking message Recommendation Q.723, Table 3/Q.723
SI	INS	IS	Service indicator Recommendation Q.704, § 14
SIE	ETAU	IAE	Status indication "emergency terminal status" Recommendation Q.703, §§ 7.2, 7.3 and 10.1.3, Figures 2/Q.703, 4/Q.703, 7-9/Q.703, 13-16/Q.703
SIF	INF	CIS	Signal information field Figure 3/Q.703
SIN	ETAN	IAN	Status indication "normal terminal status" Recommendation Q.703, §§ 7.2, 7.3 and 10.1.3, Figures 2/Q.703, 4/Q.703, 7-9/Q.703, 13-16/Q.703
SIO	SER	OIS	Service information octet Figure 3/Q.703, Recommendation Q.723, § 1.2

English	French	Spanish	Meaning
SIO [2]	ETAP	IFA	Status indication "out of alignment" Recommendation Q.703, §§ 7.2, 7.3 and 10.1.3, Figures 2/Q.703, 4/Q.703, 7-9/Q.703, 13-16/Q.703
SIOS	ETHS	IFS	Status indication "out of service" Recommendation Q.703, §§ 7.2, 7.3 and 10.1.3, Figures 2/Q.703, 4/Q.703, 7-9/Q.703, 13-16/Q.703
SIPO	ETIP	IIP	Status indication "processor outage" Recommendation Q.703, § 10.1.3, Figures 2/Q.703, 7/Q.703, 8/Q.703, 13-16/Q.703
SLC	COC	CES	Signalling link code Recommendation Q.704, § 15, Figure 14/Q.704
SLM	GCS	GES	Signalling link management Recommendation Q.704, §§ 12.1 and 12.6, Figures 23/Q.704, 25/Q.704, 26/Q.704, 27/Q.704, 29/Q.703
SLS	SCS	SES	Signalling link selection code Recommendation Q.704, § 2.2.4, Figures 3/Q.704, 4/Q.704, 26/Q.704, A-3.1/Q.705
SLTA	ESCA	AMPS	Signalling link test message acknowledgement
SLTM	ESCO	MPES	Signalling link test message Figure 2/Q.707
SMH	OMS	TMS	Signalling message handling Recommendation Q.704, § 2, Figures 23/Q.704, 43/Q.704
SP	PS	PS	Signalling point Figures 8/Q.704, 23/Q.704, 24/Q.704, 26/Q.704, 27/Q.704, 30/Q.704, 31/Q.704, 42-44/Q.704
SPRC	CPS	CPS	Signalling procedure control Recommendation Q.724, § 10.1, Figures 1-7/Q.724
SRM	GRS	GRS	Signalling route management Recommendation Q.704, § 13, Figures 23/Q.704, 25-27/Q.704, 43/Q.704
SSB	OCC	ABO	Subscriber-busy signal (electrical) Table 3/Q.723, Figure 3/Q.724
SSF	DSS	CSS	Sub-service field Recommendation Q.704, § 13.1.1, Recommendation Q.723, § 1.2
SST	TSI	TIE	Send-special-information-tone signal Figures 1-7/Q.724
ST	ST	SFN	End-of-pulsing signal Recommendation Q.724, § 1.3
STLC	ESC	CPES	Signalling link test control Figures 25/Q.704, 26/Q.704, 2/Q.707
STM	GTS	GTS	Signalling traffic management Recommendation Q.704, § 4, Figures 23/Q.704, 25-27/Q.704, 30/Q.704, 35/Q.704, 39/Q.704, 43/Q.704
STP	PTS	PTS	Signalling transfer point Figure 4/Q.701, Recommendation Q.705, § 3, Figures A-1/Q.705, A-2/Q.705, Recommendation Q.706, § 4.3.3, Table 3/Q.706
SU	TS	US	Signal unit Figures 2/Q.703, 7/Q.703
SUA	DSA	ADGSL	Software generated group unblocking-acknowledgement messages Table 3/Q.723

[2] In English, another abbreviation will have to be found for *status indication "out of alignment"*, since the abbreviation SIO is already used for *service information octet*.

English	French	Spanish	Meaning
SUERM	STTS	MUS	Signal unit error rate monitor Figures 7/Q.703, 8/Q.703, 11/Q.703, 18/Q.703
SUM	SEE	ESNC	Sample unsuccessful backward setup information message Recommendation Q.723, § 3.7.1
TB	TEM	MT	Transmission buffer Figures 7/Q.703, 13/Q.703, 15/Q.703
TC	GT	CT	Transaction Capabilities Recommendations Q.700 and Q.771-Q.775
TCAP	SSGT	PACT	Transaction Capabilities Application Part Recommendations Q.700 and Q.771-Q.775.
TCBC	GTCN	TCRS	Changeback control Recommendation Q.704, § 6, Figures 27-29/Q.704, 31/Q.704
TCOC	GTCS	TCER	Changeover control Recommendation Q.704, § 5, Figures 27-30/Q.704, 37/Q.704
TCRC	GTRN	TCRC	Controlled rerouting control Recommendation Q.704, § 8, Figures 27/Q.704, 29/Q.704, 33/Q.704, 45/Q.704
TFA	TAO	TRA	Transfer-allowed signal Table 1/Q.704
TFM	TF	MTR	Transfer-prohibited and transfer-allowed messages Table 1/Q.704
TFP	TIO	PTR	Transfer-prohibited signal Table 1/Q.704
TFRC	GTRS	TCRF	Forced rerouting control Recommendation Q.704, § 7, Figures 27/Q.704, 29/Q.704, 32/Q.704
TLAC	GTSD	TCDE	Link availability control Recommendation Q.704, Figures 27-31/Q.704, 37/Q.704
TSFC	GTFX	CFTS	Signalling traffic flow control Figures 27/Q.704, 29/Q.704, 34/Q.704
TSRC	GTAC	CEN	Signalling routing control Recommendation Q.704, Figures 27-34/Q.704, 36/Q.704, 37/Q.704, 44-46/Q.704
TUP	SSUT	PUT	Telephone user part Recommendation Q.701, § 2.1, Figure 2/Q.701, Recommendation Q.721, § 1
TXC	EMI	CT	Transmission control Figures 8/Q.703, 9/Q.703, 12-16/Q.703
UBA	DBA	ARD	Unblocking-acknowledgement signal Table 3/Q.723
UBL	DBO	DBL	Unblocking signal Table 3/Q.723
UBM	EE	MEI	Unsuccessful-backward-set-up-information message Table 3/Q.723
UNN	NNU	NNA	Unallocated-national-number signal Table 3/Q.723, Figure 3/Q.724
UP	SSU	PU	User part Figure 2/Q.704

ISBN 92-61-03531-0