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Contents

Foreword

This document is the Publicly Available Specification (PAS) of the TETRAPOL land mobile radio system, which shall provide digital narrow band voice, messaging, and data services. Its main objective is to provide specifications dedicated to the more demanding PMR segment: the public safety. These specifications are also applicable to most PMR networks.

This PAS is a multipart document which consists of:

Part 1	General Network Design
Part 2	Radio Air interface
Part 3	**Air Interface Protocol**
Part 4	Gateway to X.400 MTA
Part 5	Dispatch Centre interface
Part 6	Line Connected Terminal interface
Part 7	Codec
Part 8	Radio conformance tests
Part 9	Air interface protocol conformance tests
Part 10	Inter System Interface
Part 11	Gateway to PABX, ISDN, PDN
Part 12	Network Management Centre interface
Part 13	User Data Terminal to System Terminal interface
Part 14	System Simulator
Part 15	Gateway to External Data Terminal
Part 16	Security
TTR 1	Guide to TETRAPOL features
Part 18	Base station to Radioswitch interface
Part 19	Stand Alone Dispatch Position interface

Introduction

The present Part specifies the TETRAPOL Air Interface Protocol used for the Voice and Data transfer. It describes the service primitives, the protocol procedures, the message structures, the different information elements and the their values.

The TETRAPOL radio protocol layers which are optimised for radio protocol performance are modelled as:

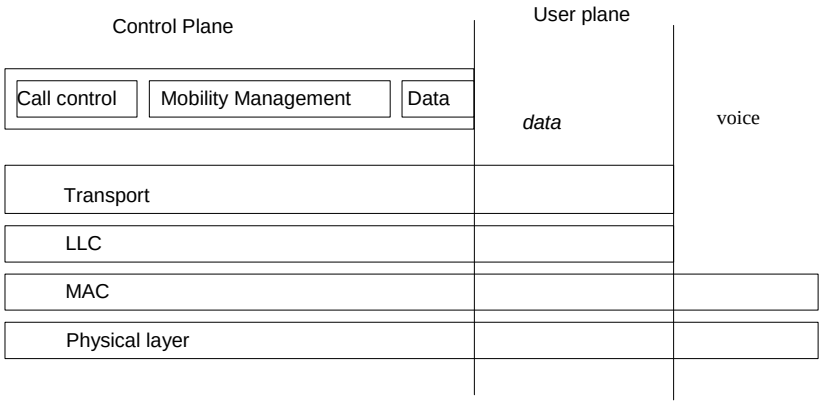


Figure 1: TETRAPOL Air Interface Protocol

The Air Interface Protocol is composed of the following layers and sublayers:

- Call control (CC), Mobility management (MM) and Data Application layers;
- Transport layer;
- Layer 2: Link level Control (LLC) + Medium Access Control (MAC);
- Layer 1: physical layer.

Part 3 describes the Application, Transport and LLC layers.

Layer 2 MAC and Layer 1 are described in PAS 0001-2 [4].

Part 3 is split into four subparts:

- **subpart 3-1 specifies the air interface application protocol;**
- subpart 3-2 specifies the air interface application messages;
- subpart 3-3 specifies the air interface transport protocol;
- subpart 3-4 specifies the air interface circuit mode protocol.

1. Scope

The present subpart 3-1 specifies the TETRAPOL air interface application protocol between the Radio Terminal and the Base Station at the R3 reference point (see PAS 0001-1-1 [1]). The underlying protocol is the transport protocol described in PAS 0001-3-3 [6].

The air interface application messages are described in PAS 0001-3-2 [5].

2. Normative references

This PAS incorporates by dated and undated reference, provisions from other applications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revision of any of these publications apply to this PAS only when incorporated in it by amendment or revision. For undated references the latest edition of publication referred to applies.

[1] PAS 0001-1-1: "TETRAPOL Specifications; General Network Design; Reference Model".

[2] PAS 0001-1-2: "TETRAPOL Specifications; General Network Design; Voice & Data Services".

[3] PAS 0001-1-3: "TETRAPOL Specifications; General Network Design; General mechanisms".

[4] PAS 0001-2: "TETRAPOL Specifications; Radio Air Interface".

[5] PAS 0001-3-2: "TETRAPOL Specifications; Air Interface Protocol; Air Interface Application Messages".

[6] PAS 0001-3-3: "TETRAPOL Specifications; Air Interface Protocol; Air Interface Transport Protocol".

[7] PAS 0001-3-4: "TETRAPOL Specifications; Air Interface Protocol; Air Interface Circuit Mode Protocol".

[8] TTR 0001-1-2: "TETRAPOL Specifications; Guide to TETRAPOL features; References and terminology'.

3. Definitions and abbreviations

3.1 Definitions

For the purposes of this PAS, the following definitions apply:

logical channels: Predefined subset of superframe blocks. Endpoint SwMI or RT applications use logical channels for exchanging TSDUs (defined in this document). If the exchange is bidirectional, both blocks subsets are identified by the same name in the superframe sent by the SwMI and the superframe received by the SwMI respectively.

Base Network (BN): Autonomous equipment assembly (RSW, digital links, radio cells, line access base stations, etc.) used throughout a given geographic area providing RT with system services.

RT address: Logical identifier (RFSI) which identifies an RT within the system. The RT address is a string of numeric characters, the first characters identify the Home Base Network (HBN).

coverage: Predefined set of cells.

group (of users) / Operational Group (OG): Group of RT sharing the same service at a given time.

group number / alias **"OG number"**: Logical number which identifies an operational user group.

3.2 Abbreviations

For the purposes of this PAS, the following abbreviations apply:

A/I	Air Interface
AG	Access Gate
BCH	Broadcast CHannel
BN	Base Network
BS	Base Station
BSC	Base Station Controller
CC	Connection Confirm
CCH	Control CHannel
CGI	Collective Group Identifier
COI	Collective Object Call identifier
CR	Connection Request
CRP	Connection Reference Point
CTCH	Collective Traffic CHannel
CUG	Closed User Group
DACH	Dynamic Access CHannel
DB	DataBase
DC	Disconnection Confirm
DCH	Data CHannel
DCN	Delivery Confirmation Notification
DCS	Dispatch Centre Server
DFN	Delivery Failure Notification
DM	Direct Mode
DM/NM	Direct Mode / Network Monitoring
DP	Dispatch Position
DR	Disconnection Request
DT	Data Transfer
DU	Data Unit
ECCH	Extended Control CHannel
EDT	External Data Terminal
FBM	FallBack Mode
FDR	Fast Disconnection Request
HMSW	Home Main SWitch
HRSW	Home RadioSWitch
ISI	Inter System Interface

KMC	Key Management Centre
LABS	Line Access Base Station
LCT	Line Connected Terminal
LLC	Logical Link Control
MAC	Medium Access Control
MCCH	Main Control CHannel
MM	Mobility Management
MOCH	Multisite Open CHannel
MS	Mobile Station
MSG APPLI	Messaging APPLIcation
NMC	Network Management Centre
OC	Object Call
OG	Operational Group
OMC	Operation and Maintenance Centre
PABX	Private Automatic Branch eXchange
PAS	Publicly Available Specification
PCH	Paging CHannel
(P)DN	(Public) Data Network
PDU	Protocol Data Unit
PMR	Private Mobile Radiocommunications
PSTN	Public Switched Telecommunications Network
PTCH	Private Traffic CHannel
PTT	Push-To-Talk
RACH	Random Access CHannel
RCH	Random access answer CHannel
Ri	Reference point index i
RNK	Regional Network Key
RP	RePeater
RSW	RadioSWitch
RT	Radio Terminal
RTI	Random Terminal Identity
SADP	Stand Alone Dispatch Position
SCH	Stealing CHannel
SCH_TI	Stealing CHannel for Transmitter Interruption
SDCH	Signalling and Data CHannel
SDL	Specification and Description Language
SDP	Submit Delivery Protocol
SFN	Submit Failure Notification
SIM	Subscriber Identity Module
ST	System Terminal
SwMI	Switching and Management Infrastructure
TCH	Traffic CHannel
TCP/IP	Transmission Control Protocol/Internet Protocol
TDX	Telephone and Data eXchange
TKK	Terminal Key of Key
TMSG-Id	Temporary MeSsaGe Identifier
TP	TransPort layer
TPDU	Transport service Protocol Data Unit
TSAP	Transport Service Access Point
TSAP-Id	Transport Service Access Point Identifier
TSDU	Transport Service Data Unit
TTI	Temporary Terminal Identity
UA	User Agent
UDT	User Data Terminal
VRSW	Visited RadioSWitch
X.400 MTA	X.400 Message Transfer Agent

4. General

The protocol described here applies to RT and to AG so the ST (system terminal) will be referred as RT in the whole document.

Applications are divided into groups and the Protocol is described for each of them. Each application shall fulfil a specific protocol function:

The group of VOICE applications:

- PRIVATE CALL: (INDIVIDUAL CALL, PABX CALL, MULTIPARTY CALL, INTRUSION);
- GROUP COMMUNICATION: OPEN CHANNEL, TALK GROUP, BROADCAST CALL, OBJECT CALL, TOWER COMMUNICATION;
- EMERGENCY;

The group of DATA application:

- DATA: SHORT DATAGRAM, CONNECTED PACKET, BROADCAST MODE with or without paging, TRANSFER IN POLLING MODE.

The group of Monitoring and Observation applications; This group shall include all the mechanisms required to monitor the RT so as to guarantee data and voice service provision as follows:

- BROADCAST;
- TRANSPORT PROTOCOL MANAGEMENT;
- REGISTRATION;
- RT MANAGEMENT;
- KEY DELIVERY;
- INFORMATION DELIVERY.

The SwMI and RT endpoint applications shall exchange TSDU sequences using Service Transport primitives (see PAS 0001-3-3 [6]).

Any TSDU sequence exchanged during a transport connection shall be called an **application transaction**.

4.1 Logical Interface Model

4.1.1 Main Control Channel

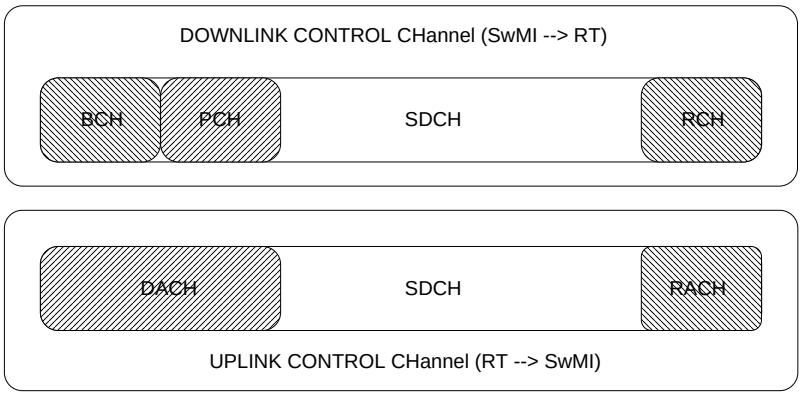


Figure 2: Main Control channel model

There is always one, and only one, main control channel per cell.

The SwMI and RT endpoint applications shall exchange TSDU sequences across logical BCH, SDCH and DACH control channels.

- the SwMI broadcasts technical network information on the BCH and both technical and operational information on SDCH;
- SwMI and RT dialogue on SDCH;
- the RT can send fast, short application information on DACH;
- Other logical control channels defined in PAS 0001-3-3 [6] are used for initiating dialogues (PCH, RACH and RCH).

The control channel structure is a system parameter. It shall associates each superframe segment with a logical channel. This structure is defined in PAS 0001-3-3 [6].

The main control channel scrambling parameter on the downlink shall be the same for all network cells. It shall be a system constant.

The main control channel scrambling parameter on the uplink may be not the same for all network cells. It shall be an interface parameter.

4.1.2 Extended Control Channel

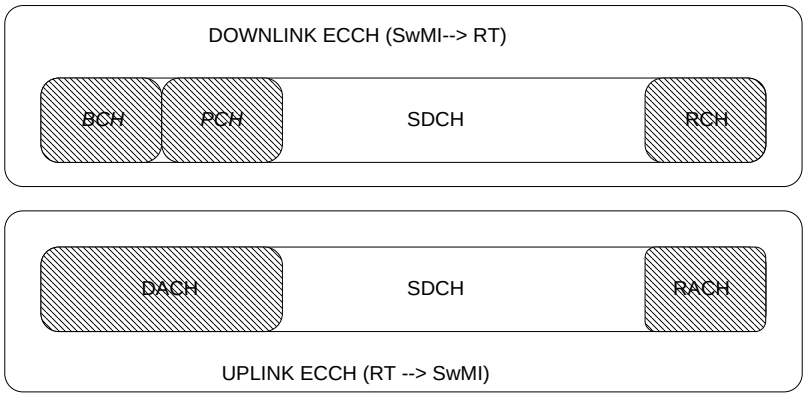


Figure 3: Extended Control Channel model

The SwMI may enable one or more extended control channels (ECCHs) in a cell, whenever required, in conjunction with MCCH for SwMI / RT dialogues. The channels are multiplexed in exactly the same way as for MCCH.

The SwMI shall inform the RT of the existence, number and characteristics of ECCH on each control channel. It shall be an interface parameter.

SDCH, BCH, PCH, DACH. RCH and RACH shall be used in the same way as MCCH.

Case: MODE = 1 <=> ECCH is an MCCH extension
Case: MODE = 0 <=> ECCH is an SDCH extension (PCH and BCH are not used).

The ECCH scrambling parameters on the downlink and uplink may be not the same for all network cells. It shall be an interface parameter.

How RT (and SwMI) determines which ECCH they will use for dialogue?

RT examine the D_ECCH_DESCRIPTION TSDU, more precisely the ECCH_ORGANISATION information element see PAS 0001-3-2 [5].

N is the number of ECCH in used.

M is the CCH number corresponding to the RT: with 0 = MCCH, 1 to N is the rank of the ECCH in the D_ECCH_DESCRIPTION TSDU.

Case: MODE = 0 <=> the MCCH may be used as a dialogue channel

M = Bin [SN7, SN8] modulo (N+1)

Case: MODE = 1 <=> the MCCH shall not be used as a dialogue channel

M = 1 + Bin [SN7, SN8] modulo N

Bin [SN7, SN8] = Binary Transformation of 2 last digits of the RT serial number

Example, SN = 1 2 3 4 5 6 7 8

SN 7 = 7 , SN 8 = 8 ➔ Bin [SN7,SN8] = Bin [78] = 4E = 0100 1110
If N = 2 (2 ECCH) and MCCH = 0, then M = 0100 1110 modulo 3 = 0 (RT shall dialogue on MCCH)
If N = 2 (2 ECCH) and MCCH = 1, then M = 1 + 0100 1110 modulo 2 = 1 (RT shall dialogue on first ECCH)

4.1.3 Traffic Channel

4.1.3.1 Voice Traffic Channel

The RT and SwMI endpoint applications shall exchange TSDU sequences on the SCH channel.

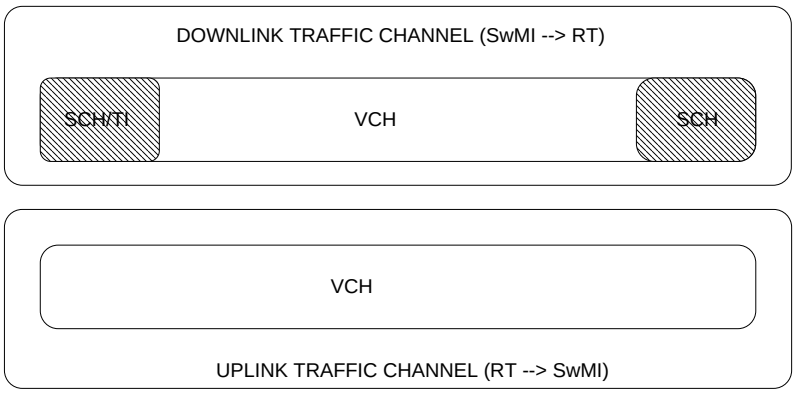


Figure 4: Voice Traffic Channel model

SCH_TI is used to force RT reception during transmission.

SCH is used to send TSDU. The logical channel shall be constructed in mode 1 or mode 2.

Mode 1, the number of segments used to construct the logical channel shall be limited to 2 to minimise the impact on voice channels.

Mode 2, SCH occupies the entire superframe.

The remaining Traffic Channel is used to construct the VCH which conveys end to end speech or data frames and protocol control frames "in circuit mode". See description in PAS 0001-3-4 [7].

4.1.3.2 Data Traffic Channel

The RT and SwMI endpoint applications shall exchange TSDU sequences on the DCH traffic channel.

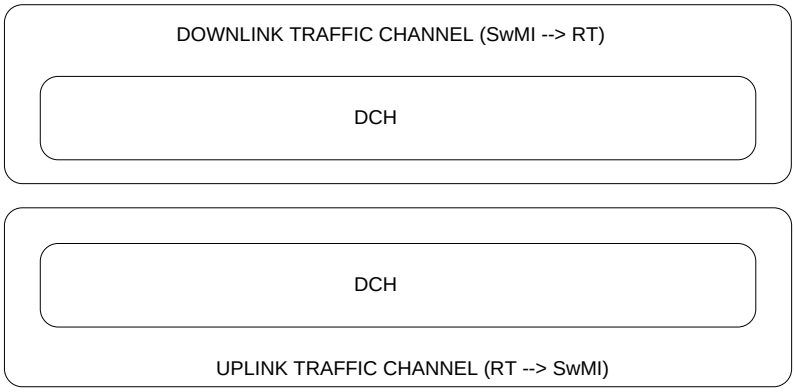


Figure 5: Data Traffic Channel model

4.2 Protocol Definition

4.2.1 Link Level

Figure 6: Link level

An RT shall be associated with no more than one level 2 link at a given time.

4.2.1.1 Address

4.2.1.1.1 Individual terminal address

The level 2 individual address used for SwMI-RT interface exchanges shall be derived from the Temporary Terminal Identifier (TTI) assigned to the RT by the SwMI.

The TTI-RT association shall be confirmed when the first application transaction succeeds.

The TTI-RT association shall be broken off:

- If the SwMI or the RT detects that T730 has expired;
- If the RT sends a new TTI assign request;
- If both the RT and the SwMI detect RT disabling.

4.2.1.1.2 Random individual address

The RT shall use a level 2 random address to ask the SwMI to assign a TTI. It shall be derived from the Random Terminal Identifier (RTI) drawn by the RT.

4.2.1.1.3 Collective address

A level 2 collective address shall be used to identify a group of RTs and shall be used by the SwMI in connectionless mode associated with the datagram transport layer.

There shall be 2 collective address sub-types:

- the ALL RT address which designates all the RTs present in the cell, derived from a special TTI which designates ALL RTs;
- the GROUP address which designates a group of RT, derived from a collective group identity or CGI (in turn derived from the Operational Group).

Table 1: Types of addresses

Address Type	Sub-Type	Derived from
Individual		individual TTI
Random		RTI
Collective	ALL RT	ALL TERMINAL TTI
	GROUP	Collective group identity CGI (=OG)
		Collective object call identity COI

4.2.1.2 Set-up

The SwMI shall set-up level 2 connections during the registration procedure. In principle, level 2 remain in the CONNECTED status.

When level 2 is in the DISCONNECTED status, the SwMI shall re-establish the connection prior to each application transaction requested by the SwMI or the RT.

4.2.1.3 Monitoring

Level 2 monitoring shall consist in checking of the validity of the TTI assigned to a Terminal.

4.2.1.4 Release

If the RT level 2 encounters a disconnect condition, it shall alert the application and change to disconnected status.

This event shall involve a level 4 disconnection if a transport connection is established.

4.2.1.5 DACH

The data link protocol handles access and application information transfers on DACH (see PAS 0001-3-3 [6]).

4.2.2 Transport level

Figure 7: Transport level definition

4.2.2.1 Transport Service Access Points (TSAP)

A TSAP shall be defined on the radio interface for each separate application.

The TSDU exchanged by the SwMI and RT endpoint applications shall be carried onto the radio interface with a TSAP identifier, TSAP_ID, which designates the application.

A transport connection shall be identified by 2 TSAP identifiers (one for each endpoint application).

4.2.2.2 Use of the Transport service in datagram mode

This mode shall be used on logical channels: BCH, SCH, SDCH.

In this mode, the Transport layer shall be supported by level 2 in non-acknowledged mode.

The TSDU sent by the SwMI shall be carried onto the radio interface with a single TSAP identifier, TSAP_ID, which shall designate the receiver application.

4.2.2.3 Use of the Transport service in "DACH access" mode

This mode shall be reserved for transferring information sent by the RT to the SwMI on DACH.

Two data segments shall be used on DACH for sending signalling messages, the size of the TSDU is fixed at 10 octets.

The TSDU shall be carried onto the radio interface with a single TSAP identifier, TSAP_ID, which shall designate the sender application.

4.2.2.4 Use of the Transport service in connection-oriented mode

This mode is reserved for transferring information exchanged by the SwMI and the RT on SDCH.

4.2.2.4.1 Transport connection

Each application transaction shall use a new Transport connection opened for the first (and closed after the last) TSDU in the sequence.

Both the SwMI and the RT can initiate the transport connection.

4.2.2.4.2 Quality of Service

Unless otherwise indicated, each application works on the SwMI-RT interface with minimum quality of service (value 0) at Transport level.

4.2.2.4.3 Transport connection opening

The applications on both ends, RT or SwMI can request Transport connection opening.

The quality of service field, QoS, shall convey the preferred uplink transfer quality, and the selected downlink transfer quality.

4.2.2.4.4 Transport connection closing

The application shall initiate Transport connection closing.

Each endpoint releases level 4 in the following cases:

- normal end of transport connection;
- confirmation of going to TCH;
- disconnection of level 2.

4.2.2.4.5 Disconnection

When a level 4 communication error triggers level 4 disconnection and where the level 2 connection is sustained, the RT shall no longer consider itself as engaged in any application transaction with the SwMI and shall change back to stand by on the CCH.

4.2.3 Application Level

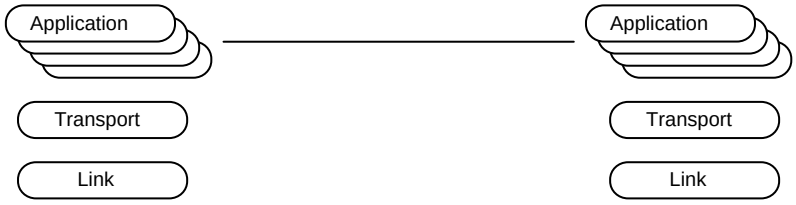


Figure 8: Application level definition

4.2.3.1 Conventions

The protocol is illustrated by the exchange TSDU data flow charts, the following conventions shall apply:

Each application protocol TSDU shall be identified by:

- a unique name;
- an uplink or downlink direction (SwMI → RT or SwMI ← RT);
- the TPDU which convey it.

TSDUs shall be exchanged by the SwMI on the left and the RT on the right.

The exchanged TSDU name is shown over the arrow going from the sender to the receiver.

Optional exchange shall be shown in brackets.

If, at any given time, an application can choose to send any of a number of TSDU, without affecting the remaining data flow chart, the TSDUs shall be shown with a separator.

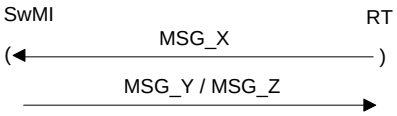


Figure 9: Message exchange representation

Timers-shall be represented on the side of the application that sets, cancels them and handles time-out. The chart below shows Txyz and Tabc:

- Txyz, timer set in the RT after sending a TSDU, shall be cancelled on receipt of a response from SwMI;
- Tabc, timer set in the SwMI after sending a TSDU to guard against no reply from the RT, on expiry another TSDU is sent.

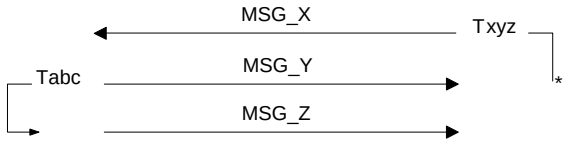


Figure 10: Timers representation

When of interest, a lower level exchange may be shown in an application transaction (if it influences an application timer setting, for example), in this case the exchange shall be shown with a dotted line:

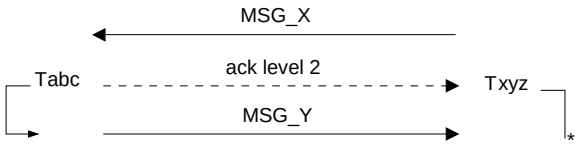


Figure 11: Lower level exchange representation

To highlight an error, the TSDUs not received by the other end may be illustrated, in which case they are shown by a broken line:

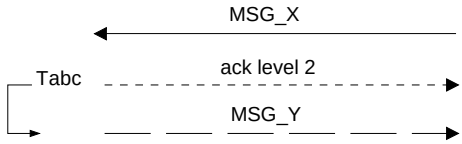


Figure 12: Message flow error representation

4.2.3.2 Priority, Application references

An application connection is the exchange of TSDUs required to implement an application service (E.g.: individual call).

It is comprised of one (e.g.: REGISTRATION) or more (e.g. PRIVATE CALL) application transactions.

Either end shall assign an application reference (BS_REF, RT_REF) to the application connected, which is generated by the application involved on receiving an open application connection request. These 2 references shall appear in the first 2 TSDUs of each application transaction and shall be conveyed in Connection Request (CR) and Connection Confirm (CC) TPDUs.

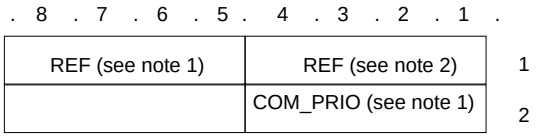


Figure 13: 2 header octets in the first application transaction TSDU

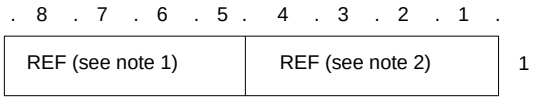


Figure 14: Header octets in the TSDU reply

NOTE 1: Set by the initiating application when the application connection is opened.

NOTE 2: Set by the other end when the application connection is opened, this field is not significant in the first TSDU of the first application connection transaction.

To an application connection shall be assigned an application priority (CALL_PRIORITY), set by the initiating application. The priority shall appear in the first TSDU of each application transaction.

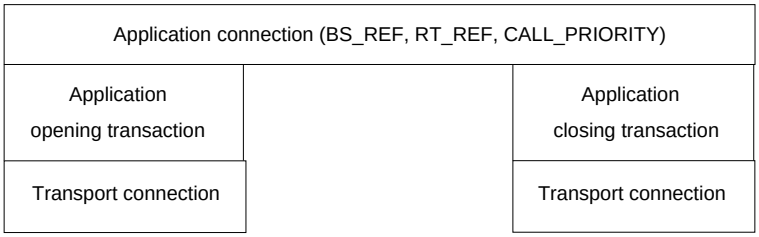


Figure 15: Application priority

The (BS_REF, RT_REF, CALL_PRIORITY) references shall concern a specific application interface service (e.g.: private call), regardless of the number of application transactions executed during the service life.

4.3 General mechanisms

4.3.1 RT Monitoring by the SwMI

The SwMI shall monitor the RT, i.e., it shall know where the RT is located in the system, can identify it on the SwMI-RT interface and knows the RT's Private Traffic Channel (PTCH) position in the radio cell.

4.3.1.1 RT location

The SwMI can locate the RT in its location area via its address.

The mechanisms used to enable this function on the radio interface shall be described in BROADCAST and REGISTRATION applications.

4.3.1.2 RT identity

The SwMI shall identify an RT by a TTI (Temporary Terminal Identity) within a location area.

The SwMI shall assign the TTI which is then used to generate a level 2 individual address.

TTI assignment to an RT, and also the mechanisms used to maintain it shall be described in the subclause corresponding to REGISTRATION and RT MANAGEMENT applications.

4.3.1.3 RT CCH / TCH position management

- RT is"accessible" or"busy"

If a SwMI-RT application connection is open on CCH or RT is engaged in a private call on PTCH (where the RT switching to PTCH is always controlled by the SwMI), the SwMI can locate the RT on one of these channels (MCCH, ECCH, PTCH) in a radio cell.

If the SwMI can initiate an application transaction with the RT (determined by application priorities defined in PAS 0001-1-3 [3], the SwMI considers the RT as "accessible".

If the SwMI cannot initiate an application transaction RT (determined by application priorities defined in PAS 0001-1-3 [3], the SwMI considers the RT as "busy".

- RT is "free"

If no application connection is open, namely the case of RT standing by on the control channel or taking part in a collective voice application. In the second case the RT switches between CCH and CTCH according to the group communication activity status, without informing the SwMI who ignores the participant's identity, the SwMI considers the RT as "free".

The SwMI cannot precisely locate the RT in one of the location area cells (see below).

4.3.2 Exchange initiation

Either the RT or the SwMI may initiate an exchange.

4.3.2.1 Terminal initiated exchange

If the RT is on the TCH, it first shall switch over to the CCH without informing the SwMI.

4.3.2.1.1 Spontaneous access on DACH

An RT application shall use the Dynamic Access Channel (DACH) to send a short information message.

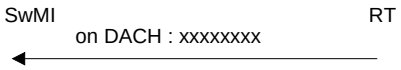


Figure 16: Spontaneous access on DACH

4.3.2.1.2 Spontaneous access on RACH

The RT shall access the RACH to initiate-or re-establish an application transaction.

The RT shall use the RACH and supply its current TTI identifier (RTI for a TTI assignment request).

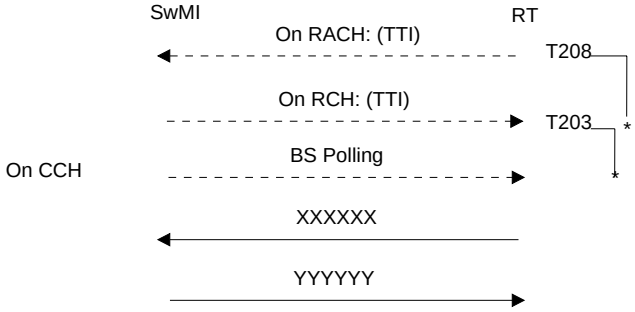


Figure 17: RACH / RCH transmission

The SwMI shall poll the RT according to the level 2 protocol definition.

If the RT is no longer polled by the SwMI and wishes to restart the dialogue, it shall use in the same way the random access (RACH).

4.3.2.2 Network initiated exchange

Two cases are encountered:

- the SwMI wishes to make "immediate contact" (RT warning on DCH or SCH channel and immediate sending of a TSDU to the RT);
- the SwMI wishes to make "acknowledged contact" (RT warning and wait for wake-up confirmation by the RT on DACH).

and the RT status ("accessible", "free", "non-registered") as seen by the SwMI is deterministic.

- RT is accessible (see definition above)

  The SwMI shall know the exact RT location (cell number) and position (PTCH, MCCH, DCH or ECCH).

- RT is "free" (see definition above)

  The RT is registered in one of the location area cells, it is either on stand-by on the CCH, or engaged in a group communication, or unreachable (switched off or in direct mode: generally temporary not reachable by the network). The SwMI does not know the exact RT location (cell number), or position (CTCH, CCH).

- The RT is "non-registered"

  The SwMI cannot locate the RT within the system, the SwMI shall not take any action.

4.3.2.2.1 Preliminary remarks. RT paging on CCH or TCH

- T500 Setting: The RT in stand-by mode shall set a T500 timer when a PCH segment contains at least one address derived from:
  - the RT's TTI containing an "immediate contact" indication;
  - the ALL RT TTI;
  - a CGI;
  - a COI
  - or a concerned bit in the bitmap.

- T501 Setting: The RT shall set a T501 timer after each application transaction or when it receives a message asking the RT to leave TCH or DCH and stand by on the CCH, derived from:
  - the RT's TTI containing an "immediate contact" indication;
  - the ALL RT TTI;
  - a CGI,

As long as T500 or T501 are set, the RT shall listen to the CCH.

When the PCH or SCH, responsible for setting T500 or T501, is addressed by an individual TTI, the RT shall not switch to CTCH as long as T500 or T501 is running.

- T500 and T501 cancelling:

The RT cancels T500 or T501:

- when level 4 sends a Connection Request (CR) up to the higher layers.
- after changing channels.

If T501 or T500 expires, the RT shall return to stand-by mode.

4.3.2.2.2 The RT is accessible (engaged in an application transaction with the SwMI)

The SwMI shall sends a Fast Disconnection Request (FDR), or disconnection Request (DR). The RT shall send an acknowledgement, remain on stand-by on the CCH and set a timer.

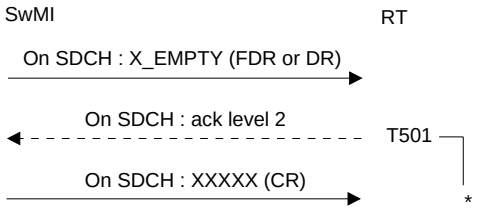


Figure 18: Paging - case RT engaged in an application transaction

The RT shall cancel T501 when level 4 sends a CR to the above layers. T501 expiry is handled in the same way as above (see above).

4.3.2.2.3 RT is accessible (on PTCH), (immediate contact)

The SwMI wishes to initiate an exchange with an RT on PTCH, in "immediate contact mode", the dialogue shall take place on CCH.

1) If the RT is transmitting, the SwMI shall issue an order to go to reception on SCH/TI and shall wait at least D150. The RT shall remain on stand by on TCH for at least D101.

2) The SwMI shall send a return to CCH order on the SCH, and shall wait D551 before sending all the TSDUs addressed to the RT on the SDCH.

3) When the RT receives the order, it stands by on the CCH and sets a T501 timer. It shall cancel T501 when level 4 sends a CR to the above layers.

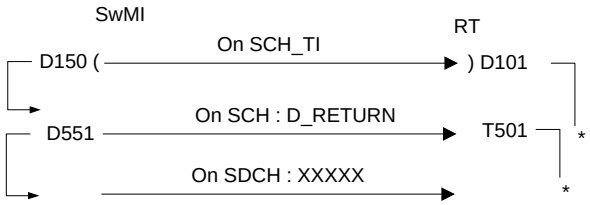


Figure 19: Paging - case RT accessible - immediate contact

4) If T501 expires, the RT shall return to stand-by mode.

If the RT does not answer, the SwMI level 2 informs the above layers, the SwMI shall repeat the entire sequence. The maximum number of retransmissions shall be N551.

4.3.2.2.4 RT is accessible (on PTCH) (acknowledged contact)

The SwMI wishes to initiate an exchange with a RT on the PTCH, in "acknowledged contact" mode, the dialogue shall take place on the CCH.

1) The SwMI shall alert the RT on PTCH/SCH that the D_RETURN TSDU address field, derived from the RT's TTI, contains an "acknowledged contact" indication: see CGI / RTI / TTI / COI coding. This message may be preceded by a SCH_TI in the same conditions as before.

2) After sending the message on the SCH, the SwMI shall wait for an acknowledgement from the RT (U_ANSWER_TO_PAGING TSDU) for at least T506 then shall retransmit the same message.

The total number of retransmissions shall be fixed at N551.

4) As soon as it receives the U_ANSWER_TO_PAGING TSDU acknowledgement message, the RT shall set T507. The RT shall cancel T507 when level 4 sends a CR to the above layers.

The RT shall not execute the switching to CTCH as long as T507 is running.

5) When T507 expires, the RT shall return to stand-by mode.

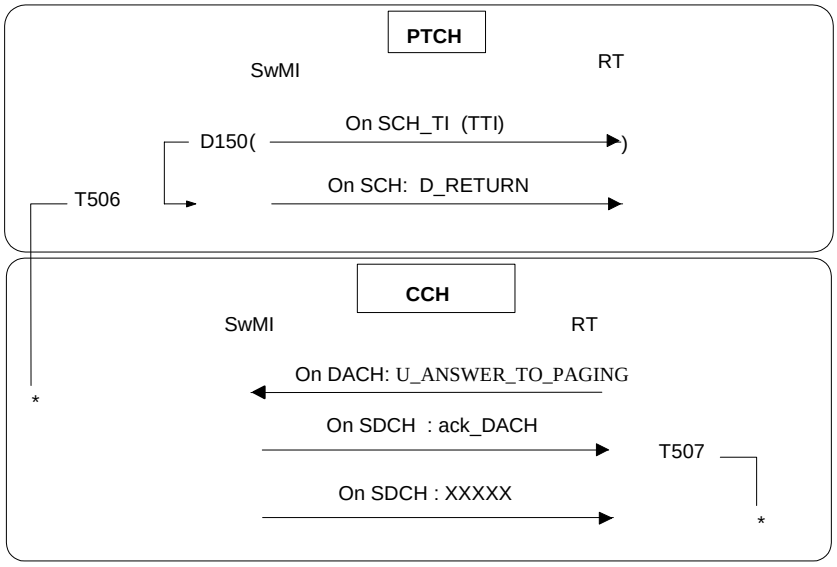


Figure 20: Paging - case RT accessible - acknowledged contact

4.3.2.2.5 The RT is free (Immediate contact)

When the SwMI wishes to dialogue to initiate an exchange with a free RT, it shall use:

- the PCH; for the first attempt;
- and then the PCH and the SCH of certain CTCH of the current cell + umbrella cell, determined by the incoming call priority table defined in PAS 0001-1-3 [3].

1) The SwMI shall send a PCH indication which shall convey the RT individual address + an "immediate contact" indication. See CGI / RTI / TTI/ COI coding in document PAS 0001-3-3 [6].

   Between the transmission of the wake-up message (PCH) and the first TSDU on the SDCH, the SwMI shall wait for at least D551.

   If the SwMI level 2 detects no response from the RT, the following sequence shall be repeated N550 times.

2) the SwMI shall end (in addition to another PCH indication), on
   - CTCH/SCH of the current cell an order to switch to CCH (D_RETURN). This message may be preceded by SCH_TI if the RT is identified by RT as transmittng RT on TCH.
   - CTCH/SCH of the umbrella cell an order to switch to CCH (D_BACK_CCH).

   Between the transmission of the wake-up message (PCH) or SCH message and the first TSDU on the SDCH, the SwMI shall wait for at least D551.

   Both messages are adressed with a TTI (D_RETURN) or collective ALL_RT (D_BACK_CCH) + an "immediate contact" indication. See CGI / RTI / TTI coding in PAS 0001-3-3 [6].

3) When the RT receives the PCH, it shall set a T500 timer and switch-over to the CCH.

   When it receives the D_RETURN or D_BACK_CCH message, the RT shall set a T501 timer and remain on stand by on the CCH.

   The RT shall cancel T500 or T501 when level 4 sends a CR to the above layers.

4) When T500 or T501 expires, the RT shall remain on stand by on the CCH.

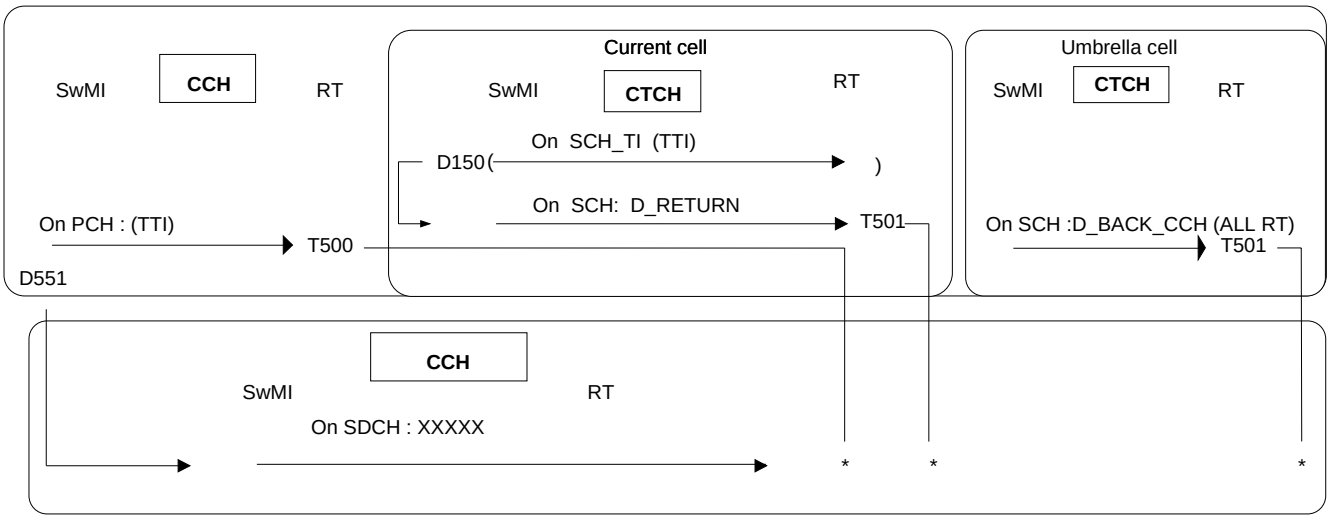


Figure 21: Paging - case RT free - immediate contact

4.3.2.2.6 The RT is free (Acknowledged contact)

When the SwMI wishes to dialogue to initiate an exchange with a free RT, it shall use:

- the PCH; for the first attempt
- and then the PCH and the SCH of certain CTCH (see note) of the current cell + umbrella cell.

NOTE: CTCH choice is determined by the incoming call priority table defined in PAS 0001-1-3 [3].

1) The SwMI shall send a PCH indication which shall convey the RT individual address + an "acknowledged contact" indication. See CGI / RTI / TTI / COI coding in document PAS 0001-3-3 [6].
After transmission of the PCH, the SwMI shall wait for the acknowledgement from the RT (U_ANSWER_TO_PAGING TSDU) for at least T506 then retransmit the entire sequence.

If the SwMI detects no response from the RT, the following sequence shall be repeated N550 times.

2) the SwMI shall end (in addition to another PCH indication), on
   - CTCH/SCH of the current cell an order to switch to CCH (D_RETURN). This message may be preceded by SCH_TI if the RT is identified by RT as transmitting RT on TCH;
   - CTCH/SCH of the umbrella cell an order to switch to CCH (D_BACK_CCH).

   Both messages are adressed with a TTI (D_RETURN) or collective ALL_RT (D_BACK_CCH) + an "acknowledged contact" indication. See CGI / RTI / TTI coding in PAS 0001-3-3 [6].

   After transmission of the last message on the PCH or the SCH, the SwMI shall wait for the acknowledgement from the RT (U_ANSWER_TO_PAGING TSDU) for at least T506 then retransmit the entire sequence (The total number of retransmissions shall be fixed at N551).

3) When the RT receives the PCH or the SCH, it shall switch over to the CCH and send a U_ANSWER_TO_PAGING TSDU on DACH.

4) As soon as it receives the U_ ANSWER_TO_PAGING TSDU acknowledgement, the RT shall set T507. The RT shall cancel T507 when level 4 sends a CR to the layers above.

5) When T507 expires, the RT shall remain on stand by on the CCH.

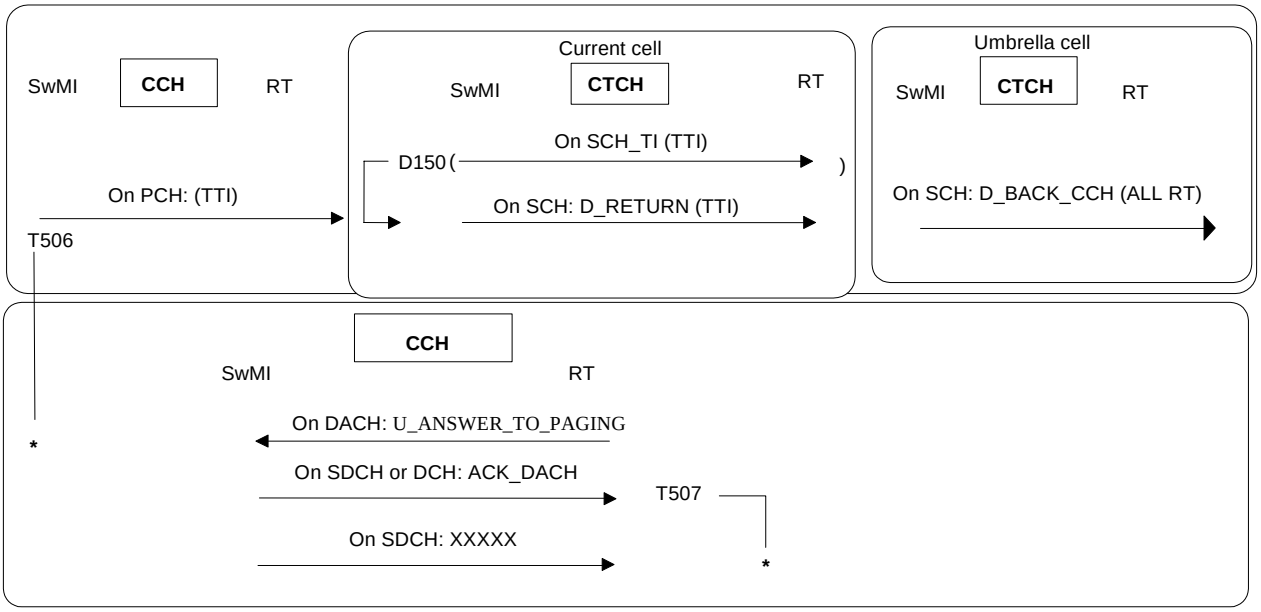


Figure 22: Paging - case RT free - acknowledged contact

4.3.3 Coexisting versions

The RT and the SwMI shall handle the situations created when different protocol versions co-exist, Different situations may be encountered:

(a) The RT receives an unknown or errored TSDU in an application transaction.

This occurs when the SwMI version is an upgrade of the RT version. The TSDU is sent to the RT via its TTI in Network connected mode and RT:

- does not recognise the TSDU (unknown operation code);
- detects the absence or a coding error in a "mandatory" IE (see PAS 0001-3-2 [5]);
- detects the absence or a coding error in a "conditional" IE (when the value or the presence of a "mandatory" IE requires its presence).

If the TSDU was the last in the application transaction (conveyed by the DR TSDU), the RT shall send an "X_EMPTY" TSDU.

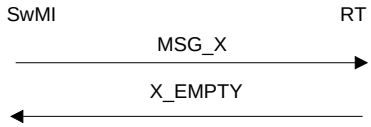


Figure 23: Dialogue failure RT side - error in last TSDU

Else, the RT shall abort the application transaction for cause of "Unknown TSDU", "Missing mandatory IE" or "Missing conditional IE"

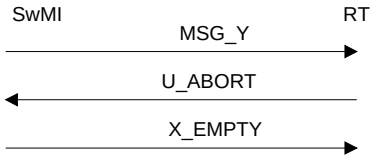


Figure 24: Dialogue failure RT side - error in TSDU

(b) The RT receives an unknown TSDU sent in datagram mode.

The RT shall ignore the TSDU.

(c) The RT receives an errored TSDU sent in "datagram" mode.

The RT detects the absence or a coding error in a "mandatory" or "conditional" IE (see PAS 0001-3-4 [7]). This case is unlikely.

The RT shall ignore the TSDU.

(d) The SwMI receives an unknown or an errored TSDU in an application transaction

This occurs when the RT version is an upgrade of the SwMI version.

This can happen when the SwMI:

- cannot interpret the TSDU (unknown operation code);
- detects the absence or a coding error in a "mandatory" IE (see PAS 0001-3-2 [5]);
- detects the absence or a coding error in a "conditional" IE (when the value or the presence of a "mandatory" IE requires its presence).

If the TSDU was the last in the application transaction (conveyed by the DR TPDU), the SwMI shall send an "X_EMPTY" TSDU.

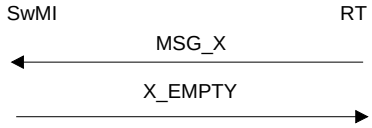


Figure 25: Paging failure SwMI side - error in last TSDU

Else, the SwMI shall refuse the application transaction for cause of "Unknown TSDU", "Missing mandatory IE" or "Missing conditional IE"

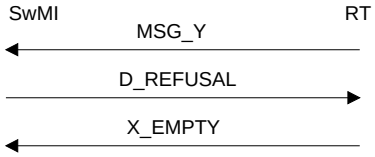


Figure 26: Paging failure SwMI side - error in TSDU

The SwMI shall receive an unknown or errored TSDU on the DACH: the SwMI shall acknowledge the request, but shall ignore the TSDU.

4.3.4 Application defence

4.3.4.1 Concurrent application transactions

(a) Terminal on CCH

Only one application transaction shall exist on a Terminal at any given time (a single level 4 connection per application at a given time).

Potential conflicts are:

- between an incoming application and an outgoing application; or,
- by crossed requests sent by the Terminal and the Network.

The conflict shall be resolved according to the priority rules stated in PAS 0001-1-3 [3], and is based on the Transport Service Access Point Identification (TSAP_ID) information (associated with each application) as well as on the application request priority.

If one of the two requests cannot be selected according to these rules, then the request sent by the network shall be chosen. The SwMI or the RT shall send an X_EMPTY TSDU to indicate that the application transaction request is refused.

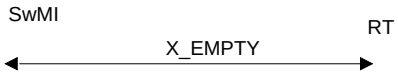


Figure 27: Refusal of an application transaction request

(b) Terminal on PTCH

A Terminal positioned on PTCH shall necessarily be engaged in a private voice application.

During the main phase when the terminal is on the PTCH, signalling from SwMI to RT shall be done in datagram mode on SCH.

(c) Terminal on the CTCH

A Terminal positioned on the CTCH shall necessarily be engaged in group communication.

During the main phase, when the terminal is on CTCH, signalling from SwMI to RT shall be done in datagram mode on SCH.

(d) Terminal on the DCH

The conflict shall be resolved according to the priority rules stated in PAS 001-1-3 [3], and is based on the Transport Service Access Point Identification (TSAP_ID) information (associated with each application) as well as on the aplication request priority.

If the network chooses to interrupt the current data transaction, it shall send the D_DATA_END message to the RT with the following cause:

"preemption": A preemptive application in the swMI causes the interrupt of data transmission.

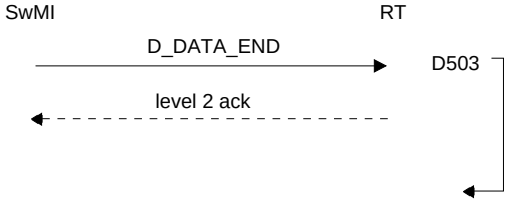


Figure 28: Preemption of the transmission

if the interruption is on RT initiative, the RT switches immediately on its own to CCH. On CCH, the RT initiates the dialogue for the preemptive application. The RT and SwMI shall discard the preempted data transmission connection.

4.3.4.2 Security of application transactions

The RT shall set protective application timers (T7XX) to secure any application transaction, which is not protected by the lower layer protocols.

Time out normally should not occur since those timers increase the time that the SwMI dedicates to the RT for this application transaction phase.

If a time-out does occur:

- if the RT was waiting for a disconnect request at transport level, the RT shall send an X_EMPTY TSDU;
- else the RT shall abort the application transaction for cause of "application failure".

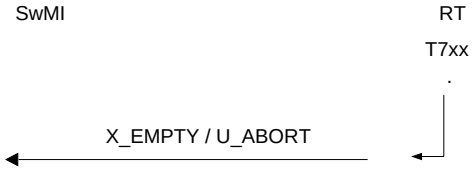


Figure 29: Application transaction failure

The RT shall set a protective protocol timer (T504) when it is waiting for the end of an application transaction without any further application information.

At time-out, the RT shall initiate the application transaction closing sequence.

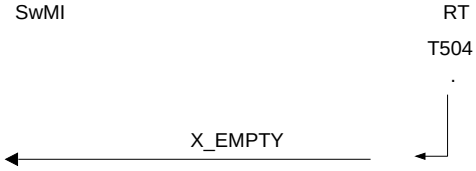


Figure 30: Application transaction closing

The RT shall react to any fault it detects in its own software while application transactions are being executed.

If any such fault is detected during an ongoing transaction, the RT shall close the application transaction at T504 expiry (transmission of X_EMPTY TSDU).

4.3.5 Application transactions failures

4.3.5.1 SwMI side

The SwMI shall refuse an application transaction called by the RT when the request is abnormal (unknown RT, coding error in the information conveyed by the TSDU, etc.). The cause for refusal is usually due to the user.

The SwMI shall reject an application transaction initiated by the RT or by itself because the transaction cannot be successfully continued (RT pre-emption, lack of resources, unreachable called party), the cause for rejection is usually due to the system.

The SwMI therefore shall send a D_REFUSAL (D_REJECT) TSDU containing CAUSE information giving the reason for refusal (rejection).

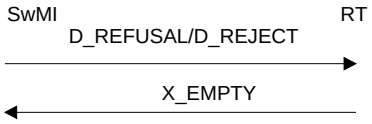


Figure 31: Application transaction failure - refusal or reject

The RT shall send an X_EMPTY TSDU to mark the end of the application transaction.

4.3.5.2 RT side

The RT shall abort an ongoing application transaction. The reason for the abort is usually due to user decision.

If the RT had requested the transport connection opening, it shall wait for the end of the transaction: Connection Request (CR) and connection confirm (CC) are exchanged.

The RT shall therefore transmit a U_ABORT TSDU containing CAUSE information giving the reason.

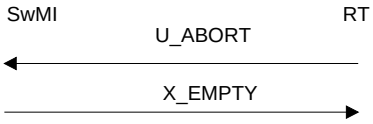


Figure 32: Application transaction failure - abort

The SwMI shall then transmit an X_EMPTY TSDU which ends the application transaction.

The RT shall transmit X_EMPTY TSDU instead of a U_ABORT TSDU when it is waiting for a disconnect request at transport level, in the same way as when a protective application timer expires**.**

Figure 33: Application transaction failure - Abort when disconnect waiting

In any case, the Transport protocol (see PAS 0001-3-3 [6]) shall protect the RT against no reply to the U_ABORT or D_REFUSAL/D_REJECT TSDU.

4.3.6 Application transactions closing

4.3.6.1 Application transaction release (SwMI side)

To release the RT: SwMI shall transmit a D_RELEASE TSDU containing CAUSE information giving the reason for release.

The RT shall acknowledge the request with a U_ACK TSDU and sets a protective protocol timer T504**.**

The SwMI shall then transmit an X_EMPTY TSDU to end the application transaction.

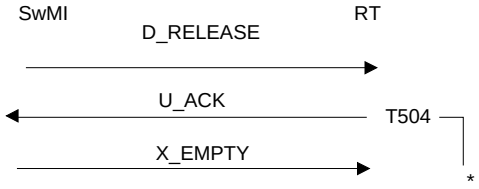


Figure 34: Application transaction release by the SwMI

If T504 expires, the RT shall initiate an application transaction closing.

4.3.6.2 Application transaction termination initiated by the RT

The RT withdraws: it shall send a U_TERMINATE TSDU containing CAUSE information giving the reason for withdrawal.

The SwMI then shall send a X_EMPTY TSDU to end the application transaction.

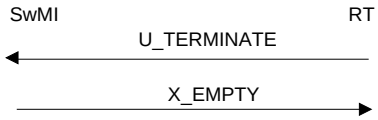


Figure 35: RT withdrawal from the application transaction

4.3.6.3 Group communication participants dispersion

See Clause concerning Group communications.

4.3.7 Asynchronous broadcast

4.3.7.1 Overview

The SwMI shall implement an asynchronous broadcast mechanism whereby the TSDU is periodically broadcast on CCH.

Example of applications using this mechanism:

- BROADCAST;
- GROUP COMMUNICATION;
- EMERGENCY
- CHANNEL SAVING

4.3.7.2 Implementation

The SwMI application initiating the broadcast may:

- modify broadcast TSDU contents. In this case, the new broadcast is again preceded by a collective address on PCH;
- temporarily or permanently stop TSDU broadcasts. A collective address PCH is transmitted whenever broadcasts are started again.

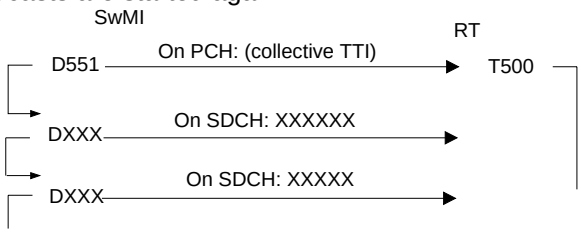


Figure 36: Asynchronous broadcast sequence

For every TSDU to be broadcast:

- the SwMI shall alert all the RTs involved on PCH using a collective address, (see note 1);
- then after a time of at least D551 shall start to send the first TSDU, (see note 2);
- the TSDU is retransmitted every DXXX (see note 3).

NOTE 1: The collective address is a "group" or "ALL RT" address depending on the type of message to be broadcast.

NOTE 2: The TSDU are always addressed with an "ALL RT" collective address.

NOTE 3: The DXXX delay depends on the TSDU to be broadcast.

When the RT receives a PCH with a collective address, the RT shall set a T500 time-out in the same conditions as those defined in "exchange initiation".

4.3.8 CCH/ TCH switch-over for private communication

4.3.8.1 Overview

The action consists in executing RT switch-over to the TCH controlled by the SwMI by enabling one of 4 possible procedures:

- a "Connect to PTCH" procedure executed during an application transaction for all "free" RTs;
- a "Switch to PTCH" procedure executed via an application transaction for "accessible" RTs;
- a "Assignment to CCH" procedure executed during a data signalling transaction;
- a "Assignment to DCH" procedure executed during a data signalling transaction.

4.3.8.2 Implementation

1) a) The SwMI shall send a D_CALL_CONNECT or D_CALL_SWITCH TSDU to the RT with the parameters identifying the PTCH for a voice call;

   b) The SwMI shall send a D_DATA_REQUEST or D_DATA_AUTHENTICATION TSDU to the RT for a data call.

2) The RT shall inform the SwMI that it is ready to execute the request by sending a U_CALL_CONNECT or U_CALL_SWITCH or U_DATA_DOWN_ACCEPT or U_AUTHENTICATION TSDU. The RT sets D502.

3) The SwMI sends the D_CALL_START or D_CONNECT_CCH or D_CONNECT_DCH (with parameters identifying the DCH) TSDU to the RT, which orders execution and ends the application transaction. The SwMI then considers that the RT is on the TCH.

4) On receiving D_CALL_START or D_CONNECT_CCH or D_CONNECT_DCH TSDU, the RT sets D503 but does not cancel D502.

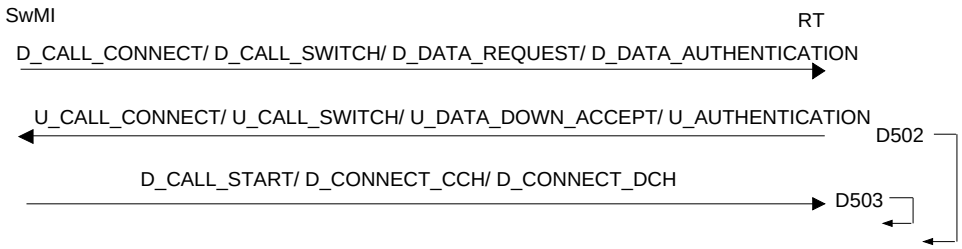


Figure 37: Connection to traffic channel sequence

4.3.8.3 Function of D502 and D503 timers

- Before D502 expiry: the RT shall stop calling the SwMI, unless the SwMI prompts an exchange; D502 shall then be cancelled.

- Before D503 expiry: the RT shall remain on the CCH to allow the lower protocol layer to stabilise before the RT switches over to the TCH.

- At D503 expiry: the RT shall execute effective TCH switch-over.

- At D502 time out:

    - If the D_CALL_START or D_CONNECT_CCH or D_CONNECT_DCH TSDU has not been received, then the RT shall initiate an application transaction termination and withdraws due to "application event";

    - Else

        - If the user has gone on hook, the RT opens a TERMINATION transaction with "cleared by user" cause;

        - Else, no RT action.

4.3.8.4 Error on RT side after TCH switch-over

Once on TCH, if the RT is unable to go on because it ignores the ciphering key reference, the RT quits the set-up call by executing a TERMINATION application transaction, with "terminal not configured" cause field.

See "Application transaction termination initiated by RT".

4.3.9 RT switch-over to CTCH

Whenever the open channel is activated, the SwMI shall inform all the RTs within the coverage area that the open channel is active in two steps :

1) **Step 1** : The SwMI shall immediately send a first D_ECH_ACTIVATION, D_GROUP_ACTIVATION or D_OC_ACTIVATION TSDU.

2) **Step 2:** As long as the open channel is "active", the SwMI shall continuously broadcast the D_XXX_ACTIVATION TSDU on SDCH using the general asynchronous broadcast mechanism.

Figure 38: RT switch-over to CTCH

The TSDU shall be sent every D756 for emergency or D774 fot the other group communication.

It shall be sent in datagram mode and shall use the "ALL RT" address for emergency or with “group” for the other group communication.

The first, and only the first, TSDU shall be preceded by a collective group address PCH characteristic of the open channel (see TTI/RTI/CGI coding in PAS 0001-3-2 [5]).

- the RT shall execute switch-over to CTCH without alerting the SwMI;
- After switch-over to CTCH, the SwMI/RT dialogue shall be handled by the VOICE protocol (see PAS 0001-3-4 [7]).

5. Applications

The present Clause describes the implementation details for each application protocol on the SwMI-RT interface.

For clearer presentation, the common application time-out mechanisms which have been defined previously are not represented any more in TSDU interchanges defining the protocol.

The list of application identified at the SwMI-RT interface is given below:

- BROADCAST;
- TRANSPORT PROTOCOL MANAGEMENT;
- REGISTRATION;
- PRIVATE CALL;
- GROUP COMMUNICATION;
- EMERGENCY;
- DATA;
- RT MANAGEMENT;
- KEY DELIVERY;
- INFORMATION DELIVERY.

5.1 Broadcast

5.1.1 Overview

The BROADCAST application is designed to permanently provide the RT with a full description of the system and services.

The SwMI shall broadcast information on the control channel by means of two different modes:

continuous broadcast mode on the BCH whereby the SwMI supplies the RT with:

- System information ..... D_SYSTEM_INFO

asynchronous broadcast mode on the SDCH by which the SwMI supplies:

- the list and characteristics of established group communications .... D_GROUP_LIST
- the list of adjacent cells ..... D_NEIGHBOURING_CELL
- GROUP OG participants (see note 1) ..... D_GROUP_COMPOSITION
- ECCH characteristics (see note 2) ..... D_ECCH_DESCRIPTION

NOTE 1: This TSDU is not broadcast when the OG associated with the open channel is a single OG.

NOTE 2: This TSDU is broadcast if there is at least one ECCH in the cell even if all ECCH are not in service.

Whenever the content of a TSDU is modified, the SwMI shall send a collective "ALL RT" address on the PCH before the new broadcast.

5.1.2 System information

The SwMI shall continuously broadcast D_SYSTEM_INFO TSDU on the BCH. This TSDU shall be broadcast every 2 seconds.

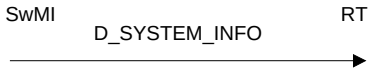


Figure 39: System information

When the cell changes from BSC disconnected mode to normal operating mode, or vice versa, a delay D722 shall precede the D_SYSTEM_INFO TSDU broadcast during which time the SwMI shall not transmit on the control channel.

When the cell is operating in BSC disconnected mode, the CCH shall support the BCH only. The unused superframe segments shall be filled with stuffing frames defined in PAS 0001-3-3 [6].

The TSDU shall contain network information, which may be modified, depending on the parameter:

- either the modified parameter value means that the entire cell has to be reinitialised;
- or the parameter is modified at any time, the RTs are informed by a collective address to ALL RTs on PCH before the first modified BCH block is sent.

Unless otherwise indicated, the cell shall be reinitialised whenever an information element is modified.

5.1.2.1 Cell status vector

The vector shall supply the RT with:

- System operating mode

This field describes the way in which the cell is connected to the system. The different modes are described in PAS 0001-1-3 [3]:

- "NORMAL";
- "Inter-BN disconnected mode";
- "Main Switch disconnected mode";
- "Radio Switch disconnected mode";
- "BSC disconnected mode".

If the field contains BSC disconnected mode, the RT is aware that some of the following fields are either "not significant" or do not exist.

- the BCH block number

The superframe shall contain two BCH blocks numbered 0 and 1. Since block 0 is the first BCH block in the superframe, the RT derives the position of segment 0 in the superframe.

- Cell category

- "experimental Cell";
- "operational Cell".

The SwMI shall use this information to selectively accept or bar each RT category present in the cell:
- the RT is self-defined as "experimental" or "operational".

This access restriction may be used: during the set-up phase preceding the operational phase, or at any time to grant cell access to the experimental RT for test purposes.

5.1.2.2 Cell configuration

Not applicable when the cell is operating in "BSC disconnected mode" and may be modified without cell reinitialisation.

This information field shall define cell characteristics:

- "Double coverage" cell: The cell is covered by an umbrella cell;
- "Simulcast" cell: The cell operates in simulcast mode;
- Radio multiplex: makes it possible to define several possible CCH or TCH logical channels multiplex configurations;
- Operational ECCH: Indicates if at least one ECCH is operational at that instant.

-

5.1.2.3 Country Code

Not applicable when the cell is operating in BSC-disconnected mode.
This field shall identify the country where the cell is located.

5.1.2.4 Version / System identity

Not applicable when the cell is operating in BSC-disconnected mode.
This field shall identify the system (associated with the country code) and the system version.

5.1.2.5 Location area identifier

Not applicable when the cell is operating in BSC-disconnected mode.

Shall identify the current location area (a geographical area made up of a set of cells).

When this information element is set to a special value (0), the idea of "location area" is not supported by the system.

5.1.2.6 Cell identity

The cell shall be identified in the system by a:

- base network logical number identifier;
- an RSW number in the base network, a cell number in the RSW combination.

With this information element, the RT can determine whether the cell where it is trying to register:

- is the cell where it has to register (Fixed radio terminals);
- belongs to the RSW controlling the line connection units where it is due to register (line connected terminals);
- belongs to the base network controlling the cells where it is due to register.

5.1.2.7 Cell "R" field

Not applicable when the cell is operating in BSC-disconnected mode.

This information shall identify the base network to which the cell belongs in order to:

- to reply to the "Preferred BN" user request when a preferred BN is designated for RT registration;
- to determine its "Home located RT" status if the R field in its address is identical to the R field in the received information element, or determine its "Visitor RT" status if the R field in its address is not identical to the R field in the received information element.

5.1.2.8 Scrambling parameter

The cell is operating in BSC-disconnected mode, this parameter shall indicate uplink and downlink open channel scrambling in BSC-disconnected mode.

In all other cases, this parameter shall indicate uplink MCCH scrambling.

This information shall not be changed after the RT has acquired and stored the parameter.

5.1.2.9 Cell radio parameters

These parameters may be modified without cell reinitialisation.

This field shall provide the RT with:

- the radio link loss detection counter value;
- the maximum transmitted power to be used in the cell;
- the RT transmission control parameter (see note 1);
- the cell threshold (see note 2).

NOTE 1: The RT determines its own transmission level from this information and from the received signal power level.

NOTE 2: Corrective parameter associated with each cell in the system and used to compare 2 cells.

5.1.2.10 Time

Not applicable when the cell is operating in BSC-disconnected mode. May be modified without cell reinitialisation.

The SwMI shall maintain a local time counter in the cell. The time is expressed in units (uTLR).

The SwMI shall reset the counter periodically. Each RT shall use the information to abide by TTI allocation rules, via the REGISTRATION application.

5.1.2.11 Access classes

Not applicable when the cell is operating in BSC-disconnected mode. May be modified without cell reinitialisation

(a) Registration class

This information element shall define the minimum access class for RT registration in the cell.

It shall be used to limit the number of RT registrations.

(b) Service class

This information element shall define the minimum class required to provide the service in the cell. It shall be used to limit the number of RT service accesses.

5.1.2.12 Superframe _cpt

Not applicable when the cell is operating in BSC-disconnected mode.

This information element shall count the superframe of 4s number.

It is never modified without cell reinitialisation.

At each cell reinitialisation this counter is reinitialised.

5.1.2.13 "Isolated cell" or BSC-disconnected open channel number

This information shall only exist when the cell is operating in BSC-disconnected mode

This field shall contain the open channel number.

5.1.3 List of established group communications

The SwMI shall broadcast the D_GROUP_LIST TSDU in asynchronous broadcast mode.

Figure 40: List of set-up group communications

The specific parameters shall be:

- the TSDU is retransmitted every D720;
- a collective "ALL RT" address shall be transmitted on the PCH whenever the message content is modified.

This message shall contain the list of group communication references which are set-up in the radio cell or the line access base station.

Group identity may be defined by a single OG or multi-OG.

5.1.4 Group composition

For each multi-OG participating in a established open channel, the SwMI shall broadcast the D_GROUP_COMPOSITION TSDU throughout the entire open channel call coverage area in asynchronous broadcast mode.

This TSDU shall not be broadcast when all the participating OG in open channel calls in the cell are single participating OGs.

Figure 41: Group composition

Specific parameters:

- the TSDU shall be retransmitted every D721;
- a collective "ALL RT" address shall be transmitted on the PCH whenever the message content is modified.

This message shall contain the group identity of open channel participants is a single OG.

5.1.5 Additional participants

For an established open channel, the SwMI may broadcast the D_ADDITIONAL_PARTICIPANTS TSDU throughout the entire open channel call coverage area in asynchronous broadcast mode.

This TSDU shall be broadcast to allow additional participants to those designated by participating OG.

Figure 42: Additional participants

Specific parameters:

- the TSDU shall be retransmitted every D725;
- a collective "ALL RT" address shall be transmitted on the PCH whenever the message content is modified.

This message shall contain:

- open channel reference;
- up to 3 individual adresses of additional participants.

5.1.6 Adjacent cells information

The SwMI shall broadcast the TSDU in asynchronous broadcast mode.

Figure 43: Adjacent cells information

The specific parameters shall be:

- the TSDU is permanently transmitted every D723;
- a collective "ALL RT" address shall be transmitted on the PCH whenever the message is broadcast.

This message shall contain:

- the number of adjacent cells;
- the CCH reselection parameters.

and for each adjacent cell:

- the CCH channel number;
- the cell threshold of the cell;
- an indicator specifying whether the cell belongs to the same Base Network as the current cell;
- an Indicator specifying whether the cell belongs to the same location area as the current cell;
- an indicator specifying whether the cell is experimental or operational.

The RT shall use this information to compare the quality of the radio link in the cell with the estimated quality of radio links if it were to change cells.

5.1.7 ECCH Characteristics

The SwMI shall broadcast the D_ECCH_DESCRIPTION TSDU in asynchronous broadcast mode.

This TSDU shall not be broadcast if there is no ECCH configured in the cell.

Figure 44: ECCH Characteristics

The specific parameters shall be:
- the TSDU is permanently transmitted every D724s;
- a collective "ALL RT" address is transmitted on PCH whenever the message is created or modified..

This message shall contain:
- the number and characteristics of operational ECCHs;

and, for each ECCH:
- the channel identifier;
- the uplink ECCH scrambling parameter;
- the downlink ECCH scrambling parameter.

The order in which the "ECCH" objects appear in this TSDU shall determine their ordering number in the cell, beginning with 1. The RT shall use this ordering number to determine the ECCH to be used for SwMI exchanges.

5.2 Transport protocol management

5.2.1 Overview

This application shall support:

RESYNCHRONISATION
FAULT REPORTING
PRELIMINARY PAGING FOR INCOMING CALL (IMPLICIT ADDRESSING MECHANISM)
PRELIMINARY PAGING FOR INCOMING BROADCAST MESSAGE TO IMPLICIT ADDRESS
ATTACH/DETACH

5.2.2 Resynchronisation

5.2.2.1 Initial conditions

The RT has been obliged to abort an open applicative connection without possibility of informing SwMI. As soon as possible RT shall execute a "resynchronisation" except if another transaction is necessary (registration, activity, etc.).

5.2.2.2 Implementation

The RT shall bar user access to operational applications (except for emergency) while the RESYNCHRONISATION function is active.

5.2.2.3 Successful case

In case of a power failure and while a transport connection was open, the RT shall reinitialise the level 2.

The RT shall send a U_EVENT_REPORT TSDU with cause information explaining the cause when the application is activated.

When it receives an X_EMPTY TSDU, the RT is sure that the SwMI is aware of its return to the control channel. The RT shall then disable this RESYNCHRONISATION function.

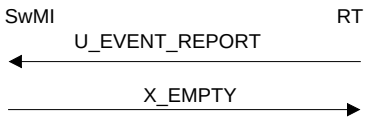


Figure 45: Resynchronisation sequence

The cause may be:

"insufficient TCH quality"
The RT returns to its old cell, after a CCH selection routing caused by "TCH loss"

"power supply failure"
The RT was on the TCH, or a transport connection was open.

"application fault"
Protocol failure on return to CCH.

5.2.2.4 Unsuccessful case

If the SwMI does not reply, the RT shall reactivate the function.

5.2.3 Fault reporting

5.2.3.1 Initial conditions

The fault reporting function shall be activated whenever:

- the RT detects an illegal access (see RT MANAGEMENT applications);
- the TDX detects a fault on the link with PABX;
- the TDX detects re-establishment of the link.

5.2.3.2 Implementation

The RT shall bar user access to operation applications (except for the emergency) while the FAULT REPORTING function is active.

5.2.3.3 Successful case

The RT shall transmit a U_ERROR_REPORT TSDU with information explaining the cause when the application is activated.

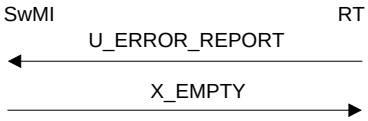


Figure 46: Fault reporting sequence

The cause may be:

"intrusion"
After receiving barring information with an ordering number that does not match its own ordering number.

"Internal TDX link fault"
The RT detects the onstart of a TDX internal fault.

"External TDX link fault"
The RT detects the onstart of a link fault with PABX.

"Internal TDX link re-establishment"
The RT detects the ending of the TDX internal link fault.

"External TDX link re-establishment"
The RT detects the ending of the link fault with PABX.

5.2.3.4 Unsuccessful case

If the SwMI does not reply, the RT shall reactivate the function.

5.2.4 Preliminary paging for incoming Call (Implicit addressing mechanism)

5.2.4.1 Principle

The SwMI shall activate this function for all incoming private (voice or data) calls destined for an implicit address if at least one RT from the implicit address list is free when the incoming call is set-up.

The calls involved are:

- Private call:
  - individual or multiparty (see note 1);
  - call from a TDX interface (see note 1);
  - call to a TDX interface (see note 2);

- Data calls (see note 2).

NOTE 1: In these specific cases, the RT alerts the user unless the user is engaged in an group communication with higher priority than that of the waiting call.

NOTE 2: In this specific case, the RT never alerts the user and decides alone whether to accept or refuse the waiting call, depending on the status of the equipment to which it is connected (IPABX or UDT).

- SwMI establihes the list of RT "free" which belong to the implicit address.

- SwMI sets a global T562 Timer.

- The SwMI shall therefore inform the N567 (maximum) first RTs from the list than an incoming call is waiting and set T561 timer for each of them.

- Depending on the case:
  - the RT shall ignore, accept or refuse the call notification;
  - the RT shall alert the user who can accept or refuse the call.

- Depending on the answer:
  - one RT accept the call, the presentation is finished and the RT is chosen;
  - one RT refuse the call, it is withdrawn from the list and SwMI informs the next RT (or the first) from the list that an incoming call is waiting and set T561 timer for this RT;
  - one RT does not answer, (T561 issue) and SwMI inform the next (or the first) RT in the list than an incoming call is waiting and set T561 timer for this RT.

- T562 expires or every RT has refused: The process failed, no RT is chosen.

5.2.4.2 Implementation

- a D_CALL_WAITING TSDU shall be sent in datagram mode and addressed to an RT;
- any PCH is sent before the D_CALL_WAITING TSDU.

5.2.4.2.1 Successful case (call accepted)

One of the users or one of the RTs accept the presented call.

1) One of the users accepts the presented call (private call, call from TDX).

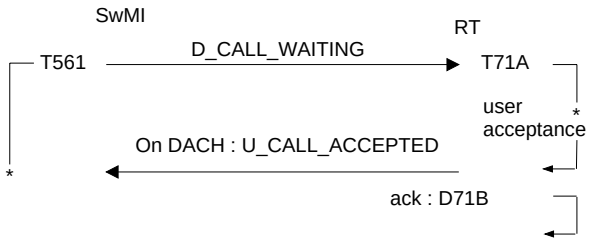


Figure 47: Private call accepted by one user

2) One of the RTs accepts the presented call (data call, incoming TDX Call).

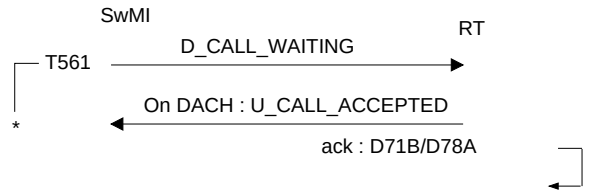


Figure 48: Data call or call for TDX accepted by one RT

In both cases:

- if the RT is reserved for another call, the SwMI shall ignore the U_CALL_ACCEPTED message and the T561 timer shall not be cancelled;

- if the RT is not reserved for an another call, the SwMI shall reserve the RT for the waiting call and shall ignore all the U_CALL_ACCEPTED TSDUs for the same call, the T561 timer is cancelled;

- after sending the U_CALL_ACCEPTED message, the RT shall ignore all other D_CALL_WAITING messages for the same call (voice call) till D71B expiry;

- after sending the U_CALL_ACCEPTED message, the RT shall ignore all other D_CALL_WAITING messages for the same call (data) till D78A expiry.

5.2.4.2.2 Unsuccessful case (call refused)

One of the users or one of the RTs refuses the presented call.

1) One of the users refuses the presented call (private call, call from PABX).

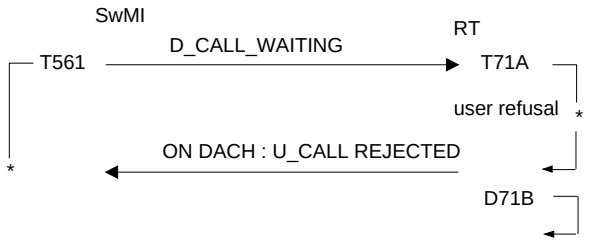


Figure 49: Private call or call from PABX, Call refused by one user

2) One of the RTs refuse the presented call (data call, incoming PABX CALL).

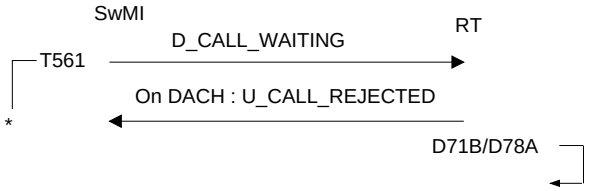


Figure 50: Data call or incoming PABX Call refusal by one RT

In both cases:

- after sending the U_CALL_REJECTED message, the RT shall ignore all other D_CALL_WAITING messages for the same call through D71B (voice) or D78A (data);
- as soon as the U_CALL_REJECTED TSDU is received, the SwMI shall remove the RT from the list of free RTs for that call;
- receipt of the U_CALL_REJECTED TSDU shall cancel T561 only if the RT is the only free RT.

5.2.4.2.3 Unsuccessful case (no reply)

No user replies to the presented call.

Figure 51: Unsuccessful call presentation no reply

- Call presentation failed

5.2.5 Preliminary paging for incoming broadcast message (Implicit addressing mechanism)

5.2.5.1 Principle

The SwMI shall activate this function for all incoming broadcast message destined for an implicit address, when there is no RT of the implicit adress list is which is candidate to broadcast messager reception.

The concerned messages are:

- D_EXPLICIT_SHORT_DATA
- D_FUNCTIONAL_SHORT_DATA
- D_BROADCAST

- If a preliminary paging phase for this implicit adress is running, SwMI shall not activate the presentation process, at the end of the current presentation phase, the selected RT will receive all pending messages.

- otherwise, the SwMI shall therefore inform the N568 (maximum) first RTs from the list than an incoming call is waiting and set T568 timer for each of them.

- Depending on the case:
  - the RT shall ignore or accept the message notification;

- Depending on the answer:
  - one RT accept the call, the presentation is finished and the RT is chosen
  - one RT does not answer, (T568 issue) and SwMI inform the next RT in the list than an incoming broadcast message is waiting and set T568 timer for this RT.

- If no RT respond : The process failed, no RT is chosen.

5.2.5.2 Implementation

- a D_BROADCAST_WAITING TSDU shall be sent in datagram mode and addressed to an RT;
- any PCH is sent before the D_ BROADCAST_WAITING TSDU.

5.2.5.2.1 Successful case (call accepted)

One of the users or one of the RTs accept the presented message.

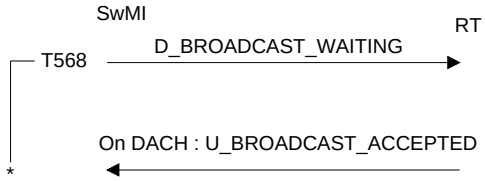


Figure 52: Broadcast message accepted by one user

5.2.5.2.2 Unsuccessful case (no reply)

No user replies to the presented call.

Figure 53: Unsuccessful Broadcast message presentation no reply

5.2.6 Attach

5.2.6.1 Initial conditions

RT may activate **an attach** function in the following cases:

- the RT is powered ON (except if another transaction is necessary (registration, activity, etc.);
- RT returns from direct mode;
- One of the parameters exchanged between SwMI and RT in attach procedure has been changed on RT side;
- At any time, RT detects a change on SwMI side in the parameters exchanged between SwMI and RT in attach procedure,
- On registration confirmation, the network indicates the use of the default terminal profile, which is not the right terminal profile.

See PAS 0001-1-3 [3].

5.2.6.2 Implementation

The RT shall bar user access to operational applications (except for emergency) while the ATTACH or DETACH function is active.

This message shall be transmitted over the DACH (see PAS 0001-3-3 [6]).

5.2.6.3 Successful case

The RT shall send a U_ATTACH TSDU with the cause why the application is activated.

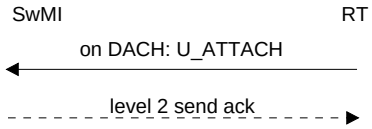


Figure 54: Attach sequence

The cause may be:

"normal"

5.2.6.4 Unsuccessful case

If the SwMI does not reply (failure of the random access procedure on the DACH, see PAS 0001-3-3 [6]), the RT shall activate a cell selection.

5.2.7 Detach

5.2.7.1 Initial conditions

RT may activate **a detach** function in the following cases:

- the RT is powered OFF;
- before going in direct mode.
- User erasure indication

5.2.7.2 Implementation

The RT shall bar user access to operational applications (except for emergency) while the DETACH function is active.

5.2.7.3 Successful case

The RT shall send a U_DETACH TSDU with the cause why the application is activated.

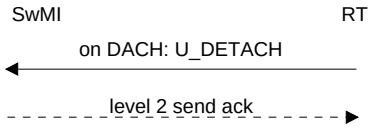


Figure 55: Detach sequence

The cause may be:

"normal"
"User erasure indication"

5.2.7.4 Unsuccessful case

If the SwMI does not reply (failure of the random access procedure on the DACH, see PAS 0001-3-3 [6]), the RT shall execute the command (turn the power off or going in direct mode).

5.2.8 Dedicated channel initialization

This initialisation is reserved for AG recorder.

5.2.8.1 Initial conditions

The SwMI shall activate the dedicated channel initialization as soon as a registered RT, which shall have a dedicated channel (recording interface for example), connects itself (depends on the RT profile). If the RT is not registered, it shall wait for the registration end before activating this function.

5.2.8.2 Implementation

The initialization message shall be sent in datagram mode and addressed to an individual RT. The SwMI shall then set T571.

The RT shall acknowledged the initialization over DACH (see 0001-3-3 [6]).

5.2.8.3 Successful case

The SwMI shall send the D_CHANNEL_INIT TSDU with the channel identification and set T571. The RT shall acknowledged with the U_CHANNEL_INIT_ACK message on DACH.

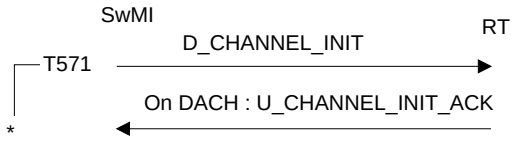


Figure 56: Initialization sequence

T571 shall be cancelled on reception of the U_CHANNEL_INIT_ACK TSDU.

5.2.8.4 Unsuccessful case

T571 expiry: the SwMI shall repeat the initialization N571 times.

5.3 Registration

5.3.1 Overview

The REGISTRATION application shall be used for RT location and identification and for subscription to periodic emission service.

The RT shall transmit a registration request, which shall include 2 distinct, sequential phases:

- TTI negotiation;
- effective registration procedure.

The RT shall signal its presence to the SwMI at regular intervals through;

- location activity dialogue between the RT and the SwMI;

The SwMI may try to force the RT to register:

- forced registration.

In the following circumstances:

- the RT has detected part or total non volatile data corruption;
- the RT is "powered on for the first time";
- after subscriber configuration parameters modification.

The RT shall perform a specific registration sequence: "complete registration". This procedure shall always be handled by HRSW. Registration counters shall be set with the values indicating that a "complete" SwMI registration procedure is required.

5.3.1.1 Registration conditions

The RT shall transmit a registration request in the following cases:

- After changing cells, the new and previous cells do not belong to the same location area;
- its TTI is no longer assigned since the RT has been inactive for too long (switched off, out of coverage, generally "not reachable by the network"). See subclause "minimum exchange";
- its TTI is no longer assigned (after a DISABLING transaction, see Subclause "Service barring");
- The cell is not operating in RSW-Isolated Mode, and the uplink CCH scrambling parameter has been changed since the last TTI assignment (see note).

NOTE: The uplink CCH scrambling parameters do not take disconnected cell fall back modes situations into account (Radio Switch and BSC disconnected mode).

Table 2: Example of RT registration conditions

Cell status is	**It changes to**	**then returns to:**
NORMAL (scrambling = X)	BSC Disconnected mode (scrambling = Y)	Inter-RN disconnected mode (scrambling = X)
RT is registered	RT not registered	Registration not necessary

The RT shall not send a registration request in the following cases:

- The cell is operating in BSC-disconnected mode;
- The cell is operating in Radio switch disconnected mode;
- If its registration class is strictly below the class broadcast in the cell, except in the case of "forced registration".

5.3.1.2 Registration classes

Each RT shall have a "Registration Class" (RT_RC) of its own.

The RT shall compare RT_RC to the "Minimum authorised RT Registration Class" (SwMI_RC), permanently broadcast through the cell.

While SwMI_RC > RT_RC, the RT shall not transmit any registration request.

The RT shall not take this condition into consideration, and shall re-evaluate its registration rights in the following cases:

- In case of emergency initiated by the RT user;
- After detecting a forced registration request.

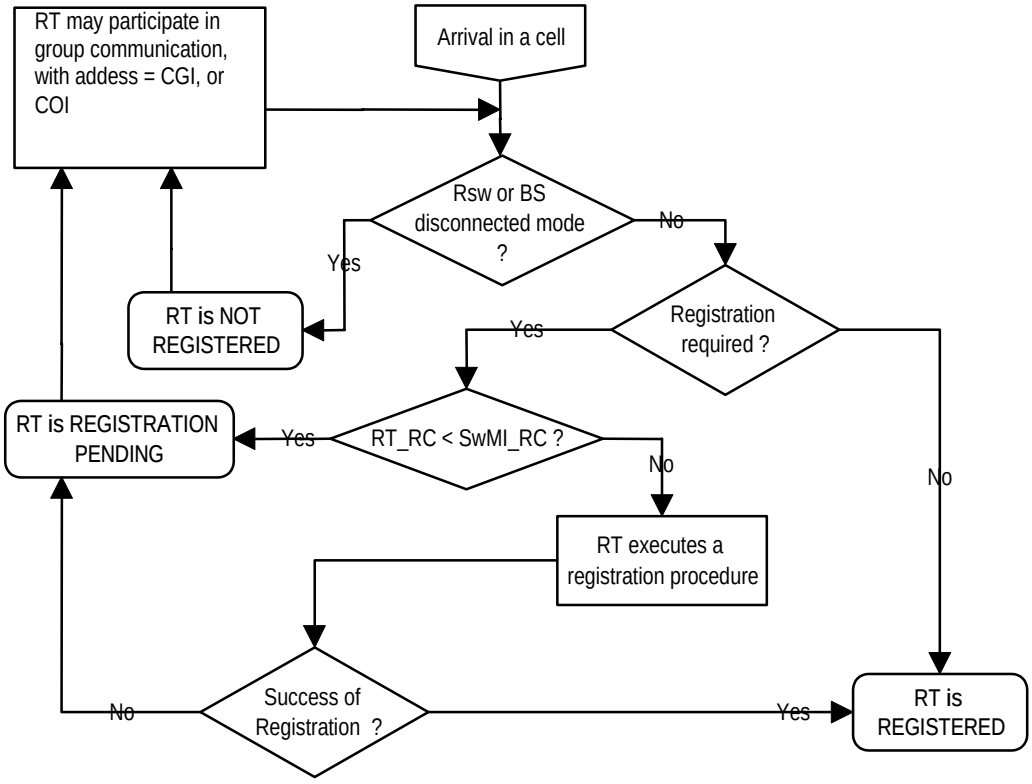


Figure 57: RT registration states

5.3.2 TTI Negotiation

5.3.2.1 Sequence of events

1) The RT shall draw a random terminal identity (RTI) with which it shall request transmit rights (see PAS 0001-3-3 [6]). The use of an RTI type address on the SwMI-RT interface shall indicate to the SwMI that an RT wishes to set-up a first exchange and has not yet been assigned a Temporary Terminal Identifier (TTI).

2) The SwMI shall send a D_TTI_ASSIGNMENT TSDU in datagram mode using the RTI address to inform the RT that the request is being handled. TSDU shall not include transmit rights; and is transmitted N700 times, every D700.

3) After a delay of D701 following the first D_TTI_ASSIGNMENT transmission, the SwMI shall try to open a level 2 connection, the RT being identified by its TTI.

   The N700 retransmitted D_TTI_ASSIGNMENT TSDU and the N201 attempted level 2 connections are nested: one TSDU, one attempt, one TSDU, etc.).

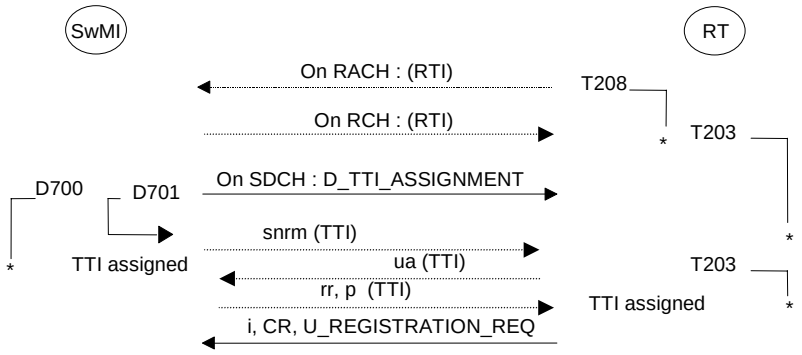


Figure 58: TTI negotiation sequence

NOTE 1: Considering their importance, level 2 exchanges are represented.

NOTE 2: The U_REGISTRATION_REQ is only shown in the chart to show how the TTI assignment and effective registration procedures are sequenced.

The SwMI shall consider the TTI to be assigned when it receives a UA frame (see PAS 0001-3-3 [6]).

The RT shall consider the TTI to be assigned when it receives the RR frame granting transmit rights (see PAS 0001-3-3 [6]).

5.3.2.2 Unsuccessful case

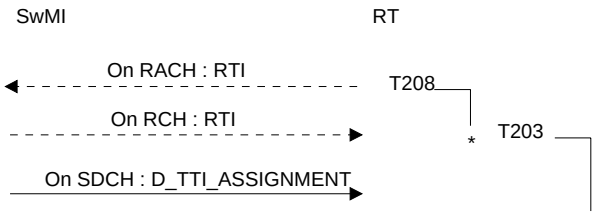


Figure 59: TTI negotiation - Unsuccessful case

(T208, T203) expiry: If (T208, T203) expires before the transmit rights are granted, the RT shall start cell selection process.

The SwMI has no available TTI: the SwMI shall send a D_TTI_ASSIGNMENT TSDU to the RT. The RT shall attempt to use the indication supplied by the SwMI.

- if "lack of resources", The SwMI can not supply the RT with a TTI for the time being. The RT may attempt to negotiate another TTI in the cell, since the indication presupposes a temporary situation.
- if "cell satured", The maximum number of RTs registered in the cell has been reached (1).
- if "switch satured ", The maximum number of RTs registered under the current switch has been reached.

  This situation is unlikely, since the "registration class" parameter broadcast through the cell should have prevented the RTs from sending a registration request, nevertheless the RT shall check the parameter and:

  - if the RT is not allowed to register (its registration class prevents it): the RT shall behave like a non-registered RT, and can only access group communications;
  - if the RT is allowed to register (its registration class allows it): the RT shall immediately start cell selection process.

The SwMI cannot set-up a level 2 connection with the RT: The SwMI shall consider that the TTI is no longer reserved, The TTI value may be selected for another RT, but shall conform to the "last in, last selected" rules applied to all TTI values which are neither reserved nor assigned.

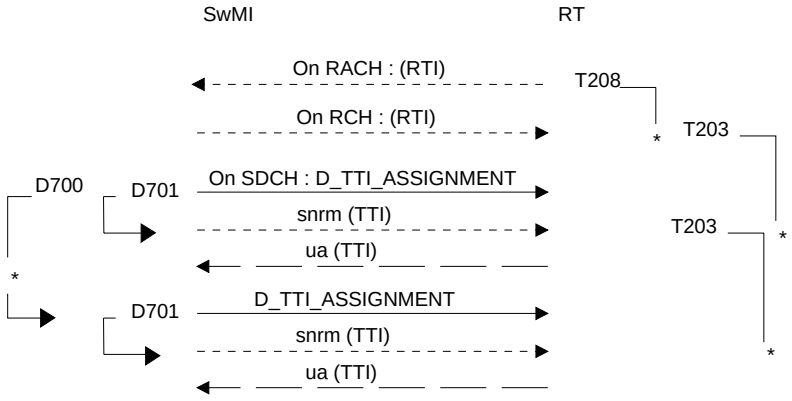


Figure 60: TTI negotiation sequence

NOTE: The broken lines mean "not received" by the other end.

5.3.3 Registration procedure

This transaction shall systematically be executed after a successful TTI negotiation where transmit rights are granted.

5.3.3.1 Sequence of events

1) The RT sends a U_REGISTRATION_REQ TSDU;

2) The RT sets T702 after the SwMI accepts the application transaction;

3) The SwMI decides whether the registration is successful (D_REGISTRATION_ACK) or not (D_REGISTRATION_NAK);

4) The RT ends the application transaction by sending an X_EMPTY TSDU.

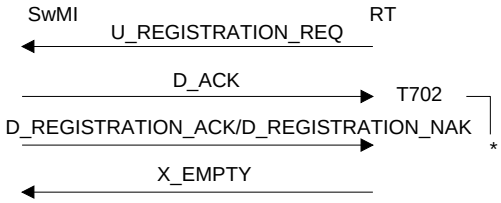


Figure 61: Registration sequence

The RT has to check that the address supplied in the D_REGISTRATION_ACK or D_REGISTRATION_NAK TSDU matches the address given in the U_REGISTRATION_REQ TSDU. In case of a mismatch, the RT shall ignore any other information, consider it can no longer use its TTI and start cell selection process.

The SwMI shall analyse the RT status information and, depending on the case:

- either modify the forwarding indication to alert the RT that the RT forwarding status stored in the SwMI does not match the status given by the RT;

- or continue with an access barring, traffic disabling or traffic enabling procedure after accepting the RT registration, because:

    - the RT status information is not up to date (traffic barring);

    - its behaviour shows that the RT is not informed (access barring).

5.3.3.2 Successful case

Receipt of a D_REGISTRATION_ACK TSDU means that registration is successful

- the RT shall consider the negotiated TTI is assigned to it;
- the RT shall take the value of T730 time-out into account;
- The RT shall store the registration counters for use in the next registration sequence;

- In case of "normal" registration:

  - if the RT detects that the SwMI has changed the forwarding indication (RT status vector) exchanged in U_REGISTRATION_REQ and D_REGISTRATION_ACK TSDUs, it shall activate the start or stop forwarding process defined in the RT MANAGEMENT application to update the SwMI database;

  - if the RT detects an incoherence in one or several information elements carried by U_ATTACH and D_REGISTRATION_ACK TSDUs, it shall activate the "attach" process defined above to update the SwMI database;

  - if the RT detects an incoherence in one or several information elements carried by U_PERIODIC_ACCES_SUBSCRIPTION_RQ and D_REGISTRATION_ACK TSDUs, it shall activate the “periodic message emission” subscription process.

  - In case of "complete" registration: the RT ignores all RT status information other than configuration information:

  - the RT and the SwMI shall erase any forwarding flag;

  - moreover, an appropriate application transaction has to be opened to send any traffic or access disabling information to the RT (see RT MANAGEMENT application);

  - the RT shall however store its fixed or mobile RT condition and obligations (CCH stand-by mode, store attachment RSW identity or attachment cell identity).

5.3.3.3 Unsuccessful case

Whatever the cause, RT shall consider the TTI as not assigned to it and erase all traces from its memory.

- Failure due to T702 expiry,
  the RT starts a CCH search.

- Failure indicated by the D_REGISTRATION_NAK TSDU :
  - "RT assigned to an attachment cell": the RT starts a cell selection process until it finds the cell which identity was supplied in the D_REGISTRATION_NAK TSDU (In case of a Line Connected Terminal, only the RSW identity is stored and searched).
  - "RT registration disabled": the terminal has not been enabled by its home BN operator; the RT alerts the user then (1).
  - "non-explicit address": the terminal configuration is not correct: such an address cannot be used to identify an RT, the RT alerts the user then (1).
  - "RT cannot be authenticated": the RT cannot be authenticated, it has an obsolete mobile key: it has to go back to the terminal configuration phase, the RT alerts the user then (1).
  - "RT not valid": The terminal is not correctly configured (the address supplied in the U_REGISTRATION_REQ TSDU is not used to identify a terminal in the network) the RT alerts the user then (1).
  - "inconsistent RT": The RT is not correctly configured (The terminal serial number known to the network does not match the number given by the RT); the RT alerts the user then (1).
  - "SwMI database updating": the SwMI informs the RT that the registration cannot be handled for the time being, the RT starts a cell selection process.
  - "congestion": This occurs when the cell or switch has just reached its filling threshold and the RT was not therefore notified during TTI negotiations, and when the SwMI detects that the BN database is full. The RT does not notify the user.
  - "RSW saturation": this occurs when the maximum number of registration transactions is reached on the RSW, same as "SwMI database updating".
  - "MRSW saturation": this occurs when the maximum number of registrations transaction is reached on the base network pilot, same as "SwMI database updating".
  - "HRSW saturation": this occurs when the maximum number of registration transactions is reached on the HRSW, same as "SwMI database updating".
  - "out of window", The RT returns its registration sequence to 0 then performs (1).
  - "RT registration filtered": the SwMI informs the RT that it is not allowed to register in this cell, the RT starts a cell selection process.
  - "unreachable HRSW": The RT informs the user that its terminal cannot be registered in the network (the SwMI cannot check the identity information supplied by the RT because the HMSW database is unreachable or the encryption key is not available). This occurs during a complete registration procedure.

(1) Common behaviour
The RT shall disable all user's operating activity (calls enabled in or outside procedures, etc.).
The RT shall not start a cell selection process.
The RT shall not save any of this information in backup memory so that cell selection and registration sequences can be restarted by switching off, then switching on again.

5.3.4 Location activity

Hence, if no successful application transaction has taken place since T730, the RT shall set-up a "location activity" transaction to maintain regular exchanges between the SwMI and the RT with a mean to prolong the RT's temporary terminal identity (TTI) validity.

The SwMI and the RT compare the RT status vector. If a difference is found, the RT shall update its status vector in the same way as it should be in a normal registration.

5.3.4.1 TTI validity (SwMI side)

In the RT registration sequence:

- the SwMI sets T731 timer with initial value T731iv;
- the SwMI sends T731iv to the RT, given as a number of TLR units.

After each successful application transaction between the SwMI and the RT:

- the SwMI resets T731 timer with initial value T731iv;
- If T731 expires, the SwMI considers that the TTI used to identify the RT is no longer allocated to it and is now available to identify a new RT.

5.3.4.2 TTI validity (RT side)

On registration:

- the RT receives T731iv (initial value of T731) and T730iv (initial value of T730) from the SwMI. The initial values of T730 and T731 are given as a number of TLR units.

After each successful application transaction:

- the RT resets T730 with initial value T730iv;
- the RT stores TLRcvs (current value of TLR to be saved) with TLRcvb (current value of TLR broadcast in the cell) in back-up memory.

In case of T730 time out:

- the RT has not changed cells or has changed cells in the same location area, the RT executes a "location activity" transaction;

The RT changes cell (and location area):

- if the RT registers, the "location activity" function is cancelled and reactivated, with the initial value of T730 supplied by the SwMI at the time of registration;
- -If the RT is not allowed to register. The "location activity" function is cancelled.

the RT returns on network mode, after an interruption (switch-over to direct mode, power off, moving into another cell without registration etc.).

- The RT has to evaluate the time expired since the last transaction: **T = TLRcvb - TLRcvs**

Table 3: Minimum exchange criteria

Time expired	RT behaviour
T < T730iv	The RT restarts a timer in uTLR : [T730 –(current system time date - system time date of the last connected exchange with the network)]*uTLR value+ a random delay between 0 and 0,5 uTLR**.** .
T730iv ≤ T ≤ T731iv - 2 uTLR	TTI is still valid, The RT executes a "location activity" transaction after a random delay between 0 and 0,5 uTLR**.**
T731iv - 2 uTLR < T	TTI is no more valid, The RT executes a "registration" transaction**.**

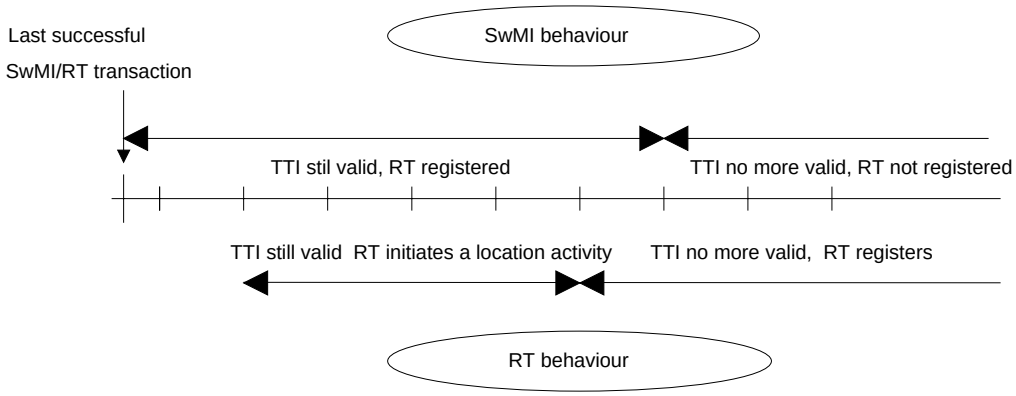


Figure 62: Registration and location activity

T730 = 2 and T731 = 7 uTLR. (One step = one TLR unit).

5.3.4.3 Location activity transaction

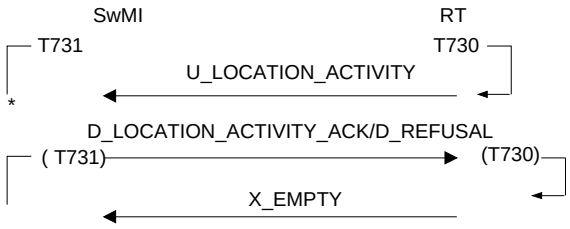


Figure 63: Location Activity transaction

1) The RT switches over to the CCH and sends a U_LOCATION_ACTIVITY TSDU.

2) The SwMI sends a U_LOCATION_ACTIVITY_ACK TSDU or notifies the failure.

3) The RT ends the application transaction with an X_EMPTY TSDU.

5.3.4.4 Successful case

- The RT receives the U_LOCATION_ACTIVITY_ACK TSDU;

The RT is allocated its temporary terminal identity for another T730.

5.3.4.5 Unsuccessful case

- Special case of protocol failure:

If the protocol fails during the "Activity reporting" application transaction, the RT restarts the transaction after reading the broadcast TLR.

- The RT receives D_REFUSAL

  - the SwMI shall consider that the TTI is no longer allocated to the RT.
  - the RT shall consider it is now unknown in the radio cell (it shall no longer use its TTI) and shall determine its behaviour on the basis of the cause information supplied by the SwMI:

    "unknown calling party";
    the RT shall act as a new arrival and execute a cell selection process.

5.3.5 Forced registration

5.3.5.1 Overview

This function shall be enabled in exceptional circumstances, its purpose is to force a non-registered RT to ignore the "registration class" parameter value broadcast in the cell and to reassess its registration rights.

Example: the SwMI wishes to provoke a non-registered RT registration (because its access class does not allow RT registration) and bar it at the same time.

This request only applies to a non-registered RT.

5.3.5.2 Implementation

All the RTs in the cells shall be informed by the D_FORCED_REGISTRATION TSDU.

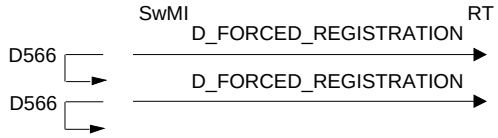


Figure 64: Forced registration sequence

The TSDU contains the Terminal address and is broadcast N566 times at intervals of D566 and addressed to all terminals:

- on CCH, over PCH and SDCH;
- on CTCH, over SCH constructed in mode 1;

5.3.5.3 RT behaviour

Previously registered RTs shall ignore the TSDU.

If the address contained in the TSDU matches the Terminal address, the Terminal shall ignore the "registration class" parameter broadcast in the cell until the next successful registration or the next time it switches off.

5.4 Private call

5.4.1 Overview

The PRIVATE CALL application on the SwMI-RT interface is designed to enable the following functions:

- Private call set up;
- Call transfer (in a private call);
- Operator intrusion in a call;
- Operator release of a private call.

The following set of transactions are described:

- Outgoing call;
- Incoming call;
- Call clearing;
- Call transfer;
- Withdrawal of a private call participant.

- Intrusion (general);
- Intrusion in a private call;
- Intrusion in an open channel call (informative);
- Intrusion in an emergency open channel call (informative);
- Release of a private call.

5.4.2 Presentation

There are several possible private call configurations.

Private call from one RT to one or more RTs (individual, multiparty call).

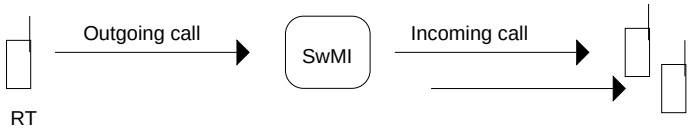


Figure 65: Individual or multiparty call

Private call from one RT to a PABX subscriber via a TDX interface (outgoing Call).

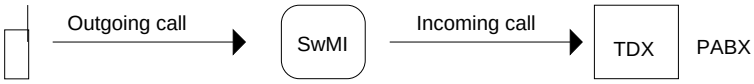


Figure 66: Outgoing PABX Call.

Private call from a PABX subscriber via a TDX interface to one RT (incoming Call).

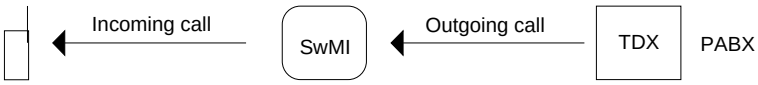


Figure 67: Incoming PABX Call

Private call from a PABX subscriber via a TDX interface to one RT, then transfer to final destination (incoming call with call transfer).

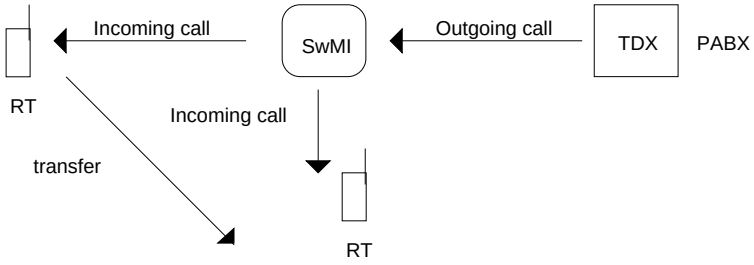


Figure 68: Incoming PABX Call with Call transfer

Private call from one RT to another RT, then transfer to the final destination (individual call with call transfer).

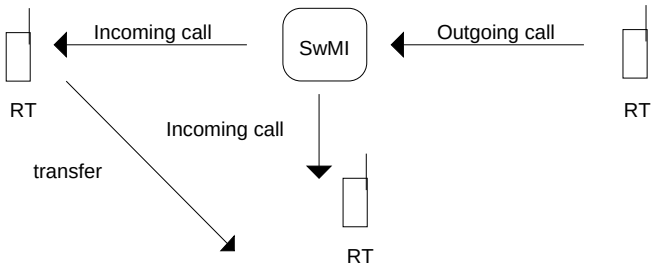


Figure 69: Individual Call with Call transfer

5.4.3 General mechanisms for private calls

5.4.3.1 Voice session

An RT participating in a private call shall execute a "voice session". A call is associated with a set of 2 application references and one application priority**.**

There are usually three phases in a voice session:

1) on the CCH (MCCH or ECCH)

   - Transport connection to voice application;
   - call opening;
   - command to terminal to switch-over to the PTCH, and Transport disconnection.

2) on the PTCH

   - voice exchanges in established mode (protocol described in PAS 0001-3-4 [7]).

3) on the CCH

   - Terminal return to the CCH;
   - Transport connection to voice application;
   - connection closing and Transport disconnection.

5.4.4 Outgoing call

The protocol described here is executed on the calling RT side:

1) Individual private call (one called party);
2) Private call from PABX (the calling party is a TDX interface);
3) Private call to a PABX (the called party is a TDX interface);
4) Multi-party private call (several called parties).

The U_CALL_SETUP TSDU shall contain:

- The called RT address (case 1 and 2);
- the PABX interface address + an additional subaddress field (optional) (case 3);
- Called RT addresses (case 4) or an address list.

and optionally :

- The calling RT user priority;
- An information element which precise the hook mode: automatic without tone, etc ....

As soon as the SwMI accepts the request (TSDU D_ACK), the RT shall set a timer T712 which covers the time needed by the SwMI:

- to determine the location of the called parties;
- to gather the resources required to set-up the voice circuit;
- to wait for the called user(s).

The calling user shall be notified when the first RT is rung (D_CALL_ALERT TSDU).
The SwMI shall negotiate the calling and called RT switch-over to PTCH at the same time.

5.4.4.1 Successful case

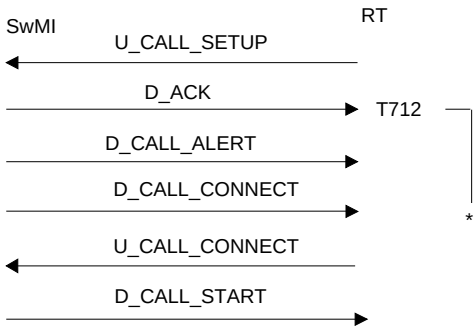


Figure 70: Outgoing call sequence

5.4.4.2 Unsuccessful case (RT side)

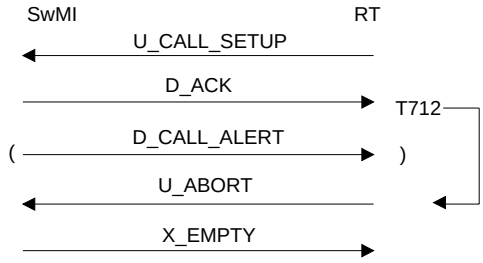


Figure 71: Outgoing call cancelled by the RT

The cause for ABORT should be one of the following ones:

- "cleared by user": the requested RT user has cleared the call;
- "application event": due to application protection T712 time-out;
- "Internal TDX link fault": When the calling party is a PABX interface;
- "External TDX link fault": When the calling party is a PABX interface;

The U_ABORT TSDU shall be sent after D_ACK TSDU reception, and before receiving the D_CALL_CONNECT TSDU. If the user cancels the call, the RT shall switch to PTCH (with respect the protocol PTCH entry rules (D503, T502)) and then execute a TERMINATION transaction.

5.4.4.3 Unsuccessful case (SwMI side/Refusal)

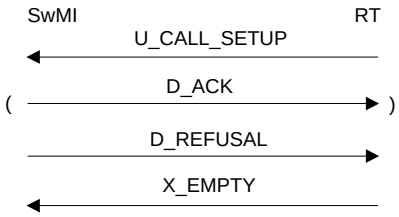


Figure 72: Outgoing call refused by the SwMI

- "unknown calling party"
- "service barred calling party"
- "inconsistent address": at least one of the addresses supplied by the calling party is incorrect
- "address cannot be parsed"

5.4.4.4 Unsuccessful case (SwMI side /Rejection)

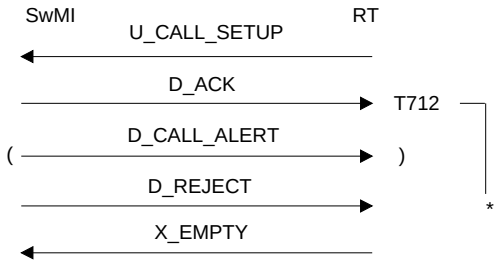


Figure 73: Outgoing call rejected by the SwMI

- "unknown called party": None of the called RTs is known.
- "service barred called party": None of the known called parties has service rights.
- "unreachable remote terminal": None of the called parties with service rights is reachable.
- "lack of resources": The SwMI has no resources to set up the call.
- "called party busy": None of the called RTs in the base network is free or accessible.
- "double transfer": The requested user is transferred to an address already transferred.
- "encryption error":
- "called party absent": None of the called RTs is present in the Base Network where the called party is located.
- "terminal pre-emption": The call set-up is cancelled: the last called RT pre-empted for another transaction while being rung by the SwMI.
- "resource pre-emption": Call set-up is cancelled: some of the resources needed to set-up the call have been pre-empted for another transaction.
- "network event":
- "no reply from called party": No called party replied.
- "all requested parties rejected": The different states of all the called RTs prevent the SwMI from setting up the call.
- "user refusal": The called party refuses the incoming call.
- "Called Party warned" : The call setup failed, anyway the called party has been warned.

5.4.5 Incoming call

5.4.5.1 Successful case (RT free)

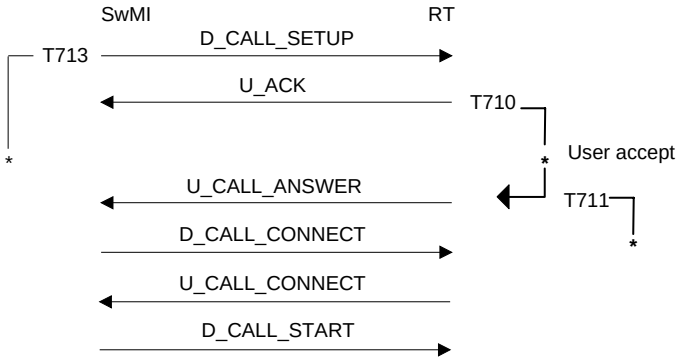


Figure 74: Incoming call sequence - case RT free

The D_CALL_SETUP contains an optional information element which indicates the hook method:

- Hook_mode = « Automatic without tone notification »: Ring is not activated and T710 timer is not set, RT sets directly T711 and sends U_CALL_ANSWER TSDU.
- Hook_mode = « Automatic with tone notification »: A Short ring is activated and T710 timer is not set, RT sets directly T711 and sends U_CALL_ANSWER TSDU.
- Hook_mode = RING (or absent) : Ring is activated, T710 timer is set, and The RT shall send the U_CALL_ANSWER TSDU as soon as the requested user goes off hook.

5.4.5.2 Successful case (RT accessible)

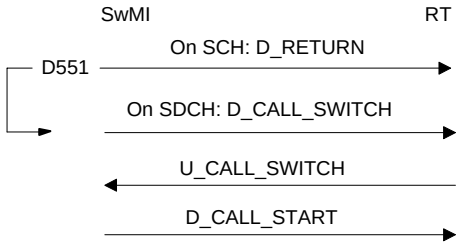


Figure 75: Incoming call sequence - case RT accessible

The called RT shall be switched from the previous TCH to the new one (see "general mechanisms").

The D_RETURN TSDU cause field is set to "Silent Call" or "normal".

In case of an incoming call to a "accessible" TDX interface, the call in progress on the RT is released, then the SwMI sets up the priority call, this case is considered as a case of call set up with a "free" RT.

5.4.5.3 Unsuccessful case (SwMI side)

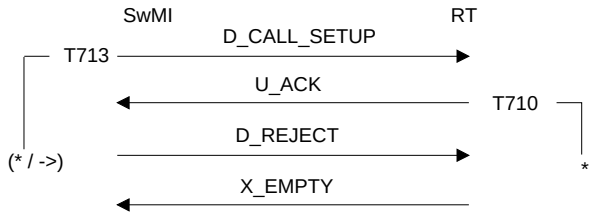


Figure 76: Incoming call failure SwMI side

Reject causes (general):
- "cleared by user": The requesting user has cleared the call;
- "terminal pre-emption": The SwMI stops ringing the called RT because the calling party is preempted for another transaction;
- "resource pre-emption": Some of the resources needed to set-up the call have been preempted for another call;
- "network event":
- "end of ringing": This shall be indicated in case of T713 expiry;
- "unreachable remote terminal": The SwMI cannot set-up a dialogue with the requesting RT;
- "no reply from called party": None of the requested users replied.

Specific reject causes for multi party call:

A call has been already set-up between a calling party and one or several called party, the call is cleared when a called party is still in "ringing phase".

- "voice inactivity": No voice activity during the call
  The SwMI shall release the other RTs with "voice inactivity" cause field

- "operator decision": The call is released by the Base network operator, The SwMI shall release the other RTs with "operator decision" cause field.

- "remote RT synchronisation": The RT was not able to report "normal" call clearing (see the RESYNCHRONISATION application) and its withdrawal prevents the multiparty call retention The SwMI shall release the other RTs with "remote RT synchronisation" cause field.

- "normal": This cause shall be indicated when end of call due to requesting or requested user clearing. The SwMI shall release the other RTs with "normal" cause field.
- "unreachable remote terminal": The dialogue is no more possible between SwMI and the calling RT (before inter-connection), The SwMI shall release the other RTs with "unreachable remote terminal" cause field.

5.4.5.4 Unsuccessful case (RT side)

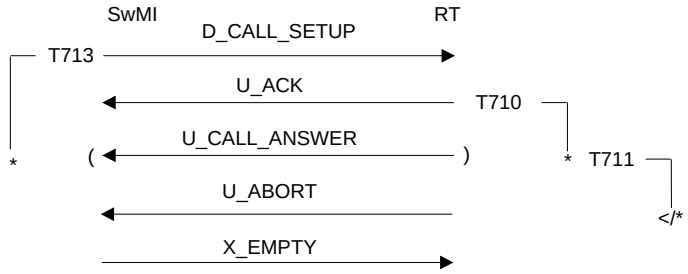


Figure 77: Incoming call failure RT side

General causes for unsuccessful case (RT side)

- "user refusal": The requested user refuses the incoming call

- "application event": T710 or T711 time-out, the second case is unlikely since T713 is set to expire before T710, and T711 expiry is due a SwMI event between acceptance the called party replay and the activation of the TCH entry procedure.

Specific causes for incoming or outgoing PABX call:
- "internal TDX link problem";
- "external TDX link problem".

Specific causes for outgoing PABX call abort:
- "unknown user sub-address";
- "PABX subscriber";
- "service barred calling party" The service is barred for the TDX, as seen by the PABX;
- "service barred called party": The called PABX user service barred, as seen by PABX;
- "no reply from requested user": The PABX detects the non response before the SwMI;
- "unknown called party": The PABX detects an incorrect address.

Specific causes for incoming PABX call abort

- "cleared by user": The PABX detects that the requesting user has cleared the call.

The U_ABORT TSDU shall be sent after the D_ACK TSDU reception and before receiving the D_CALL_CONNECT TSDU), after, If the user cancels the call, the RT will switch to PTCH (with respect the protocol PTCH entry rules (D503, T502)) and then execute a TERMINATION transaction.

5.4.6 Withdrawal of a participant

Initiated by the RT user, The RT quits the set-up call by executing a TERMINATION application transaction, with "normal" cause field.

See "Application transaction termination initiated by RT".

5.4.7 Call clearing

The procedure to clear a private call consists in opening a RELEASE application transaction with each RT participating in the call with causes:

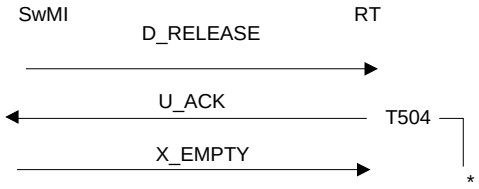


Figure 78: Private call release indication

- "normal": The calling RT or last called RT exists for whatever cause.
- "operator decision": The call is released by the operator.
- "terminal pre-emption": After the calling RT or last called RT is preempted to execute another application transaction for whatever cause (flash, traffic disabling, etc.).
- "resource pre-emption": Pre-emption of resources used for the call, if the resource prevents the calling RT or the last called RT to "remain" in the call, the SwMI shall release all RT.
- "network event": any network failure.
- "voice inactivity".
- "remote RT synchronisation": The RT is unable to report "normal" call clearing (see EVENT REPORTING application) and its withdrawal prevents the multi-user call from being maintained.
- "unreachable remote terminal": Protocol failure during dialogue with the calling RT.

  "key error": This participant in the call cannot be authenticated.

After a transfer request executed by the called RT.

- "transfer failure": Failure of transfer protocol executed on side of RT requesting the transfer.
- Same Reject causes planned at outgoing call.
- "called terminal not configured": the called RT, after call transfer, cannot participate in an encrypted call.

5.4.8 Call transfer

A called RT in a private call may request the SwMI to transfer the ongoing call to another terminal. To do this, the RT shall leave the TCH and supplies the SwMI with the identity of a new terminal where the call can be routed.

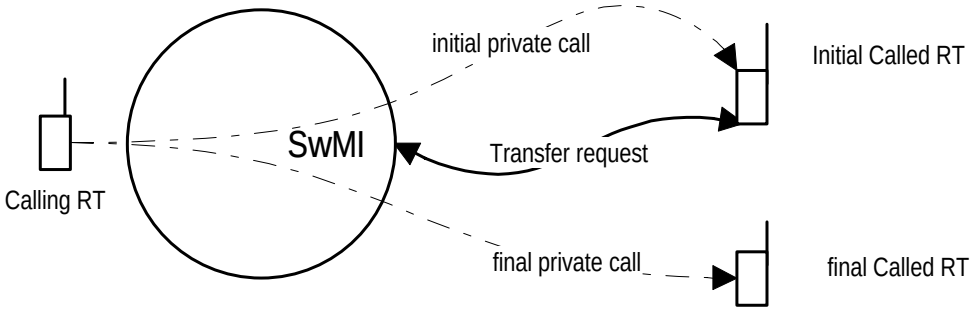


Figure 79: Call transfer representation

5.4.8.1 Transfer request successful case

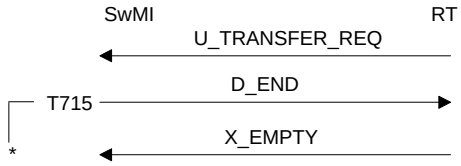


Figure 80: Call transfer request sequence

5.4.8.2 Transfer request unsuccessful case (SwMI side)

If the transfer request is inconsistent, the SwMI switches the called RT back in its call, TRANSFER may be refused for the following causes:

- "inconsistent address": The called RT address is incorrect.
- "service barred calling party": The RT requesting the transfer does not have the transfer rights (the RT is the calling party, transfer is not allowed for the type of call, etc.).

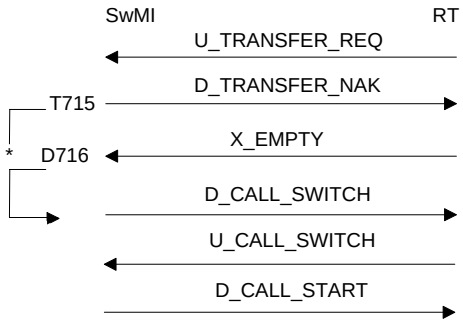


Figure 81: Call transfer request failure SwMI side

On requesting RT authentication error, the SwMI shall apply a call clearing procedure with the cause:

- "key error" for the requesting RT;
- "normal" for the calling RT.

On T715 time-out, the SwMI shall then apply a call clearing procedure on the set-up call for the calling RT with the cause: "transfer failure":

5.4.8.3 Re-routed call successful case (calling party side)

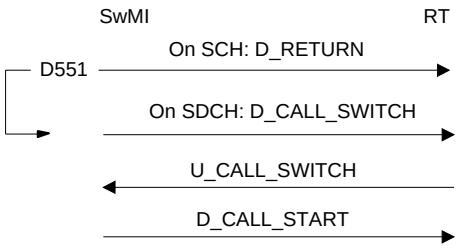


Figure 82: Transfer call sequence - calling RT side

The calling RT shall be switched from previous TCH to the new one.

The D_RETURN TSDU cause field is set to "transfer".

The Information Element (CALL_TYPE) from the D_CALL_SWITCH TSDU shall indicate "Call rerouted after transfer".

5.4.8.4 Re-routed call unsuccessful case (calling party side)

On RT authentication error, SwMI shall switch the RT to TCH and then shall apply a call clearing procedure with the cause:

- "key error" for this RT (calling RT);
- "normal" for the other RT involved in the call (final called RT).

5.4.8.5 Re-routed call successful case (final called RT side)

See "incoming call - successful case".

5.4.8.6 Re-routed call unsuccessful case (final called RT side)

See "incoming call - unsuccessful case".

On RT authentication error, SwMI shall switch the RT to TCH and then shall apply a call clearing procedure with the cause:

- "key error" for this RT (final called RT)
- "normal" for the other RT involved in the call (calling RT).

5.4.9 Release call request

This transaction shall allow one RT to ask the SwMI to clear a private call. It shall concern all types of private call (PABX call, individual or multiparty call).

The call identity supplied by the RT shall be the calling user's address.

The call participants shall be released with an "operator decision" cause field.

5.4.9.1 Successful case

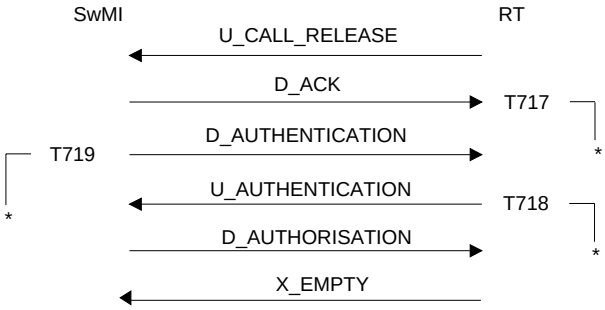


Figure 83: Release call request sequence

The D_AUTHORISATION TSDU indicates the call is released.

5.4.9.2 Unsuccessful case (RT side)

- At T717 time out, the RT shall abort with an "application event" cause field.
- On a user's decision, the RT shall abort with a "cleared by user" cause field. This may only occur before D_AUTHENTICATION TSDU transmission.
- On T718 time-out, the RT aborts with "application event" cause field.

The SwMI shall release the call as soon as the RT is correctly authenticated.

5.4.9.3 Unsuccessful case (SwMI side)

The call is not released.

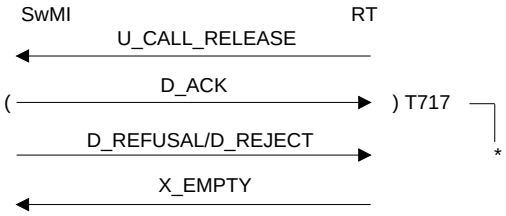


Figure 84: Release call request refused by the SwMI

The REFUSE cause should be one of the following ones:
- "unknown calling party"
- "service barred calling party": The RT is not allowed to do that.

- "identification error": This cause shall be indicated when:
  - The address supplied in the release request does not exist; or,
  - The address supplied in the release request exists but the RT is not the call initiator; or,
  - Call status prevents release.

The REJECT cause should be:

- "network event": The call cannot be set up because of a network event.

Unsuccessful RT validation:

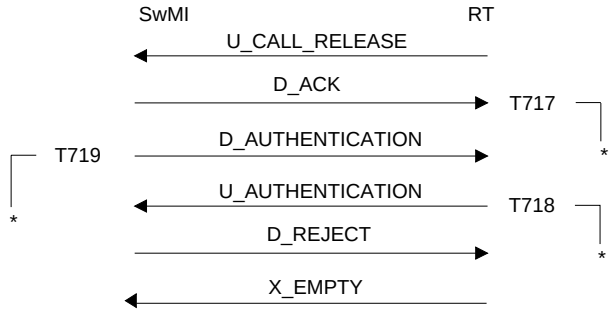


Figure 85: Release call request - RT authentication failure

The REJECT cause should be:

- "key error"

5.4.10 User intrusion in voice application (overview)

This transaction allows an RT to enter an already established (private call, open channel or emergency open channel) call.

The RT's request contains identification of the call in which the user wishes to participate. The reference depends on the call type.

After the SwMI agrees to handle the request, the RT shall set T714. It covers the time required by the SwMI to set up the resources required to allow the user's RT to participate in the call:

- Analysis of call identity;
- Regrouping of the resources needed to set up the voice circuit.

The user's RT is then allowed to participate in the call, but the SwMI does not consider the RT to be the calling nor called private call user (Call release conditions are not changed).

5.4.10.1 User withdrawal from the call

The RT withdraws from the established call on a user's decision, it executes a TERMINATION application transaction with a "normal" cause field.

The user's withdrawal has no effect on the voice application handling the intrusion.

5.4.10.2 Effects of call release on user

The user's RT is never included in the clearing criteria of the call on which it intruded.

Nevertheless, when the call is cleared, the SwMI shall set up a RELEASE transaction with the RT. The cause shall be the same as that which explains the reason for call clearing to other participants.

5.4.10.3 Effects of user pre-emption on voice call

There are no effects on the call involved.

5.4.11 Private call intrusion

The call identity supplied by the user's RT shall be the private call calling users address.

5.4.11.1 Successful case

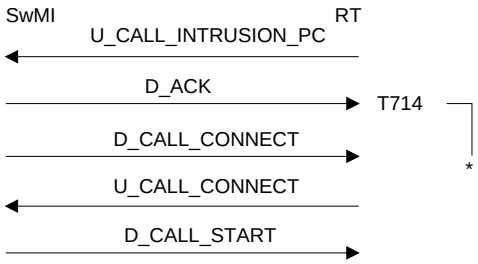


Figure 86: Private call intrusion sequence

5.4.11.2 Unsuccessful case (RT side)

When decided by the RT user, the RT may withdraw with a "cleared by user" cause.

At T714 time-out expiry, the RT shall abort the call with an "application event" cause field and shall leave the user free to decide on how to continue.

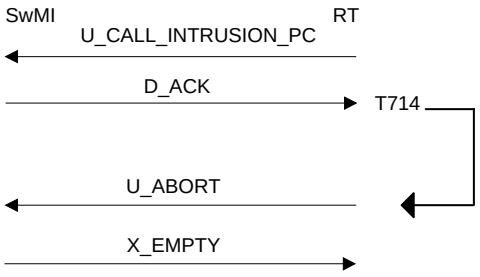


Figure 87: Private call intrusion failure RT side

5.4.11.3 Unsuccessful case (SwMI side)

Before RT validation:

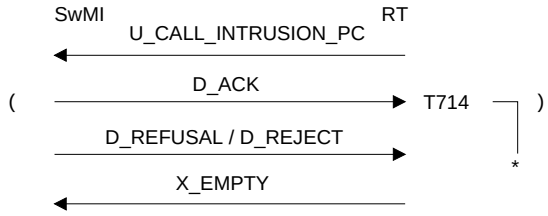


Figure 88: Private call intrusion failure SwMI side

The REFUSE cause shall be one of the following ones:
- "unknown calling user":
- "calling party service barred": The RT participation cannot be enabled from the calling RT.
- "identification error": intrusion cannot be enabled because:
  - The address supplied in the intrusion request does not exist or;
  - The address supplied in the intrusion request exists but the RT is not the call initiator or;
  - call status prevents intrusion.

The REJECT cause shall be one of the following ones:

- "lack of resources": Intrusion requires use of unavailable resources.

- "terminal pre-emption": intrusion cannot be enabled because the pre-emption of one of the RTs involved in the call causes the SwMI to clear the call.

- "resource pre-emption": intrusion cannot be enabled because:
  - the resource used for intrusion has been preempted
  - the resource used for the call in which the RT wishes to participate has been preempted.

- "network event": The call cannot be set up because of a network event.

- "terminal not configured": RT cannot participate in an encrypted call, it does not have the key.

- "Unsuccessful RT validation": If the RT is not authenticated when it switches to the TCH, the intruder's RT shall receive a release, application transaction with "key error" cause field.

5.4.12 Open channel intrusion (informative)

The reference of the open channel in which the user wishes to participate is the open channel number.

5.4.12.1 Successful case

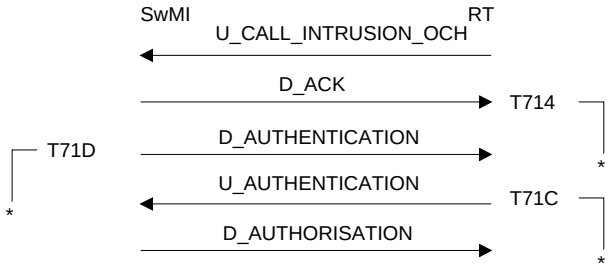


Figure 89: Open channel intrusion

5.4.12.2 Unsuccessful case (RT side)

On an RT user decision, the RT aborts the transaction with a "cleared by user" cause field. This may only occur before sending the U_AUTHENTICATION TSDU.

At T714 time-out, the RT aborts with an "application event" cause.

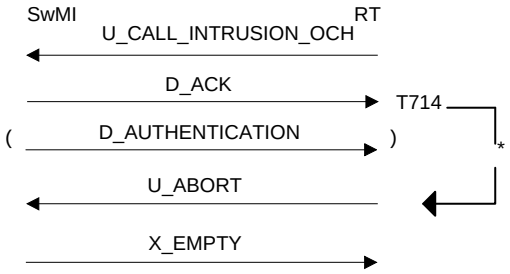


Figure 90: Open channel intrusion sequence

After sending the U_AUTHENTICATION TSDU and before receiving the D_AUTHORISATION TSDU, or when the application time-out T71C expires, the RT sends an X_EMPTY TSDU to indicate abort.

After receiving the D_AUTHORISATION TSDU, the RT initiates a TERMINATION application transaction to indicate abort.

5.4.12.3 Unsuccessful case (SwMI side)

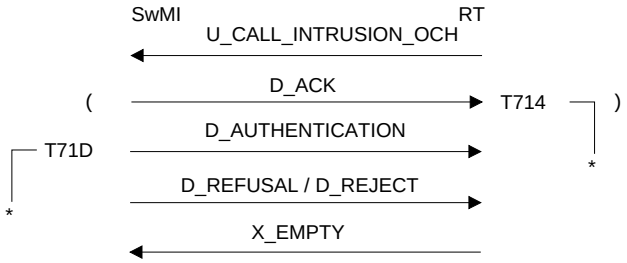


Figure 91: Open channel intrusion failure SwMI side

The REFUSE cause should be one of the following ones:

- "unknown calling party"
- "calling party service barred": The intrusion cannot be enabled from the calling RT.
- "identification error": The open channel is not set-up or not defined.
- "coverage fault": The open channel is set-up in the user's RT coverage area.

The REJECT cause should be one of the following ones:

- "lack of resources": The intrusion requires the use of unavailable resources.
- "resource pre-emption": The user cannot participate because some of the resources required for intrusion have been preempted.
- "network event": The open channel cannot be set up because of a network event.
- "terminal not configured": The RT cannot participate in an encrypted call, because it does not have the key.
- "unreachable open channel master":
- "application event" There is an application event due to T71D expiry.

"Unsuccessful RT validation"

If the RT is not authenticated in the intrusion application transaction, the SwMI executes a RELEASE application transaction with "key error" cause field at a later time.

5.4.13 Emergency open channel intrusion (informative)

The reference of the emergency open channel in which the user wishes to participate is the cell number.

5.4.13.1 Successful case

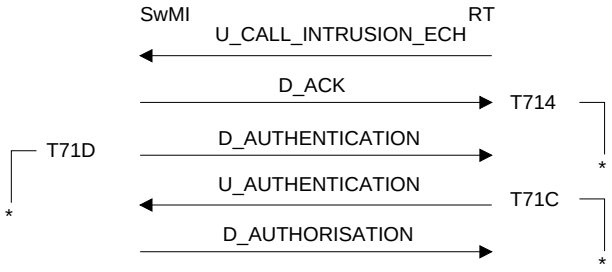


Figure 92: Emergency open channel intrusion sequence

5.4.13.2 Unsuccessful case (RT side)

On a user's decision, the RT aborts with a "cleared by user" cause field. This may only occur before sending the U_AUTHENTICATION TSDU.

On application T714 time-out, the RT aborts with an "application event" cause field.

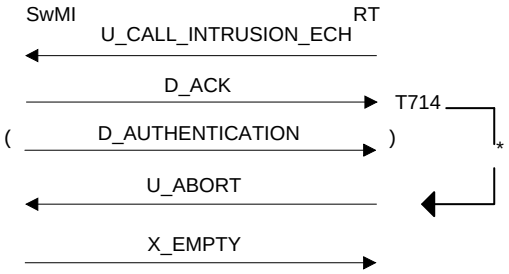


Figure 93: Emergency open channel intrusion failure RT side

After sending the U_AUTHENTICATION TSDU and before receiving the D_AUTHENTICATION TSDU, or when the time-out T71C expires, the RT sends an EMPTY TSDU to indicate abort.

After receiving the TSDU D_AUTHORISATION TSDU, the RT initiates a TERMINATION application transaction to indicate abort.

5.4.13.3 Unsuccessful case (SwMI side)

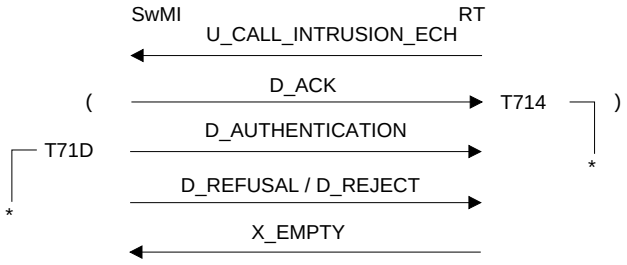


Figure 94: Emergency open channel intrusion failure SwMI side

The REFUSE cause should be one of the following one:
- "unknown calling party"
- "service barred calling party": The RT participation cannot be enabled from the calling RT.
- "identification error": The emergency open channel is no longer set-up.
- "coverage fault": The emergency open channel is set-up within the user's RT coverage.

The REJECT cause should be one of the following ones:
- "lack of resources": The RT participation require the use of resources which are not available.
- "terminal pre-emption": The user may not participate because some of the resources required for intrusion have been preempted.
- "network event": The open channel cannot be set-up because of a network event.
- "unreachable open channel master"
- "application event": There is an application event due to T71D expiry.

Unsuccessful RT validation:

If the RT is not authenticated in the intrusion application transaction, the SwMI executes a RELEASE application transaction with a "key error" cause field at a later time.

5.5 Group communications

This subclause is not applicable to BSC disconnected mode.

5.5.1 Overview

This group communication application is designed to enable the following functions:

- Call in open channel mode;
- Call in "group call" or "talkgroup" mode;
- Call in object call mode;

The SwMI shall provide operational groups with a set of predefined resources for their communication needs:

- The open channel coverage: resources shall be enabled or disabled on an RT's request (or by operator) by executing an SwMI/RT application transaction. These operations are called "open channel set-up" and "open channel release" and are described in this chapter. This is not described in this subclause

- The talkgroup, group call or object call coverage: resources shall be defined and enabled or disabled by operator , this is not described in this subclause.

In each cell of the coverage area, the SwMI shall broadcast via the CCH in asynchronous mode:

- D_GROUP_LIST TSDU: Shall contain the list of group communication coverage identities, an indication of the adjacent cells, which belong to the call coverage, and only for each open channel:

  - the associated participation rights (single or combined OG);
  - additional individual RT participants
  - the priority;

- D_GROUP_ACTIVATION TSDU: Shall contain all communication parameters of actives group communications but object call, The SwMI shall decide when a call is inactive (voice inactivity).

- D_OC_ACTIVATION TSDU: Shall contain object call communication parameters of actives object call communications, The SwMI shall decide when a call is inactive (voice inactivity).

In each cell of an open channel coverrage area, the SwMI shall broadcast via the CCH in asynchronous mode:

- D_GROUP_COMPOSITION TSDU shall contain the OG "single" participants, when the open channel is associated with "combined" OG;

- D_ADDITIONAL_PARTICIPANTS TSDU a list of additional RT authorized to participate to the open channel;

In these conditions the RT

- shall use its own criteria to decide whether or not to participate, according to:
  - user choice (selected open channel identity , talk-group identity, group call identity, object call identity);
  - open channel or (talk-group, group call, object call) coverage existence check;
  - participation right check (open channels only);
- When these 3 conditions are met, the RT shall be a "group communication participant".

The group communication participation does not require any SwMI-RT exchange, but shall oblige the RT to handle the selected group communications messages and to switch to the CTCH involved when the group communication is declared "active" and switch back to the CCH when the SwMI indicates that the group communication status has changed to "inactive". This is transparent to the SwMI.

Note : for object call no information are provided by the SwMI, all object numbers are managed locally by RT. The ST initialises locally to object numbers)

Depending on the priority level, the Open channel is used for:

- basic open channel (PRIORITY LEVEL = ROUTINE or FLASH)
- broadcast open channel (PRIORITY LEVEL = BROADCAST)
- crisis open channel (PRIORITY LEVEL = CRISIS)
- tower communication (PRIORITY LEVEL = TOWER COMMUNICATION)
-

The application at the SwMI-RT interface is described by:

- Open channel set-up;
- RT information in a cell
- Group communication setup indication;
- RT entry in group communication
- Activation request;
- Group communication paging;
- Activation indication: RT switch-over to CTCH;
- Deactivation indication: RT return to CCH;
- Temporary RT withdrawal;
- Open channel release;
- Dispersion of participants.

5.5.2 Open channel set-up by RT

This subclause is not applicable to RSW disconnected mode.

The RT shall initiate the set-up. It shall cause the SwMI to analyse the request parameters, and to set-up the open channel coverage.

The D_AUTHENTICATION TSDU shall mark the end of the first phase, it indicates that the called open channel may be opened.

5.5.2.1 Successful case

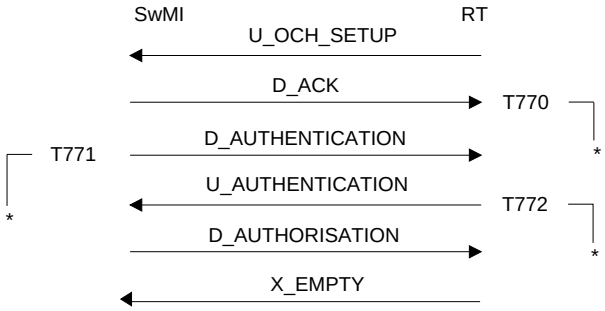


Figure 95: Open channel set-up sequence

On application transaction completion, the RT shall remain on the CCH.

After the RT authentication, the SwMI shall send the D_AUTHORISATION TSDU, whatever the application transaction outcome, the open channel shall remain set-up.

5.5.2.2 Unsuccessful case (RT side)

If the RT has to report cancelling on the user part:

- before sending the U_AUTHENTICATION TSDU, it shall use the U_ABORT TSDU. The SwMI shall then close the open channel;

- after sending U_AUTHENTICATION TSDU, it shall use the X_EMPTY TSDU, the open channel shall remain set-up.

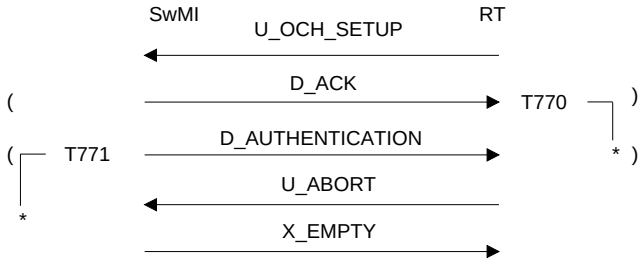


Figure 96: Open channel set-up failure RT side

The ABORT cause shall be one of the following ones:

- "cleared by user"
- "application event": There is an application event due to T770 application time-out expiry.

5.5.2.3 Unsuccessful case (SwMI side)

The SwMI shall inform the RT of the failure with a D_REFUSAL or D_REJECT TSDU, according to the cause given by the SwMI.

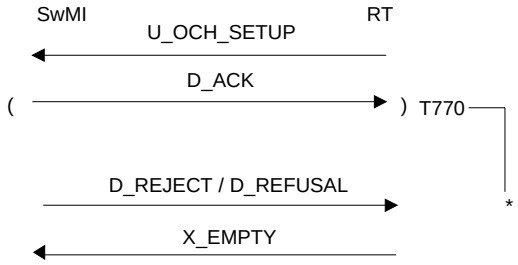


Figure 97: Open channel set-up failure SwMI side

The REFUSE cause shall be one of the following ones:

- "unknown calling party"
- "service barred calling party": The RT does not have the right discrimination for service activation, or does not belong to the operational group authorised to set-up the open channel.
- "open channel number not valid": The number is not included in the numbering plan known to the SwMI.
- "open channel not created": The coverage area is not defined.
- "open channel already set-up"
- "out of coverage cell": The requesting user is not within open channel coverage.
- "maximum OG exceeded" : The maximum number of participanting OG has been exceeded

The REJECT cause shall be one of the following ones:

- "lack of resources": indicates a time-out in waiting for resources to set-up the coverage.
- "resource pre-emption": A resource needed to set-up the open channel has been preempted.
- "network event": The open channel cannot be set-up because of a network event.
- "coverage cannot be set-up": The different equipment implementing the coverage cannot dialogue within the SwMI.
- "unreachable open channel master":
- "application event": There is an application event due to T771 expiry.

NOTE: The SwMI may reject the command following unsuccessful RT validation.

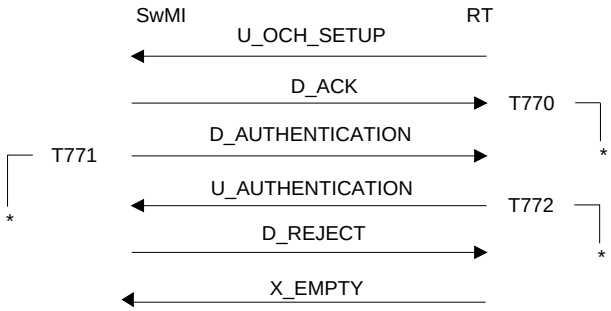


Figure 98: Open channel set-up failure - RT authentication error

The REJECT cause should be:

- "key error": In this case, the SwMI shall initiate open channel release.

5.5.3 RT information in a cell

Two different mechanisms shall be implemented to inform the RTs about open channels setup in each cell of the open channel coverage.

5.5.3.1 Information on SDCH, SCH, at the time of set-up for "crisis" open channel

This subclause is applicable for open channel setup with priority = CRISIS.

All RTs in each cell of the coverage of the open channel shall be informed by means of D_CRISIS_NOTIFICATION TSDU:

Figure 99: RT crisis notification at set-up

The TSDU shall be broadcast N778 times every D778 on channels (supporting communications with call priority ≤ CRISIS) of each cell of the open channel coverage and shall be addressed to all terminals:

- on CCH, over PCH and SDCH;
- on TCH, over SCH constructed in mode 1;

The TSDU shall contain:

- the initiator's address.
- the open channel identifier
- the initiator's organisation identity
- up to 5 participating OG.

Depending on participating OG and initiator's organisation identity, the RT shall decide to:

- If the RT is engaged in an higher priority open channel or if it is not authorized to participate, according to open channel participing OG, the TSDU is ignored.

- If the RT is already engaged in a "crisis" open channel, an audible signal shall alert the user of any new emergency call with the address of the new initiator, unless the RT is the initiator. In this case T779 shall not be set.

- either, it shall alert its user on reception of this TSDU by means of a mechanism whose duration is limited by T779. With T779 > D778

  The RT shall set T779 on receipt of the first D_CRISIS_NOTIFICATION TSDU, and shall reset it every time it receives the TSDU.

5.5.3.2 Information on SDCH, SCH, at the time of set-up for "broadcast" open channel

This subclause is applicable for open channel setup with priority = BROADCAST.

All RTs in each cell of the coverage of the open channel shall be informed by means of D_BROADCAST_NOTIFICATION TSDU:

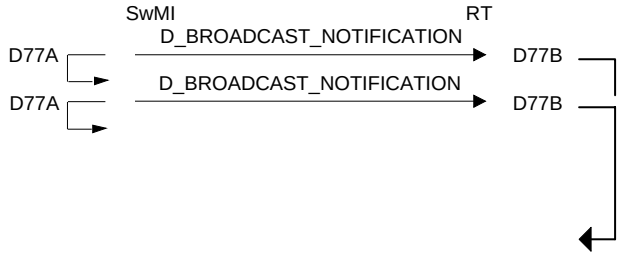


Figure 100: RT broadcast notification at set-up

The TSDU shall be broadcast N77A times every D77A on channels (supporting communications with call priority < BROADCAST) of the each cell of the open channel coverage and shall be addressed to all terminals:

- on CCH, over PCH and SDCH;
- on TCH, over SCH constructed in mode 1;

The TSDU shall contain up to 5 participating OG.

The RT shall decide to:

- If the RT is engaged in an higher or equal priority open channel or if then RT does not belong to any of the participating OG, the TSDU is ignored.
- otherwise the RT shall alert its user on reception of this TSDU and set D77B on receipt of each D_BROADAST_NOTIFICATION TSDU.
  - if an application connection is active, RT shall end it by a withdrawal or an abort.
  - If the RT is participating to a current group communication (open channel, talkgroup, group call or object call), RT suspends its participation as long as D77B is set.

5.5.3.3 Permanent information on group communications in a cell

The D_GROUP_LIST TSDU shall be broadcast under each cell of the coverage and shall give the list of established group communications (open channels identities + talkgroup, group call, object callcoverage identities). This list shall be updated each time an open channel or talkgroup, group call or object call coverage is setup or released.

Figure 101: RT information on set-up open channels

The SwMI (see BROADCAST APPLICATION) shall broadcast a D_GROUP_LIST TSDU on SDCH in asynchronous broadcast mode.

5.5.4 RT entry in group communication

5.5.4.1 "multi purpose" open channel

The RT entry on an open channel requires confirmation on the user's part:

RT shall verify existence of the open channel by the D_GROUP_LIST and shall check it's rights to participate by the D_GROUP_COMPOSITION TSDU.

Entry in the open channel shall remain an internal RT operation. It shall not give rise to any SwMI / RT exchange.

5.5.4.2 Crisis open channel

The RT entry on a crisis open channel remains the same during both open channel phases: crisis notification broadcast phase and established open channel phase.

The entry on the crisis open channel requires or not a confirmation on the user's part:

- during phase one, while the RT is alerting its user, i.e., as long as T779 is set;
- during phase two, by the
  - D_GROUP_LIST: The user knows the identity of the crisis open channel, and may therefore select one of them in the list.
  - D_GROUP_COMPOSITION TSDU: The RT is authorized to participate if it owns one of the participating OG.
  - D_ADDITIONAL_PARTICIPANTS TSDU: The RT is authorized to participate if its own individual adress is one of the participating additional individual adresses.

Entry on the crisis open channel shall remain an internal RT operation. It shall not give rise to any SwMI / RT exchange.

5.5.4.3 Broadcast open channel

The RT entry on a broadcast open channel remains the same during both open channel phases: « broadcast notification » broadcast phase and established open channel phase.

The entry on the broadcast open channel **does not** requires confirmation on the user's part:

- D77B shall give the possibility for the RT to identify and check its rights to participate:
  - D_GROUP_LIST: The user knows the identity(ies) of the broadcast open channel.
  - D_GROUP_COMPOSITION TSDU: The RT participates if it owns one of the participating OG.

Entry on the broadcast open channel shall remain an internal RT operation. It shall not give rise to any SwMI / RT exchange.

5.5.4.4 Talk group

The RT entry on a talk group requires confirmation on the user's part:

RT shall verify existence of the coverage associated to the talk group by the D_GROUP_LIST.

Entry in the talk group shall remain an internal RT operation. It shall not give rise to any SwMI / RT exchange.

5.5.4.5 Group call

The RT entry on a group call requires confirmation on the user's part:

Entry in group call shall remain an internal RT operation. It shall not give rise to any SwMI / RT exchange.

5.5.4.6 Object call

RT shall use its own criteria to decide whether or not to participate, according to user choice (initialisation of the object number);

The object call communication participation does not require any SwMI-RT exchange, but shall oblige the RT to handle the selected object call message and to switch to the CTCH involved when the object call is declared "active" and switch back to the CCH when the SwMI indicates that the object call status has changed to "inactive". This is transparent to the SwMI.

5.5.5 Group communication activation request

This message shall be transmitted on the DACH (see PAS 0001-3-3 [6]). After confirmation, the RT shall set the T773 time-out.

5.5.5.1 Successful case

If the group communication is a open channel with "broadcast" priority, once on CTCH RT shall not transmit except if the RT has requested the open channel setup.

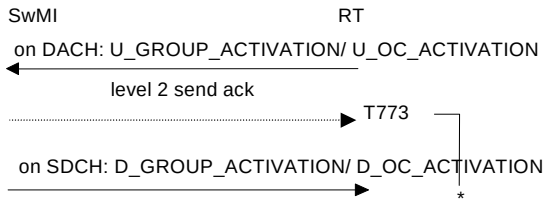


Figure 102: Group communication Activation

T773 shall be cancelled on reception of the D_GROUP_ACTIVATION/ D_OC_ACTIVATION TSDU for the requested group communication.

The mechanism is more described in 5.5.9

After the PCH emission, SWMi shall wait D551 before sending D_GROUP_ACTIAVTION on SDCH.

SwMI acks the request even if the communication is already activated.

See "RT switch-over to CTCH".

The SwMI shall consider the communication as "active" and the D_GROUP_ACTIVATION/ D_OC_ACTIVATION TSDU shall inform the RT that the communication is activated or already activated,.

5.5.5.2 Unsuccessful case RT side

For all the following cases of failure the RT shall not inform the SwMI.

(a) Time-out expiry: T773

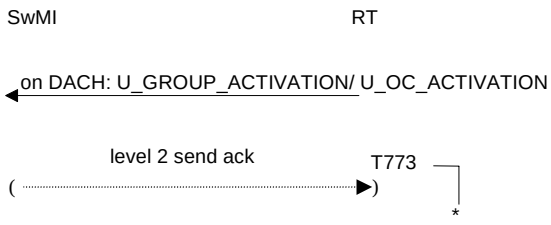


Figure 103: Activation request failure on time-out

(b) Unsuccessful message transmission: failure of the random access procedure on the DACH

(c) Unsuccessful external group call activation

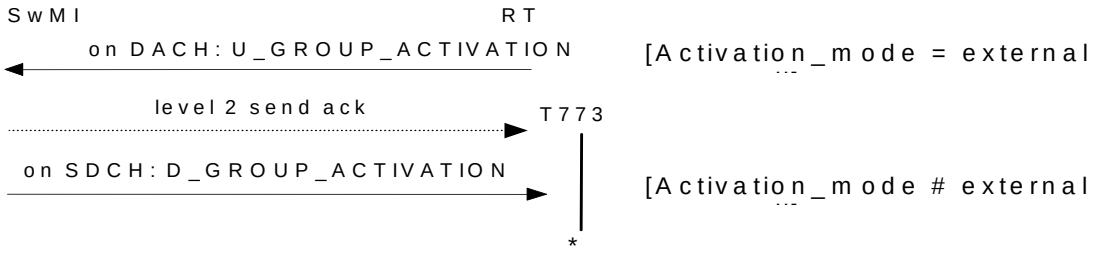


Figure 104: Group communication Activation failure (external group call)

When the RT executes an "external group call" activation (ACTIVATION_MODE information element set to "external group call" in the U_GROUP_ACTIVATION), the RT shall consider as an acknowledge the D_GROUP_ACTIVATION TSDU with ACTIVATION_MODE information element set to "external group call".

If the ACTIVATION_MODE information element is not set to "external group call", the D_GROUP_ACTIVATION TSDU is not taken into account by the RT.

5.5.5.3 Unsuccessful case SwMI side

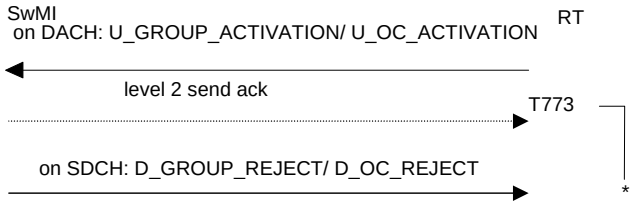


Figure 105: Activation request reject

The REJECT cause should be:
- "cell out of coverage": the group communication is not established under this cell.
- "lack of resources": indicates a time-out in waiting for activation or the saturation on the wiatin queue.
- "group already activated" : indicates that
    - The group communication is not active under this cell and another activation request is pending (waiting for radio resources) for this group communication.
    - The group communication has been activated in "internal group call" mode and the current activation request concerns an "external group call"
- "normal": other.

5.5.6 Group communication paging

When the following circumstances are met:
- A group communication has just been activated and Channel saving function is ON;
- the SwMI assumes that there is no participant for this communication in the cell (RT are not in the Cell of the activating RT).

Before doing "Group communication activation indication", SwMI executes a "Group communication paging.

Two mechanisms are available:

5.5.6.1 Mode 1: D_GROUP_PAGING is sent before the PCH.

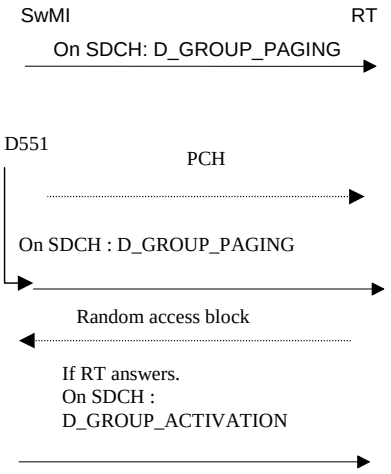


Figure 106: paging with answer from RT

If a RT answers to the first D_GROUP_PAGING, the channel saving mechanism stops, and the D_GROUP_ACTIVATION procedure starts.

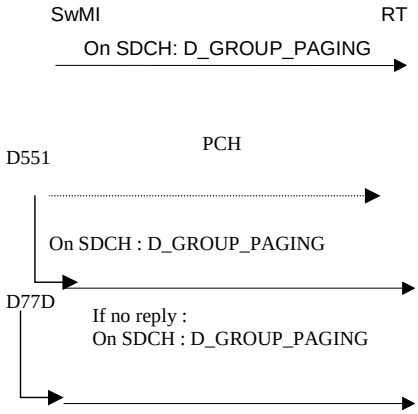


Figure 107: paging with no anwser from RT

The TSDU is sent every D77D and the second TSDU, but only the second, shall be preceded by a PCH with a collective "GROUP" address. If a RT answers, the activation is performed without a new PCH.

This TSDU is sent during the group communication activation until a RT answers.

This late entry mechanism is only authorised for N77D simultaneous group communication by cell.

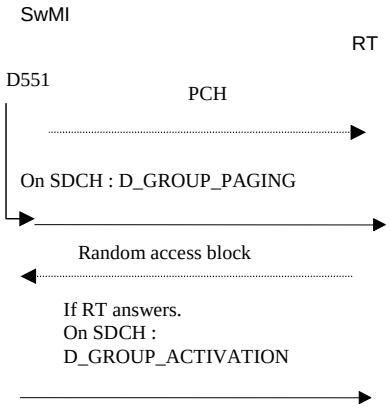
If the number is greater than N77D, SwMI sends only 2 D_GROUP_PAGING messages:

-a D_GROUP_PAGING, which is not preceded by a PCH

-and if there is no answer, SwMI sends a second D_GROUP_PAGING preceded by a PCH

The answer is described in PAS 0001-3-3 [6].

5.5.6.2 Mode 2: D_GROUP_PAGING is sent after the PCH.



The TSDU shall be prceded by a PCHwith a collectve group address. The TSDU reception will involves an answer from all RT concerned by the group communication (“participants”).

The TSDU is sent every D77D and the first TSDU, but only the first, shall be preceded by a PCH with a collective "GROUP" address. If a RT answers, the activation is performed without a new PCH.

This TSDU is sent during the group communication activation until RT answers.

This late entry mechanism is only authorised for N77D simultaneous group communication by cell.

If the number is greater than N77D, SwMI sends only 2 D_GROUP_PAGING messages:

5.5.7 Object call paging

When the following circumstances are met:
- An object call has just been activated and Channel saving function is ON;
- the SwMI assumes that there is no participant for this communication in the cell (We are not in the Cell of the activating RT).

Before doing "object call activation indication", SwMI executes a “object call paging”:

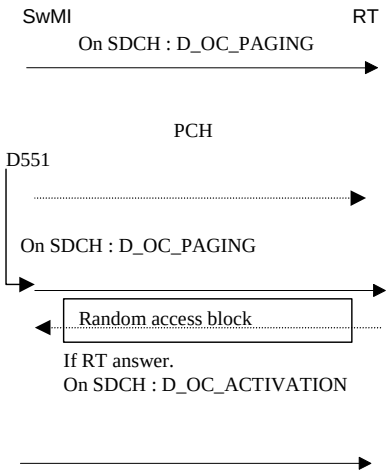


Figure 108: object call paging with RT answer

If a RT answers to the first D_OC_PAGING, the channel saving mechanism stops, and the D_OC_ACTIVATION procedure starts.

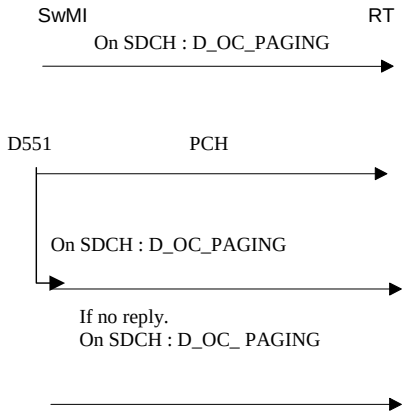


Figure 109: object call paging without RT answer

The TSDU is sent every D77D and the second TSDU, but only the second, shall be preceded by a PCH with a collective "COI" address. If a RT answers, the activation is performed without a new PCH.

This TSDU is sent during the object call activation until RT answers.

If the number is greater than N77E, SwMI sends only 2 D_OC_PAGING messages:

-a D_OC_PAGING, which is not preceded by a PCH

-and if there is no answer, SwMI sends a second D_OC_PAGING preceded by a PCH

The answer is described in PAS 0001-3-3 [6].

5.5.8 Group communication activation overload indication

When the following circumstances are met:
- This function is ON (depends on the terminal profile of the RT of the concerned cell),
- A group communication has just been activated and no traffic channel is available for this communication,

The SwMI shall send a "group communication overload indication" on CCH in datagram mode and addressed to "ALL RT".

Figure 110: D_GROUP_OVERLOAD_ID TSDU

This TSDU shall indicate the RT that the group activation request is put in a waiting queue.

5.5.9 Group communication activation indication

Whenever a communication is activated, the SwMI shall inform the RTs in the coverage areas in two steps.

1) First step : It shall immediately send a first D_GROUP_ACTIVATION/ D_OC_ACTIVATION TSDU;

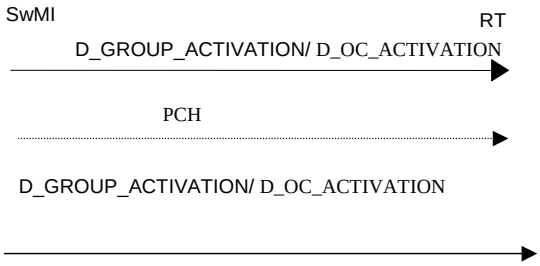


Figure 111: First D_XXX_ACTIVATION TSDU broadcast

2) Second step : While the communication is "active", the SwMI shall broadcast a D_GROUP_ACTIVATION/ D_OC_ACTIVATION TSDU on SDCH in asynchronous broadcast mode.

Figure 112: D_XXX_ACTIVATION TSDU asynchronous broadcast

The TSDU is sent:

- every D774
- or asynchronous background

Only the second shall be preceded by a PCH with a collective "GROUP" or “COI” address.

The RT shall execute switch-over to CTCH without informing the SwMI.

After changing to CTCH, the SwMI/RT dialogue shall be handled by the circuit mode protocol (see PAS 0001-3-4 [7]).

If the group communication is a open channel with "broadcast" priority, once on CTCH RT shall not transmit except if the RT has requested the open channel setup.

5.5.10 Temporary RT withdrawal from group communication

The RT leaves temporarily the group communication for another application: (location activity reporting, set up a private call, receive a call, etc.). During this time, the RT shall not consider itself to be an group communication "participant" and shall ignore all the activation messages.

At the end of the application, the RT shall automatically participate in the communication (except for group call and object call) if it is still active and after checking its rights to participate in the same communication.

5.5.11 Open channel release (by an RT)

This subclause is not applicable to RSW disconnected mode.

5.5.11.1 Successful case

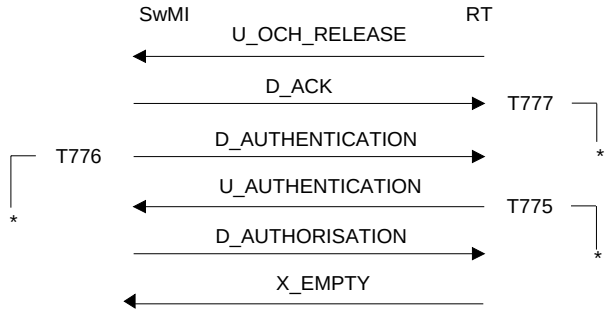


Figure 113: Open channel release sequence

The SwMI shall authenticate the RT before releasing the open channel.

5.5.11.2 Unsuccessful case RT side

Before sending the U_AUTHENTICATION TSDU:

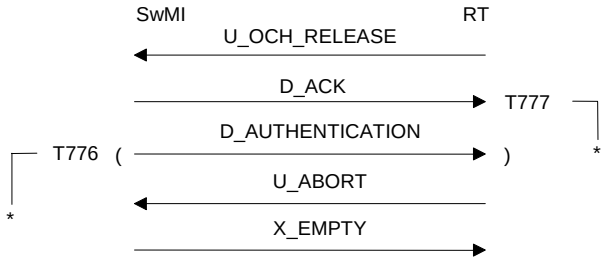


Figure 114: Open channel closing failure RT side

The ABORT cause should be one of the following ones:
- "cleared by user"
- "application event": T777 expiry

5.5.11.3 Unsuccessful case SwMI side

The SwMI shall not release the open channel.

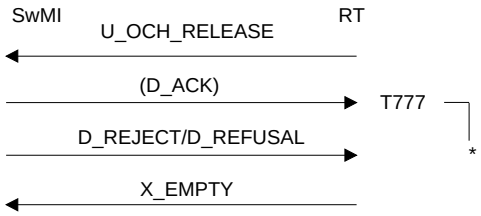


Figure 115: Open channel release failure SwMI side

Before authentication, the REFUSE cause shall be one of the following ones:
- "unknown calling party"
- "service barred calling party": The RT does not belong to an operational group with rights to release the open channel.
- "unknown open channel": SwMI already closed the open channel.
- "out of coverage cell": The requesting user is not within the open channel coverage area.

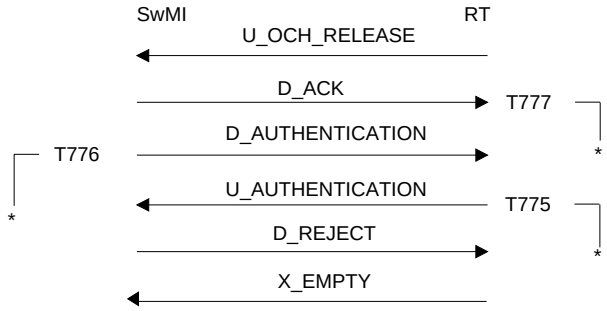


Figure 116: Open channel closing failure - authentication error

After sending the U_AUTHENTICATION TSDU:
- T776 expiry: The REJECT TSDU cause field is "application event".

- if the timer T775 expires or the user clears the call, the RT shall send an X_EMPTY DR to end the transaction.

After authentication, the REJECT cause shall be one of the following ones:
- "unreachable open channel master"
- "key error": error in RT authentication.

5.5.12 Dispersion of group communication participants

The SwMI shall initiate dispersion and release all the resources engaged for this service (in particular the traffic channel). The SwMI shall ask all the RTs present on the TCH to return to the CCH.

This shall be executed in datagram mode on SCH constructed in mode 2; all the terminals shall be addressed at the same time.

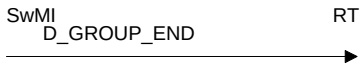


Figure 117: Dispersion of participants

The end cause shall be one of the following ones:
- "coverage not guaranteed": There is a failure of resources in the communication coverage;
- "resource pre-emption": The communication is closed to allow the SwMI to preempt resources to enable other services;
- "normal": The communication is closed by a user;
- "operator decision": The communication has been closed following an operator command;
- "open channel duration time-out".

5.5.13 RT return to CCH

After a given time without voice activity on CTCH, the SwMI shall declare the communication to be "inactive the SwMI shall request all RTs present on TCH to return to the CCH.

This shall be executed in datagram mode on the SCH channel constructed in mode 2; all the terminals shall be addressed at the same time.

Figure 118: RT return to CCH

The TSDU is repeated by SwMI with a minimum of D77C and as long as the current trafic channel remains inactive (not allocated to any active voice or data communication).

The cause contained in the TSDU should be one of the following ones:
- "voice inactivity"
- "activation time-out"

The RT shall check all the TSDU sent by the broadcast application application.

The RT shall immediately switch to TCH if called by the SwMI D_GROUP_ACTIVATION TSDU even though it may not have had time to check all the TSDU sent by the BROADCAST application.

-

5.6 Tower communication

5.6.1 Overview

The tower communication is a multiple open channel communication, the setup and release are like the MOCH.

RT has to send a speech request to a dispatcher. This service is obtained by using data application offered by the system. The terminal will issue an explicit upward short datagram type status with a functional recipient address. The speech request has no protection mechanism (the RT does not expect an acknowledgement). Only the issue of an applicative receipt (U_PRIORITY_GRP_WAITING) from the dispatcher will permit the user to know whether their speech request has been correctly accepted (D_PRIORITY_GRP_WAITING).

In each cell of the coverage area, the SwMI shall broadcast via the CCH in asynchronous mode:

- D_ PRIORITY_GRP_ACTIVATION: Shall contain all tower communication parameters for activation, The SwMI shall decide when a call is inactive (voice inactivity).

Upon reception of the tower communication activation message, a terminal that has selected the tower communication will automatically and immediately switch to this.

The application at the SwMI-RT interface is described by:

- Speech request acknowledgement;
- Activation request;
- Activation indication: RT switch-over to CTCH;
- Deactivation indication: RT returns to CCH;
- Temporary RT withdrawal;
- Dispersion of participants

5.6.2 Tower communication speech request acknowledgement

From the dispatcher:

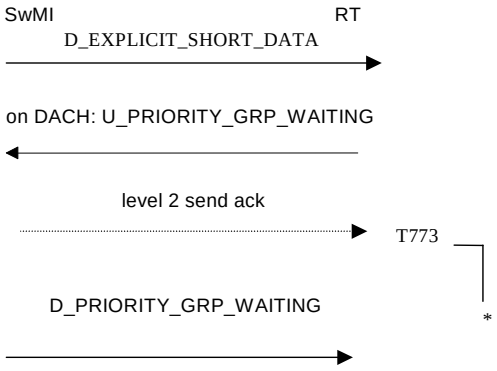


Figure 119: tower communication speech request acknowledgement

To RT the message is broadcast on SDCH

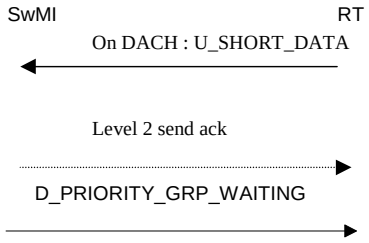


Figure 120: D_ PRIORITY_GRP _WAITING TSDU broadcast in nominal mode

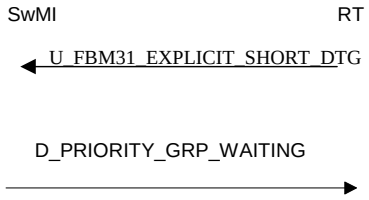


Figure 121: D_ PRIORITY_GRP _WAITING TSDU broadcast in FBM3.1 mode

5.6.3 Tower communication activation request

This message shall be transmitted over the DACH (see PAS 0001-3-3 [6]). After confirmation, the RT shall set the T773 time-out.

5.6.3.1 Successful case

From AG:

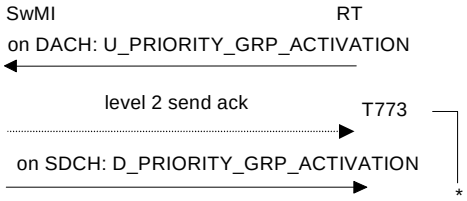


Figure 122: tower communication Activation from AG

T773 shall be cancelled on reception of the D_PRIORITY_GRP_ACTIVATION TSDU for the requested object call.

SwMI acks the request even if the communication is already activated.

See "RT switch-over to CTCH".

The SwMI shall consider the communication as "active" and the D_PRIORITY_GRP _ACTIVATION TSDU shall inform the RT that the communication is activated or already activated,.

5.6.3.2 Unsuccessful case RT side

For all the following cases of failure the RT shall not inform the SwMI.

(a) Time-out expiry: T773

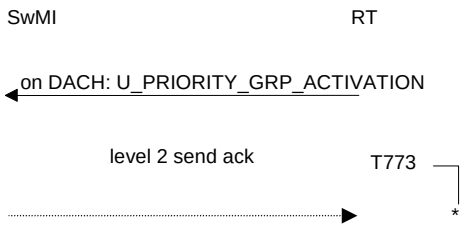


Figure 123: Tower communication Activation request failure on time-out

(b) Unsuccessful message transmission : failure of the random access procedure on the DACH

5.6.3.3 Unsuccessful case SwMI side

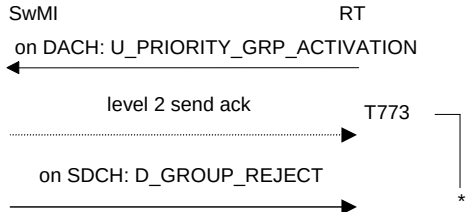


Figure 124: Tower communication Activation request reject

The REJECT cause should be:
- "cell out of coverage": the group communication is not established under this cell.
- "lack of resources": indicates a time-out in waiting for activation.
- "group already activated" : indicates that
  - The group communication is not active under this cell and another activation request is pending (waiting for radio resources) for this group communication.
- "normal": other.

5.6.4 Tower communication activation indication

Whenever a communication is activated, the SwMI shall inform all the RTs in the coverage areas in two steps.

1) First step: It shall immediately broadcast a first D_ PRIORITY_GRP _ACTIVATION TSDU;

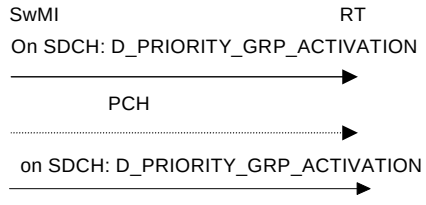


Figure 125: First D_ PRIORITY_GRP _ACTIVATION TSDU broadcast

2) Second step: While the communication is "active", the SwMI shall broadcast a D_ PRIORITY_GRP _ACTIVATION TSDU on SDCH in asynchronous broadcast mode.

Figure 126: D_ PRIORITY_GRP _ACTIVATION TSDU asynchronous broadcast

The TSDU is sent:

- every D774
- or asynchronous background

Only the second shall be preceded by a PCH with a collective "GROUP" address.

The RT shall execute switch-over to CTCH without informing the SwMI.

After changing to CTCH, the SwMI/RT dialogue shall be handled by the circuit mode protocol (see PAS 0001-3-4 [7]).

5.6.5 Temporary RT withdrawal from group communication

. The mechanism is the same the other group communication.

5.6.6 Dispersion of group communication participants

The mechanism is the same the other group communication.

5.6.7 RT return to CCH

The mechanism is the same the other group communication.

5.7 Emergency

This subclause shall not be applicable when the SwMI is in BSC disconnected mode.

5.7.1 Overview

The EMERGENCY application is designed to manage exchanges between the initiating RT (in emergency situation) and SwMI.

The EMERGENCY application on the SwMI-RT interface shall be described by:

- Emergency status signalling;
- Fast Emergency situation signalling;
- Emergency situation signalling;
- Emergency situation indication;
- Emergency situation response;
- Emergency open channel set-up;
- RT information in a cell;
- RT entry in an emergency open channel;
- Emergency open channel activation request;
- RT switch over to CTCH;
- RT return to CCH;
- Temporary RT exit from the open channel;
- Permanent RT exit from the open channel;
- Emergency open channel release;
- Emergency open channel participants dispersion.

A - When the SwMI is not in RSW disconnected mode, two modes are avalaible:

1) "local emergency open channel setup" :

The emergency open channel is set up the initiating RT's EMERGENCY application in the current cell;

There is one, and only one, emergency open channel per cell. The emergency open channel coverage shall include a predefined list of line access base stations.

The emergency open channels shall not be subject to OG access control conditions.

Once the emergency open channel is set-up: the SwMI shall send an "emergency notification" on all the radio channels in the coverage area, which shall contain the identity of the initiating RT.

The open channel may be closed either by the SwMI or by the RT.

2) Access controled mode:

The initiating RT's EMERGENCY application executes an "emergency situation signalling" transaction to indicate to SwMI EMERGENCY APPLICATION.

This indication is transmitted to a predifined list of DP via a status generated and transmitted by SwMI (via DATA APPLICATION), see "data application".

Then, depending on the emergency configuration of the initiating RT organisation, several sub-modes are avalaible.

2.1) "automatic crisis open channel setup"

The DPs are informed of the situation by the status (see "emergency situation indication") concerning the initiator RT.

The emergency situation signalling transaction ends successfully and the SwMI (GROUP COMMUNICATION) proceeds to a "crisis open channel" set-up

2.2) "dispatch acknowledge crisis open channel set-up"

The DPs are informed of the situation by the status (see "emergency situation indication") concerning initiator RT and shall accept or refuse the crisis open channel setup. Depending on the first answer of one of the DPs:

- **The DP accepts:** The emergency situation signalling transaction ends successfully and the SwMI (GROUP COMMUNICATION APPLICATION) proceeds to a "crisis open channel" set-up (see: GROUP COMMUNICATION APPLICATION).

- **The DP refuses:** The emergency situation signalling transaction ends with a refusal from the SwMI. The initiating RT continues like before the "emergency situation signalling".

2.3) "remote emergency open channel set-up":

The initiating RT shall send a status (via DATA APPLICATION) which contains a "emergency status signalling" to another RT (normally DP via a line access base station).

The emergency open channel is setup at distance, by an EMERGENCY application of one of the RT which received the status.

2.4) "Dispatch private call"

The DPs are informed of the situation by the status ("emergency situation indication") concerning initiator RT and shall accept or ignore. Depending on the first answer of one of the DPs:

- **The DP call the initiating RT**: The call is a private call with "emergency" priority level (see: PRIVATE CALL APPLICATION).

- **The DP ignores:** No action is initiated toward the initiating RT.

The crisis open channels shall be subject to OG access control conditions.

There is one predifined crisis open channel per cell and per organisation. The coverage shall include a predefined list of line access base stations and radio cell.

Once the crisis channel is set-up: the SwMI shall send an "crisis notification" on radio channels in the coverage area, which shall contain the identity of the initiating RT (see GROUP COMMUNICATION APPLICATION) and authorized OG list. Concerned RT (OG and organisation) shall alert users.

If SwMI (GROUP COMMUNICATION APPLICATION) is unable to proceed to "crisis open channel setup" then the SwMI (EMERGENCY APPLICATION) proceeds to "emergency open channel setup".

In case of no answer from the SwMI, the initiating RT goes in emergency direct mode.

B - When the SwMI is in RSW disconnected mode:

As soon as the cell is disconnected from the BSC, the SwMI proceeds to an early establishment of an emergency open channel for the current cell. The emergency open channels shall not be subject to OG access control conditions.

The initiating RT's EMERGENCY application executes a "fast emergency situation signalling" on DACH to indicate to SwMI EMERGENCY APPLICATION.

The SwMI shall send an "emergency notification" on all the radio channels in the coverage area, which shall contain the identity of the initiating RT.

The open channel shall be closed by the SwMI as soon as the cell is not disconnected from the RSW.

5.7.2 Emergency status signalling

Case of remote emergency, (specific to mode 1.2)

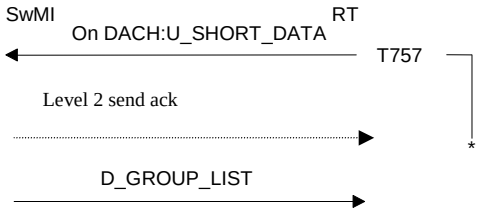


Figure 127: Emergency open channel signalling

When the RT sends an emergency STATUS message (via the DATA application), T757 shall be set. T757 shall be cancelled on reception of the first D_GROUP_LIST TSDU indicating that an emergency open channel is open in the cell.

If T757 expires, the RT shall switch to direct mode.

5.7.3 Fast emergency situation signalling

This is done by a RT in a cell in RSW disconnected mode

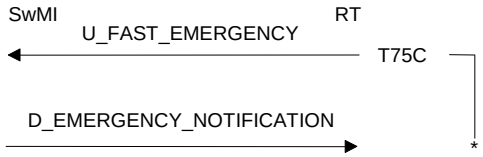


Figure 128: Emergency open channel signalling

When the RT sends a U_FAST_EMERGENCY TSDU (via the EMERGENCY application), T75C shall be set. T75C shall be cancelled on reception of the first D_EMERGENCY_NOTIFICATION TSDU indicating that an emergency open channel is open in the cell.

If T75C expires, the RT shall switch to direct mode.

5.7.4 Emergency situation signaling

This transaction is executed by a RT "in access controled mode" when the current cell is not disconnected from RSW or BSC.

The U_EMERGENCY_REQ TSDU shall contain the initiating RT's address, Once the initiating RT is authenticated, the SwMI shall ignore any attempt to cancel the call or failure on the RT side.

The issue of the transaction depends on the response from the DP.

5.7.4.1 Successful case (The emergency request is accepted by a DP)

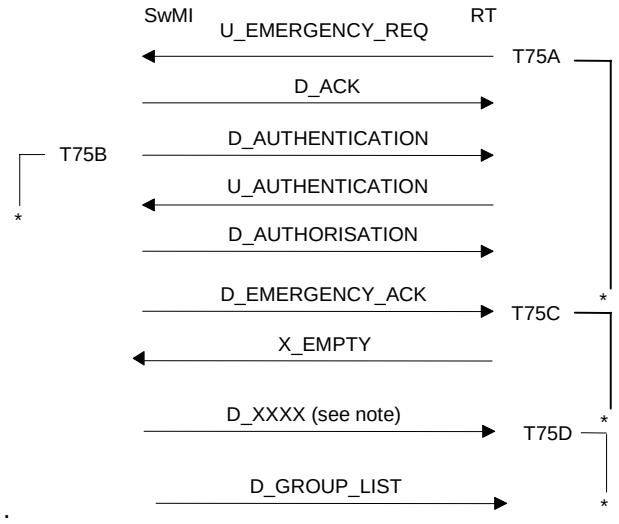


Figure 129: Emergency situation signalling (accepted)

Note : T75C shall be reset on reception of one of the following TSDU :

- D_CRISIS_NOTIFICATION containing the initiating RT adress
- D_EMERGENCY_NOTIFICATION containing the initiating RT adress
- D_CALL_SETUP with call_priority information element set to EMERGENCY, but in this case T75D is not set.

- Note :

- On reception of one of the following D_XXX TSDU :

- D_CRISIS_NOTIFICATION containing the initiating RT address, T75C shall be reset and T75D is set. T75D shall be reset on reception of one of the D_GROUP_LIST TSDU containing the crisis open channel identity.

- D_EMERGENCY_NOTIFICATION containing the initiating RT address, T75C shall be reset and T75D is set. T75D shall be reset on reception of one of the D_GROUP_LIST TSDU containing the emergency open channel identity

- D_CALL_SETUP with call priority information element set to EMERGENCY, T75C shall be reset and T75D is not set.

5.7.4.2 Unsuccessful case (The emergency request is refused by a DP)

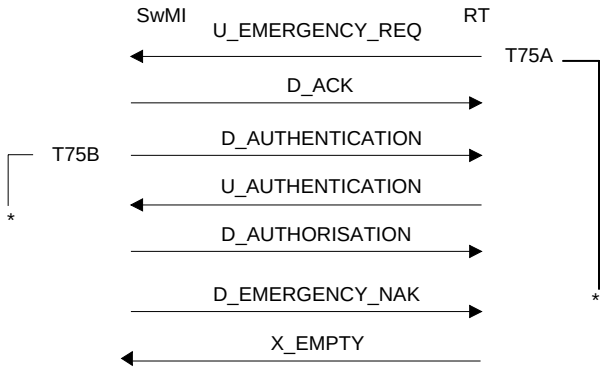


Figure 130: Emergency situation signalling (refused)

5.7.4.3 Unsuccessful case RT side

The user may decide to cancel the transaction request to invoke another application:

- if cancelling occurs before U_AUTHENTICATION TSDU transmission, the RT shall use the U_ABORT TSDU. The SwMI shall then close the open channel;
- if cancelling occurs after the TSDU transmission, the RT shall use the X_EMPTY TSDU. This shall not prevent the SwMI from continuing to set-up the called open channel.

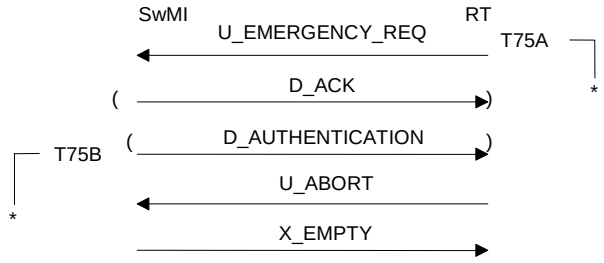


Figure 131: Emergency situation signalling failure RT side

The cause for ABORT shall be one of the following ones:
- "cleared by user":
- "application event": T75A application protection time-out.

T75A time-out expiry: , the RT shall change to direct mode;

5.7.4.4 Unsuccessful case SwMI side

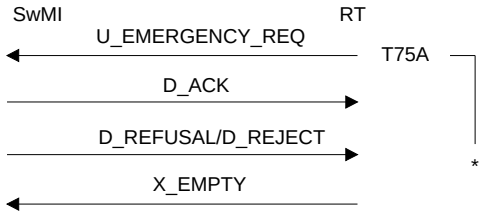


Figure 132: Emergency situation signalling failure SwMI side

(a) The REFUSE cause should be one of the following ones:
- "unknown calling party": The RT shall switch to direct call mode ;
- "identification error": The initiating RT's location is not correct;

(b) The REJECT cause shall be one of the following ones:
- "network event": The open channel can not be set-up. In case of local emergency, the RT shall change to direct mode;
- "application event": T75B expiry. In case of local emergency, the RT shall change to direct mode.

(c) RT authentication error.

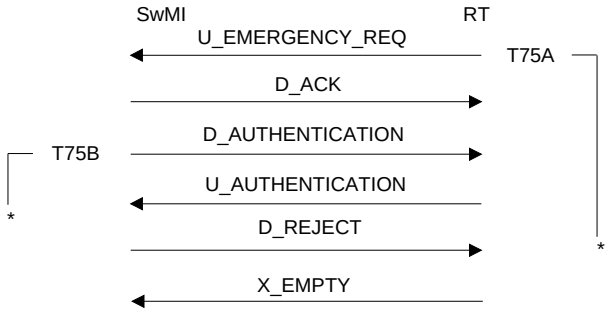


Figure 133: Emergency situation signalling failure - authentication error

The REJECT cause should be:
- "key error" : RT ends the transaction.

5.7.5 Emergency situation indication

This is executed by SwMI to a predifined list of DP in order to notify the emergency situation "in access controled mode" when the current cell is not disconnected from RSW or BSC.

The SwMI shall construct the status message with:

- RT_STATUS_CODE = the emergency mode and sub-mode (2.1 - 2.2 or 2.3)
- RT_STATUS_INFO = the initiating RT organisation's identity
- the individual address of the initiating RT;
- the initiating RT's location in the base network.

Figure 134: Emergency situation indication

The message is transmitted by DATA APPLICATION see : DATA APPLICATION - STATUS RECEPTION

5.7.6 Emergency situation response

This is the response (positive or negative) from the DP to the SwMI after an "emergency situation indication", when DP acknowledgment is required, ie (mode/ sub mode 2.2: "dispatch acknowledge crisis open channel set-up").

The TSDU shall contain:

- the full address of the sender RT;
- the initiating RT organisation's identity;
- the initiating RT's location in the base network.

Figure 135: Positive Emergency response

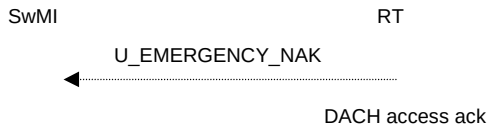


Figure 136: Negative Emergency response

See transmission procedures in PAS 0001-3-3 [6].

In cas of failure of the transmission procedure on DACH, no retry will be done.

5.7.7 Emergency open channel set-up

This transaction is initiated by

- the requesting RT (case 1.1: "local emergency open channel setup")
- or by the distant DP (case 1.2: "remote emergency open channel setup")

The U_ECH_SETUP TSDU shall contain the initiating RT's address and location, Once the initiating RT is authenticated, the SwMI shall ignore any attempt to cancel the call or failure on the RT side, and shall continue to set-up the open channel.

The D_GROUP_LIST TSDU containing the emergency open channel reference shall confirm the opening.

5.7.7.1 Successful case

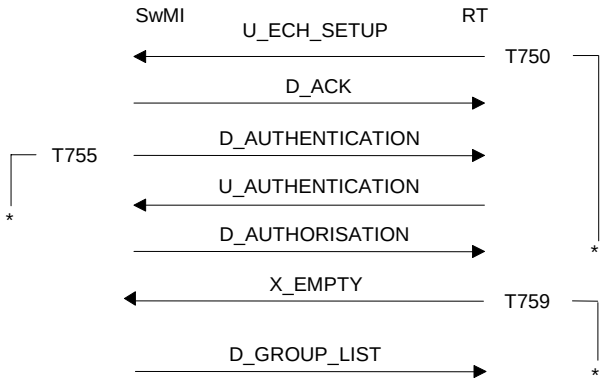


Figure 137: Emergency open channel set-up sequence

If an emergency open channel already exists in the cell, this sequence shall remain the same.

In case of "remote set-up", T759 shall not be set.

5.7.7.2 Unsuccessful case RT side

The user may decide to cancel the emergency open channel request to invoke another application:

- if cancelling occurs before U_AUTHENTICATION TSDU transmission, the RT shall use the U_ABORT TSDU. The SwMI shall then close the open channel;
- if cancelling occurs after the TSDU transmission, the RT shall use the X_EMPTY TSDU. This shall not prevent the SwMI from continuing to set-up the called open channel.

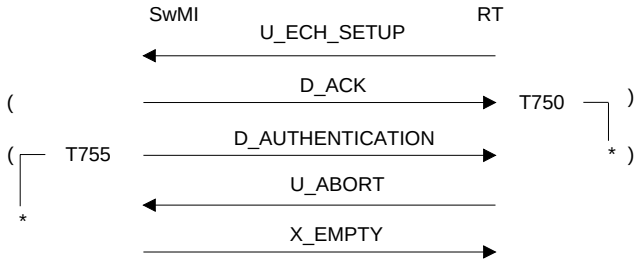


Figure 138: Emergency open channel set-up failure RT side

The cause for ABORT shall be one of the following ones:
- "cleared by user":
- "application event": T750 application protection time-out

T750 time-out expiry:
- In case of local emergency, the RT shall change to direct mode;
- In case of remote emergency, after sending the U_AUTHENTICATION TSDU, the RT shall end the transaction by sending an X_EMPTY TSDU.

T759 time-out expiry: The RT shall change to direct mode.

5.7.7.3 Unsuccessful case SwMI side

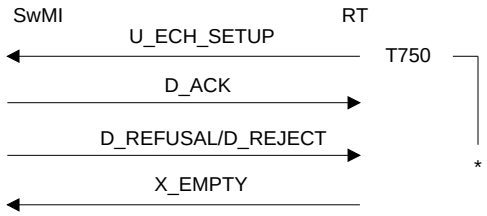


Figure 139: Emergency open channel set-up failure SwMI side

(a) The REFUSE cause should be one of the following ones:
- "unknown calling party": local emergency, the RT shall switch to direct call mode ;
- "identification error": The initiating RT's location is not correct;
- "open channel not created": The coverage area is not defined, If local emergency, the RT shall change to direct mode:
- "out of coverage cell": The requesting user is not within the open channel coverage area.

(b) The REJECT cause shall be one of the following ones:
- "lack of resources": Time-out waiting for available resources to set-up the coverage. In case of local emergency, the RT shall change to direct mode;
- "resource pre-emption": The resources required to set-up the open channel has been preempted. In case of local emergency, the RT shall change to direct mode;
- "network event": The open channel can not be set-up. In case of local emergency, the RT shall change to direct mode;
- "unreachable open channel master": In case of local emergency, the RT shall change to direct mode;
- "application event": T755 expiry. In case of local emergency, the RT shall change to direct mode.

(c) RT authentication error.

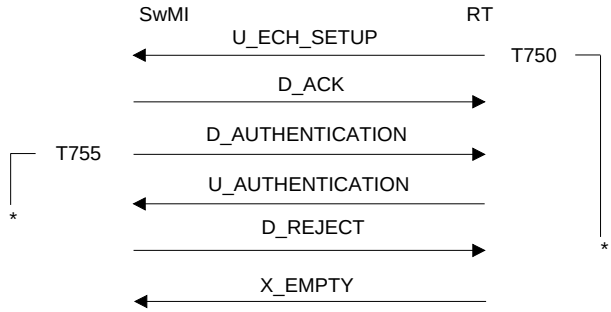


Figure 140: Emergency open channel set-up failure - authentication error

The REFUSE cause should be:

- "key error"

5.7.8 RT information in a cell

Two different mechanisms shall be implemented to inform the RTs about ongoing emergency open channels under a line access base station or a cell in nominal mode.

5.7.8.1 Information on SDCH, SCH, at the time of set-up

All RTs in the cell and all LCTs under the Line Access Base Stations in the predefined emergency open channel list shall be informed by means of D_EMERGENCY_NOTIFICATION TSDU:

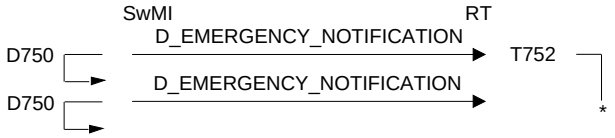


Figure 141: RT emergency notification at set-up

The TSDU shall be broadcast N750 times every D750 on all channels of the cell and shall be addressed to all terminals:

- on CCH, over PCH and SDCH;
- on TCH, over SCH constructed in mode 1;

The TSDU shall contain the initiator's cell number and address.

- If the RT is not engaged in an emergency open channel, it shall alert its user on reception of this TSDU by means of a mechanism whose duration is limited by T752. With T752 > D750

  The RT shall set T752 on receipt of the first D_EMERGENCY_NOTIFICATION TSDU, and shall reset it every time it receives the TSDU.

- If the RT is already engaged in an emergency open channel, an audible signal shall alert the user of any new emergency call with the address of the new initiator, unless the RT is the initiator. In this case T752 shall not be set.

5.7.8.2 Information on emergency open channels set-up in a cell

The D_GROUP_LIST TSDU shall be broadcast under all cells within coverage and shall give the list of emergency open channels (identified by the switch number and cell number supporting the emergency open channel). This list shall be updated at the end of the set-up phase and each time an emergency open channel is released.

Figure 142: RT information on set-up emergency open channels

5.7.9 RT entry in the emergency open channel

The RT entry on an emergency open channel remains the same during both open channel phases: emergency notification broadcast phase and established open channel phase.

The entry on the emergency open channel requires confirmation on the user's part:

- during phase one, while the RT is alerting its user, i.e., as long as T752 is set;

- during phase two, by the D_GROUP_LIST TSDU. The user knows the identity of the cell supporting the emergency open channel, and may therefore select one of the channels from the emergency open channels in the list.

Entry on the emergency open channel shall remain an internal RT operation. It shall not give rise to any SwMI / RT exchange.

5.7.10 Emergency open channel activation overload indication

When the following circumstances are met:
- This function is ON (depends on the terminal profile of the RT of the concerned cell),
- A emergency open channel has just been activated and no traffic channel is available for this communication,

The SwMI shall send an "emergency open channel overload indication" on CCH in datagram mode and addressed to "ALL RT".

Figure 143: D_ECH_OVERLOAD_ID TSDU

This TSDU shall indicate the RT that the emergency open channel activation request is put in a waiting queue.

5.7.11 Emergency open channel activation request

This message shall be sent on the DACH (see PAS 0001-3-3 [6]). On receipt of the delivery confirmation, the RT's EMERGENCY application shall set T758.

5.7.11.1 Successful case

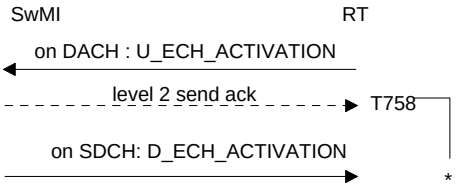


Figure 144: Emergency open channel activation request

T758 shall be cancelled on reception of the D_ECH_ACTIVATION TSDU for the emergency open channel.

The SwMI shall consider the open channel to be "active".

5.7.11.2 Unsuccessful case RT side

In the following unsuccessful cases, the RT shall not alert the SwMI, however, the user shall be informed of the situation.

(a) T758 time-out

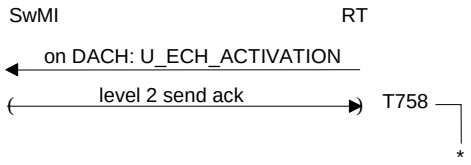


Figure 145: Emergency open channel activation request failure

(b) Message transmission procedure failure

The message sending entity shall inform the EMERGENCY application that the information has not been delivered to the SwMI (failure of the random access procedure on the DACH).

5.7.11.3 Unsuccessful case SwMI side

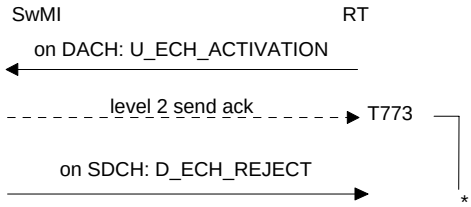


Figure 146: Activation request reject

The REJECT cause should be:
- "cell out of coverage": the group communication is not established under this cell.
- "lack of resources": indicates a time-out in waiting for activation.
- "normal": Other

5.7.12 RT switch-over to CTCH

Whenever the open channel is activated, the SwMI shall inform all the RTs within the coverage area that the open channel is active in two steps :

1) **Step 1** : The SwMI shall immediately send a first D_ECH_ACTIVATION TSDU.

2) **Step 2:** As long as the open channel is "active", the SwMI shall continuously broadcast the D_ECH_ACTIVATION TSDU on SDCH using the general asynchronous broadcast mechanism.

Figure 147: RT switch-over to CTCH

The TSDU shall be sent every D756.

It shall be sent in datagram mode and shall use the "ALL RT" address.

The second, and only the second, TSDU shall be preceded by a collective group address PCH characteristic of the emergency open channel (see TTI/RTI/CGI coding in PAS 0001-3-2 [5]).

- the RT shall execute switch-over to CTCH without alerting the SwMI;
- After switch-over to CTCH, the SwMI/RT dialogue shall be handled by the circuit mode air interface protocol (see PAS 0001-3-4 [7]).

5.7.13 RT return to CCH

Identical to the "ordinary" open channel procedure.

5.7.14 Emergency open channel release

The emergency open channel shall be released by means of a SwMI/RT application transaction.

5.7.14.1 Successful case

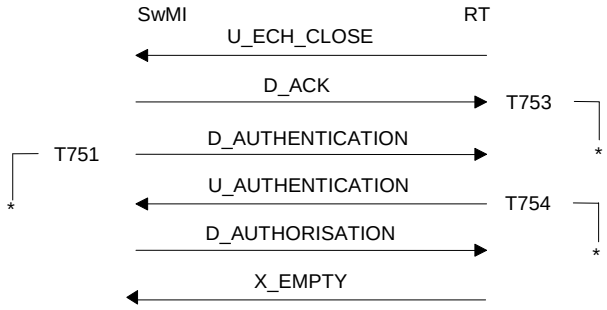


Figure 148: Emergency open channel release sequence

5.7.14.2 Unsuccessful case (RT side)

(a) before D_AUTHENTICATION TSDU transmission:

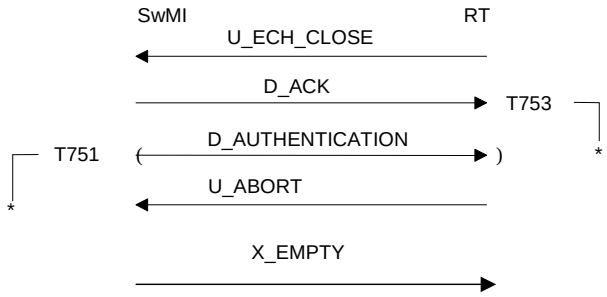


Figure 149: Emergency open channel release failure RT side

The ABORT cause should be one of the following ones:

- "cleared by user"
- "application event": T753 expiry

(b) After sending the U_AUTHENTICATION TSDU:

If T754 expires or the call is cleared by the user, the RT shall end the transaction by sending an X_EMPTY DR.

5.7.14.3 Unsuccessful case SwMI side

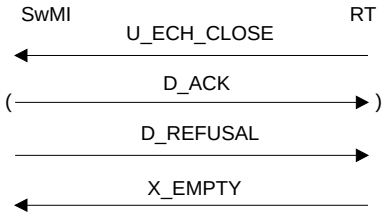


Figure 150: Emergency open channel release failure SwMI side

(a) The REFUSE cause should be one of the following ones:

- "unknown calling party";
- "service barred calling party": The RT does not belong to an operational group with rights to close the open channel. The open channel shall remain set-up;
- "unknown open channel": The requested open channel has already been released or is unknown to the SwMI;
- "out of coverage cell": The requesting user is not within the open channel coverage area;
- "identification error": The initiating RT's location is not correct;

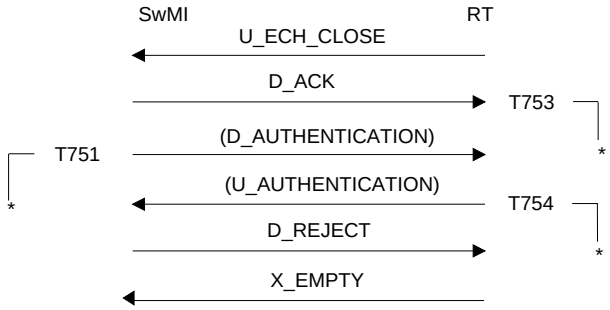


Figure 151: Emergency open channel release failure - authentication error

(b) The REJECT cause should be one of the following ones:

- "network event";
- "unreachable open channel master";
- "application event": T751 expiry;
- "key error".

5.7.15 Temporary RT exit from the open channel

Identical to the "ordinary" open channel procedure.

5.7.16 Permanent RT exit from the open channel

This operation shall cause the RT to ignore all the activation messages concerning the emergency open channel.

No application transaction shall be initiated.

5.7.17 Dispersion of emergency open channel participants

The purpose is to release all the resources engaged by the SwMI for this service, all participants shall be requested to return to the CCH.

This shall be executed in datagram mode on SCH constructed in mode 2; all the terminals shall be addressed at the same time.

Figure 152: Dispersion of emergency open channel participants

The cause sent with this TSDU cause should be one of the following ones:

- "normal": The emergency open channel is closed normally by an authorised RT;
- "operator decision": The open channel is closed on an operator's commands;
- "coverage not be guaranteed": Radio resource failure in the cell;
- "open channel duration time-out".

5.8 Data

5.8.1 Overview

The DATA APPLICATION include the behaviour for the following TSAP_APPLI: DATA MESSAGE and DATA FLOW.

Those two different TSAP_APPLI are used depending on the service as explained below :

The SwMI shall provide UDT with services via the RT, which simply enables a message switching function.

(a) Connected packet message transmission mode on CCH or DCH (Uplink and downlink)

Depending on requested service level, SwMI shall order the RT to switch on DCH to execute one or several transfers, otherwise transfers take place on CCH.

Depending on the used protocol and the source port, the TSAP APPLI may be DATA MESSAGE or DATA FLOW.

Therefore there shall be only one type of communication and its purpose on the SwMI-RT interface is to offer the RT data transfer capabilities, that is:

- uplink packet mode data transfers;
- downlink packet mode data transfers;

(b) Short datagram message transmission mode (Uplink and downlink) on CCH

Uplink transmission: This service shall provide the RT with the ability to send short information messages to the Network or to one or more RT's.

The information shall be sent on DACH (see transmission procedures in PAS 0001-3-3 [6])**.**

The SwMI shall designate the destination RT according to short datagram message type:

- Unaddressed format 1;
- Unaddressed format 2;
- Unaddressed format 3;
- Addressed format 1;
- Addressed format 2.

Downlink transmission: The SwMI shall broadcast the information on SDCH (CCH) and on SCH (TCH) in datagram mode.

This transmission mode shall use the DATA MESSAGE TSAP_APPLI.

(c) Broadcast without notification transmission mode (Downlink)

This service shall provide the SwMI with the ability to send information messages to one or more RT's (identified by a CGI) on CCH in datagram mode.

There is no radio acknowledgement on message reception.

This transmission mode shall use the DATA MESSAGE TSAP_APPLI.

(d) Broadcast with notification transmission mode (Downlink)

This service shall provide the SwMI with the ability to broadcast information messages to one or more RT's (identified by a CGI) on CCH.

There is no radio acknowledgement on message reception.

The message transmission is preceded by a notification on CCH and TCH.

This transmission mode shall use the DATA MESSAGE TSAP_APPLI.

(e) Uplink data transfer in SwMI polling mode (Uplink)

This service shall provide the RT the ability to transfer a limited length message (8 octets) on SwMI explicit invitation.

There is no radio acknowledgement on message reception.

This transmission mode shall use the DATA MESSAGE TSAP_APPLI.

5.8.2 Connected packet transmission mode

This mode is used to transfer messages between RT and SwMI within application transactions on CCH or DCH.

When a pending downlink transmission of a SDP message concerns a "busy" RT, the SwMI shall alert the RT to hook on by the "proceed to hook on" procedure.

When a pending downlink transmission of a SDP message concerns a "free" RT (for example RT on CTCH), the SwMI shall alert the RT to perform the "D_BACK_CCH" procedure according the prioritiy rules.

Depending on the transmiter (RT or SwMI) the radio transaction shall be opened by the "CCH uplink transmission request" or "CCH downlink transmission request" procedure.

Depending on the service level requested by the external data application the SwMI shall maintain the RT on CCH or switch the RT to DCH by the "transmission channel assignment " procedure.

The step of data transmission in connected packet mode is identical on CCH or DCH and is handled by the "CCH or DCH connected packet transmission" procedure.

Once the data transmited, the SwMI shall end the transmission on CCH or DCH by the "CCH or DCH transmission end" procedure.

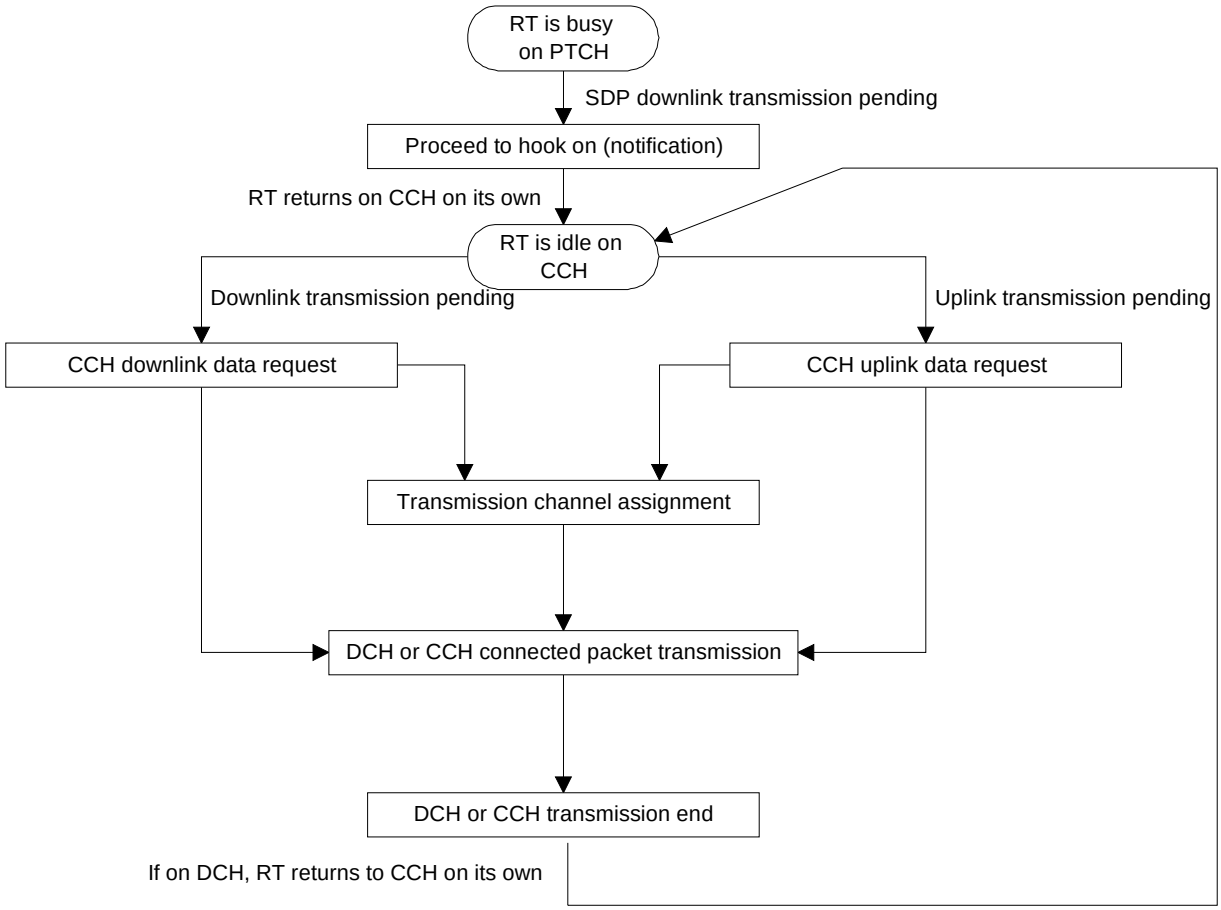


Figure 153: Connected packet transmission states

5.8.2.1 Proceed to hook on

According to the table of priorities defined in PAS 0001-1-3 [3], if the RT is busy on PTCH in an application (private call) which prevents the SwMI from initiating a downlink transmission of a SDP message, the SwMI shall attempt to alert the user to proceed to hook on. This case shall correspond to the RT "Busy" status (as seen by the SwMI).

For this the SwMI shall send a D_HOOK_ON_INVITATION TSDU with the cause field set to "downlink transmission" to oblige the user to explicitly leave TCH via a termination application transaction on the CCH.

Figure 154: Downlink data transmission

The TSDU shall execute N786 attempts every D786 until the withdrawal of the RT from the private call.

5.8.2.2 Uplink transmission request

5.8.2.2.1 Overview

The RT shall present the request of transmission which contains the informations (data application type, source and destination port) allowing the SwMI to identify the external data application and set the radio parameters required for data transmission.

According to the actual possibilities, SwMI may decide to:

- Refuse or reject the request: incorrect request;
- Allow the transmission on DCH;
- Allow the transmission on CCH (if it is requested by the RT, or as a fall back process if no DCH is available);

If the transmission request needs a DCH transfer and the DCH allocation is successfull, the SwMI shall switch the RT on DCH.

If the transmission request needs a CCH transfer, the SwMI shall assign the CCH.

5.8.2.2.2 Successful case

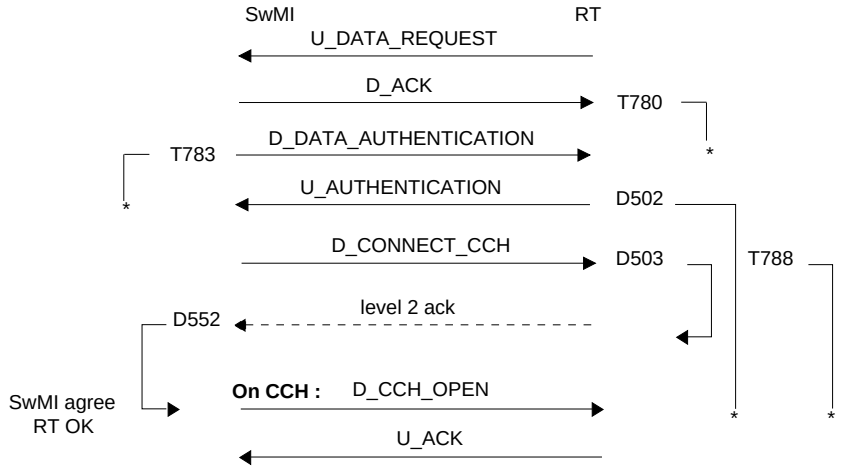


Figure 155: Uplink transmission request on CCH.

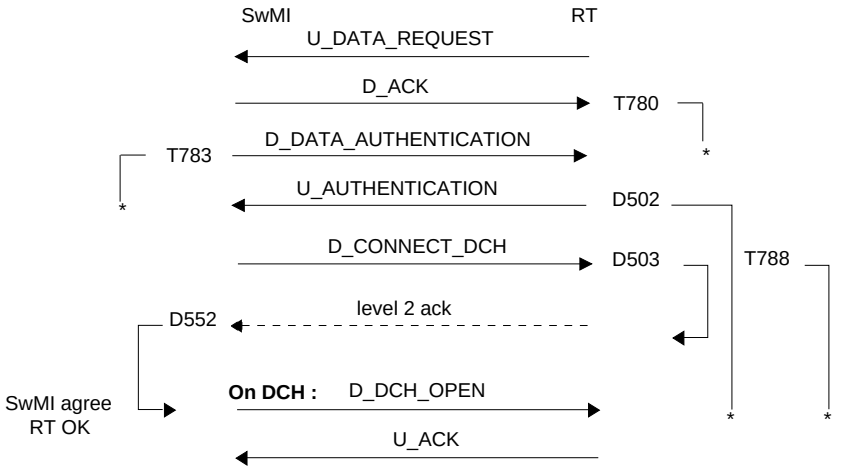


Figure 156: Uplink transmission request on DCH.

5.8.2.2.3 Unsuccessful case (SwMI side)

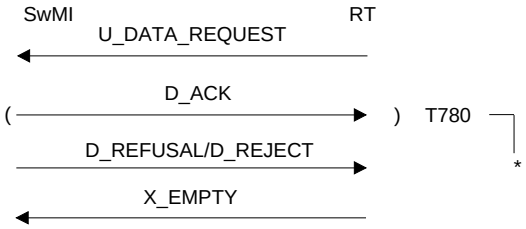


Figure 157: Failure in uplink transmission request (SwMI side).

The cause for REFUSE should be one of the following ones:

- "unknown calling party"
- "service barred calling party"
- "message length error"
- "incorrect transmission parameters"
- "service not implemented": The SwMI is not able to execute the transmission;

The cause for REJECT should be one of the following ones:

- "lack of resources"

5.8.2.2.4 Unsuccessful case (RT side)

- **T780 Expiry**: The RT shall stop the transmission -> ABORT, cause "application event".

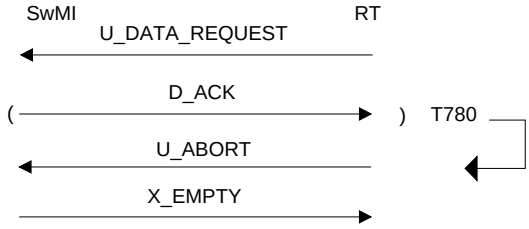


Figure 158: Failure in uplink transmission request (RT side)

5.8.2.2.5 Unsuccessful case (encryption no more available)

- The service "mandatory encryption requested" can not be supplied by the SwMI. The SwMI shall stop the transmission -> REJECT, cause "cleared by user".

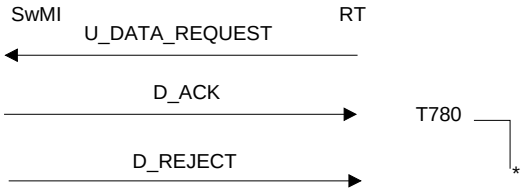


Figure 159: Failure in uplink transmission request (RT side)

5.8.2.2.6 Unsuccessful case (RT authentication error or unknown authentication/cyphering key)

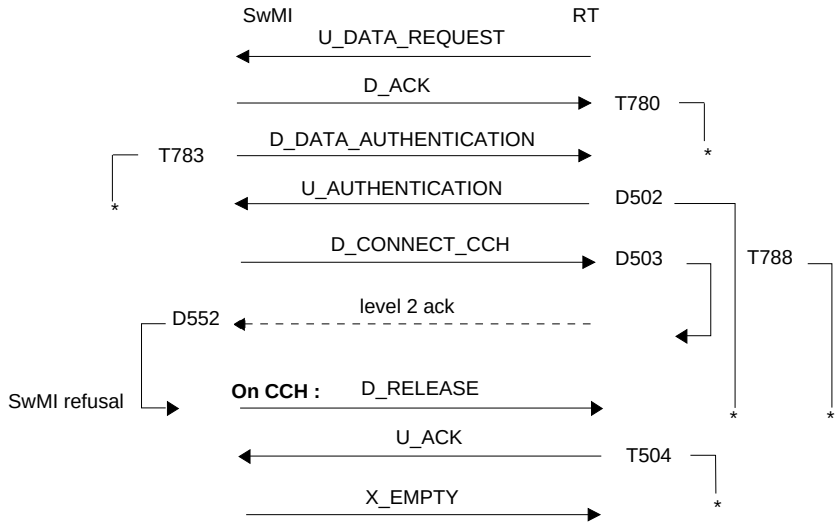


Figure 160: Failure in CCH uplink transmission request

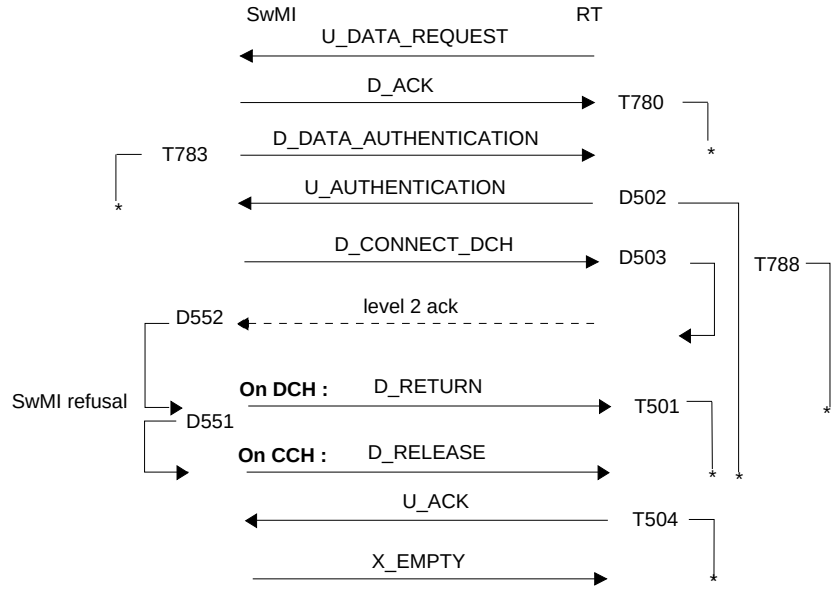


Figure 161: Failure in DCH uplink transmission request

The cause for release should be: - "key error**"**

5.8.2.2.7 Other unsuccessful cases

- T783 Expiry: The SwMI shall stop the transmission -> REJECT, cause "application event".
- T788 expiry: RT ends the transaction
- T501 expiry: the RT shall return to stand-by mode
- T504 expiry: the RT shall initiate an application transaction closing

5.8.2.2.8 Unsuccessful case (erroneous parameters in the DCH assignment)

On CCH, the RT initiates the dialogue to report an withdrawal from current application (See general mechanisms- Application transaction termination initiated by the RT). The causes for TERMINATION should be one of the following ones:

- "Incorrect low layer option".

5.8.2.3 Downlink transmission request

5.8.2.3.1 Overview

The SwMI shall present the request of transmission which contains the informations (data application type) allowing the RT to identify the external data application and enables to accept or refuse the data transmission.

If the transmission request needs a DCH transfer and the DCH allocation is successfull, the SwMI shall switch the RT on DCH.

If the transmission request needs a CCH transfer, the SwMI shall assign the CCH.

5.8.2.3.2 Successful case

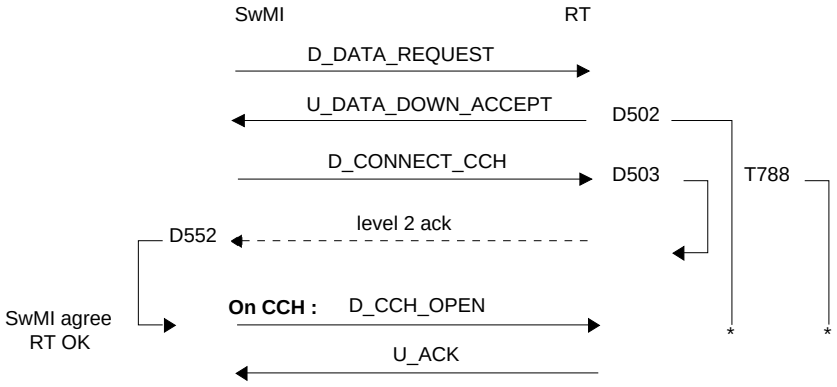


Figure 162: Downlink transmission request on CCH.

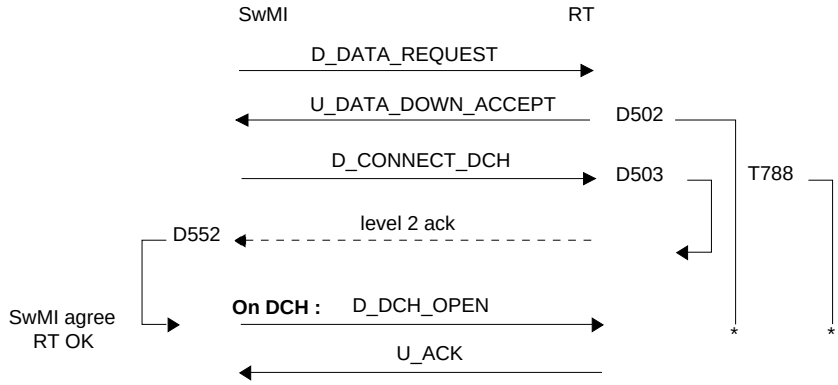


Figure 163: Downlink transmission request on DCH.

5.8.2.3.3 Unsuccessful case (erroneous parameters in the DCH assignment)

On CCH, the RT initiates the dialogue to report an withdrawal from current application (See general mechanisms- Application transaction termination initiated by the RT). The causes for termination should be one of the following ones:

- "Incorrect low layer option".

5.8.2.3.4 Unsuccessful case (RT side)

The D_DATA_REQUEST TSDU shall be sent:
- N786 times every D786 for a SDP downlink transmission request,
- one time for a UDP or TCP downlink transmission request

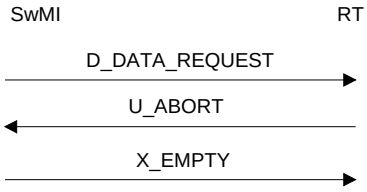


Figure 164: Failure in downlink transmission request (RT side)

The cause for ABORT for D_DATA_REQUEST should be one of the following ones:

- "buffer not empty": The RT message buffer contains a message being transmissionred to UDT;
- "UDT not connected": No UDT is connected to the RT;
- "uplink transmission priority": A message is on its way from the UDT.
- "SDP applications not supported or not opened": The UDT is not able to receive an SDP message.
- "service not implemented": The RT is not able to execute the transmision;

5.8.2.3.5 Unsuccessful case (RT authentication error or unknown authentication/cyphering key)

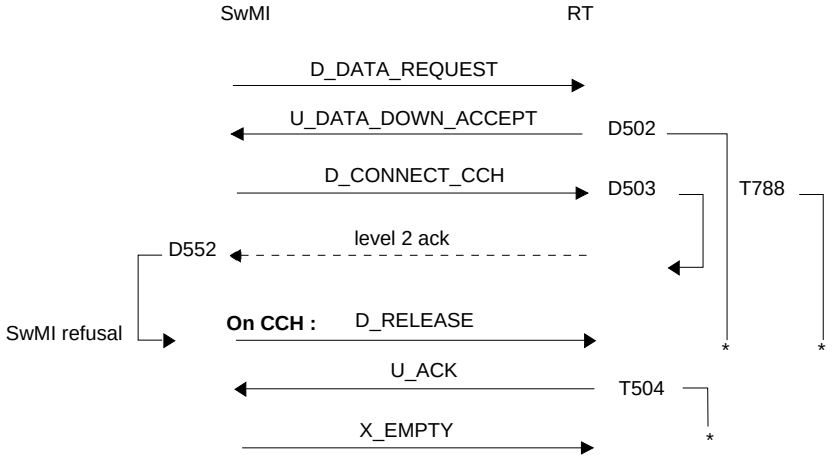


Figure 165: Failure in CCH downlink transmission request

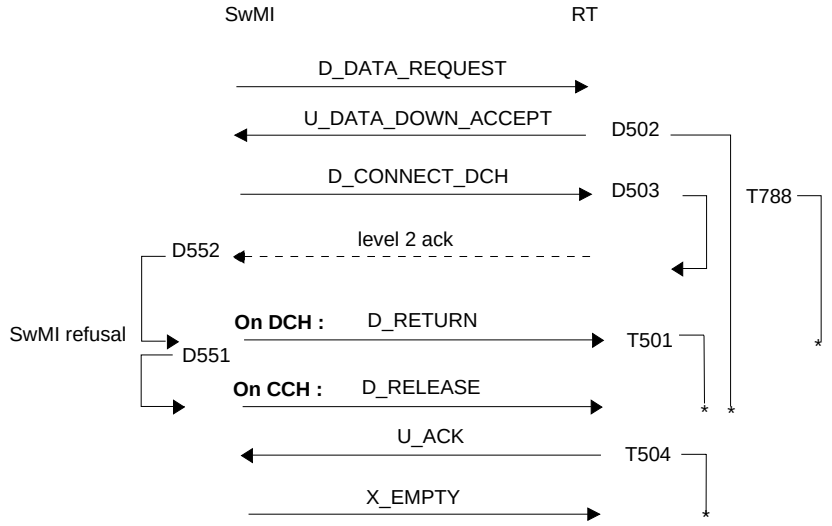


Figure 166: Failure in DCH downlink transmission request

The cause for release should be one of the following ones:
- "key error": The SwMI detects that the RT is unable to decrypt the message.

5.8.2.4 DCH or CCH connected packet transmission

5.8.2.4.1 Overview

The data transmission in connected packet mode enables the RT and the SwMI to exchange on CCH or DCH a flow of simultaneous uplink or downlink messages.

The transmission continues as long as the timer T781 do not expire.

Only the uplink and downlink messages of the external data application which has been granted, are transmited.

An SDP application shall only transmit one message at each data transmission request.

5.8.2.4.2 Examples of transmission

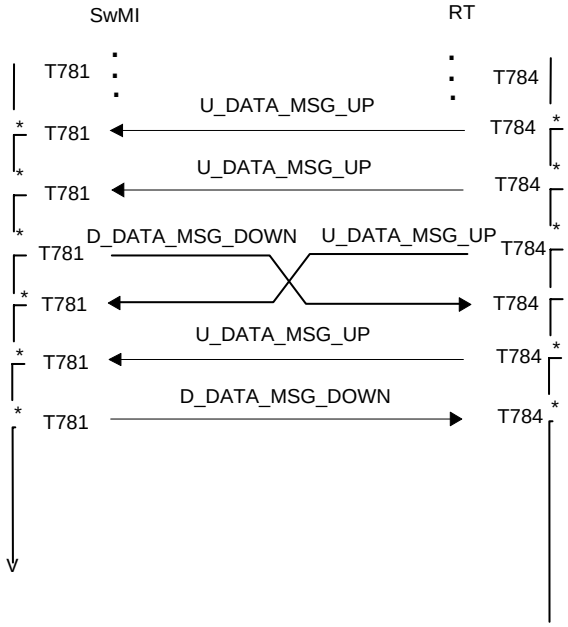


Figure 167: Example of a TCP transmission

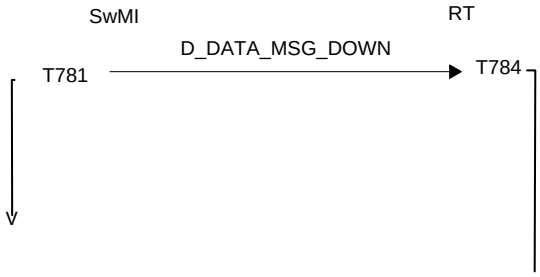


Figure 168: Example of a SDP downlink transmission

5.8.2.5 End of the transmission

5.8.2.5.1 SwMI initiative

(a) individual end:

On T781 expiration, the applicative connection on DCH or CCH is discarded. Closing the connection on DCH causes the RT return to CCH, .

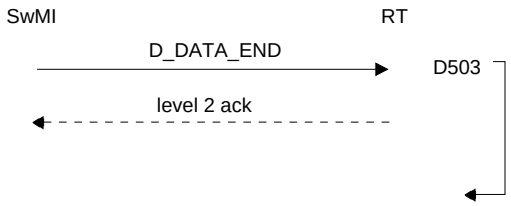


Figure 169: End of the transmission

- Before D503 expiry: the RT shall remain on the current channel to allow the lower protocol layer to stabilise before the RT switches over.

- At D503 expiry: on DCH, the RT shall execute the switch-over from DCH to CCH. On CCH, the RT remains on CCH.

The cause for D_DATA_END should be one of the following ones:

- "transmission inactivity" : Time-out of data transmission activity expiries,
- "preemption" : A preemptive application in the SwMI causes the interrupt of data transmission,
- "key renewal" : The index of the key has been moved,
- "message length error" : Incorrect uplink message size,
- "application type error" : Incorrect protocol or application field in uplink message header,
- "encryption field error" : Incorrect encryption field in uplink message header,
- "priority error": Incorrect priority field in uplink message header.

(b) general end:

If the network wants to preempt the whole data channel, it shall send the D_RETURN message on the DCH using the "ALL RT" collective address. The RT shall switch to CCH, and initiate the dialogue. The RTs and swMI shall discard the preempted data transmission connections.

5.8.2.5.2 RT initiative (preemption)

This mechanism is described in clause : « general mechanisms ».

5.8.2.5.3 RT initiative (errors of data application)

Once on CCH, the RT initiates the dialogue to report an withdrawal from current application (See general mechanisms- Application transaction termination initiated by the RT). The causes for TERMINATION should be one of the following ones:

- "application event" : T788 or T784 expiry,
- "message length error" : Incorrect downlink message size,
- "application type error" : Incorrect protocol or application field in downlink message header,
- "encryption field error" : Incorrect encryption field in downlink message header,
- "priority error": Incorrect priority field in downlink message header.

5.8.3 Short datagram message transmission mode

5.8.3.1 Short datagram sending

The transmission shall be activated whenever the RT DATA application decides to send information.

5.8.3.1.1 Successful case

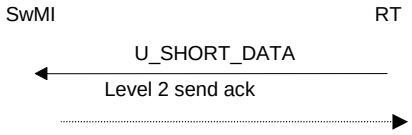


Figure 170: Short datagram transmission

See transmission procedures in PAS 0001-3-3 [6].

5.8.3.1.2 Unsuccessful case

Failure of the transmission procedure on DACH.

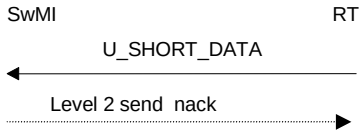


Figure 171: Short datagram transmission failure

See transmission procedures in PAS 0001-3-3 [6].

5.8.3.2 Short datagram Reception

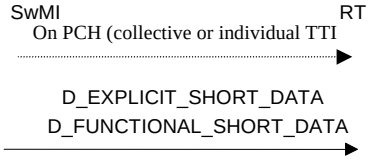


Figure 172: Short datagram reception

The message is sent in datagram mode on SDCH (of CCH) or on SDCH (of CCH) **and** on SCH (of TCH) depending on the receiver and the service invoked by the transmitter with paging on PCH.

5.8.3.3 Short datagram sending in FBM3.1

The transmission shall be activated whenever the RT DATA application decides to send information (used only for tower communication)

5.8.3.3.1 Successful case

Figure 173: Short datagram transmission in FBM3.1 mode

See transmission procedures in PAS 0001-3-3 [6].

5.8.3.4 Status Reception

The SwMI shall complete the information supplied by the RT with:

- the full address of the sender RT;
- the RT's location in the base network.

Figure 174: Status reception

The message is sent in datagram mode on SDCH without paging

It is sent N565 times at intervals of D565.

5.8.3.5 Extended Status reception

The SwMI shall construct and send this message to one or several RT.

The information supplied by the SwMI to inform one or several DP that

- a private call initiated by one RT has failed.
- a « call-me-back » request has been initiated by a RT

The message shall contain :

- the reason of the request :
- the RT’s organisation identity
- the full address of the sender RT;
- the RT's location in the base network.
- The dialed called number
- The priority of the call.

Figure 175: Extended Status reception

The message is sent in datagram mode on SDCH without paging.

5.8.4 Broadcast without notification mode

5.8.4.1 Overview

The SwMI shall implement a "broadcast service transmission mode" mechanism whereby the TSDU is broadcast to a specific RT or a group of RT on CCH **without notification**.

The initiating application shall provide two parameters:

- The security level;
- The paging mode: with or without preliminary paging.

5.8.4.2 Implementation

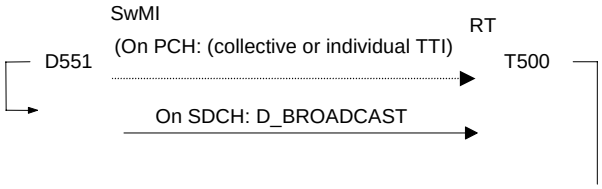


Figure 176: General Broadcast sequence

The D_BROADCAST TSDU may be segmented in several TPDU.

For every TSDU to be broadcast:

- the SwMI may (depending of paging mode, (see note 1)) alert all the RTs involved on PCH using an individual or collective address;
- then after a time of at least D551 shall send the first TSDU, (see note 2);
- the TSDU is transmitted one, two or three times (see note 3).

NOTE 1: The preliminary paging is not done if the paging mode requested by the initiating application indicates: NO_PAGING.

NOTE 2: The TSDU is addressed by the same address as PCH one.

NOTE 3: The TSDU is broadcast one, two or three time according to the security level requested by the initiating application, respectively: normal, secure, very secure, see "datagram transport level" in PAS 0001-3-3 [6].

When the RT receives a PCH with a collective address, the RT shall set a T500 time-out in the same conditions as those defined in "exchange initiation".

5.8.5 Broadcast with notification mode

5.8.5.1 Overview

The SwMI shall implement a "broadcast service transmission mode" mechanism whereby the TSDU is broadcast to a specific RT or a group of RT on SDCH of CCH **with notification** on CCH and TCH.

5.8.5.2 Implementation

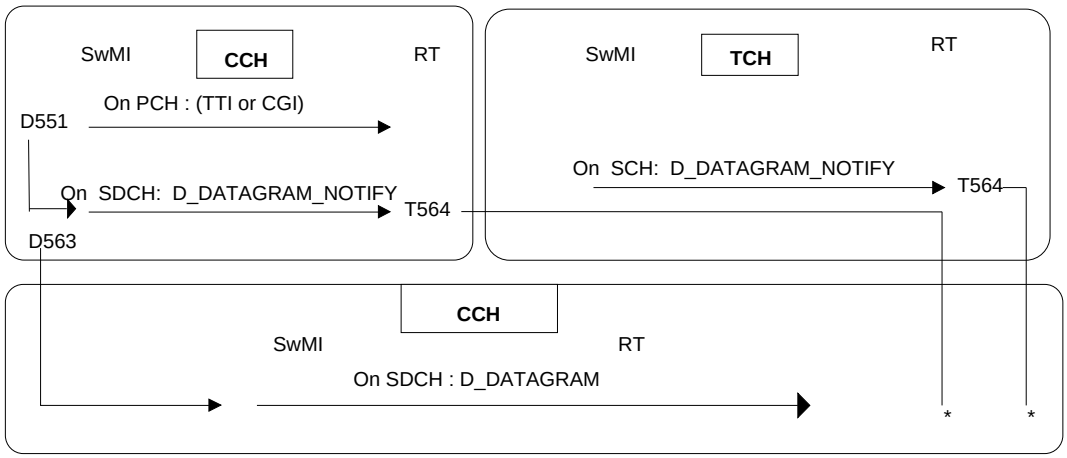


Figure 177: Asynchronous broadcast sequence

The D_DATAGRAM TSDU may be segmented in several TPDUs.

When the SwMI wishes to send the TSDU, it shall use:

- the PCH;
- and all TCH (VCH).

1) The PCH and SCH shall convey
   - the individual
   - or collective address + a "mandatory take into account" indication (Bit Z = 1 See "address field format for SCH" in PAS 0001-3-3 [6]).

   When the RT receives the PCH, it shall set a T500 timer.

2) the "D_DATAGRAM_NOTIFY" TSDU indicates that a TSDU will be broadcast on CCH. This message **is not** preceded by SCH_TI even if the TSDU is addressed to one RT in Transmission status at the moment.

3) Between the transmission of the last "D_DATAGRAM_NOTIFY" and the first TPDU of the "D_DATAGRAM" TSDU on the SDCH, the SwMI shall wait for at least D563.

4) When it receives the "D_DATAGRAM_NOTIFY" TSDU, the RT, **if it is concerned** by the following D_DATAGRAM TSDU, shall set a T564 timer and remain on stand by on the CCH.

   When T564 expires, the RT shall remain on stand- by on the CCH.

5) The "D_DATAGRAM" TSDU shall be addressed like the "D_DATAGRAM_NOTIFY" TSDU.

5.8.6 Uplink data transfer in SwMI polling mode

5.8.6.1 Short datagram sending

On explicit SwMI invitation, RT transmit a short message pending (if any), otherwise the RT does not answer.

5.8.6.1.1 Successful case

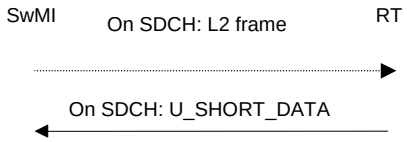


Figure 178: Data transmission in polling mode.

See transmission procedures in PAS 0001-3-3 [6].

5.8.6.1.2 Unsuccessful case

RT does not respond to SwMI invitation.

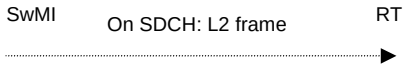


Figure 179: Data transmission failure in polling mode.

See transmission procedures in PAS 0001-3-3 [6].

5.9 RT Management

5.9.1 Overview

The RT MANAGEMENT application shall support the following functions:

ACCESS DISABLED: this function shall allow the SwMI to permanently bar RT network access.

TRAFFIC DISABLE / ENABLE, this function shall allow the SwMI to temporarily disable RT user activity on the RT.

SERVICE BARRED, this function shall allow the SwMI to report that the RT has been disabled by its home BN dispatch position.

ADDRESS FORWARDING, This function shall allow the RT to enable or disable this function to reroute its incoming traffic towards another RT.

5.9.2 Access disabled

The RT shall be informed by executing an application transaction to bar RT access. Two different protocols can be used for this transaction according to the network configuration.

For the both protocols, this transaction shall be implemented by means of two different processes:

- an immediate process;
- a permanent process.

5.9.2.1 Illustration of the first protocol

5.9.2.1.1 Successful case

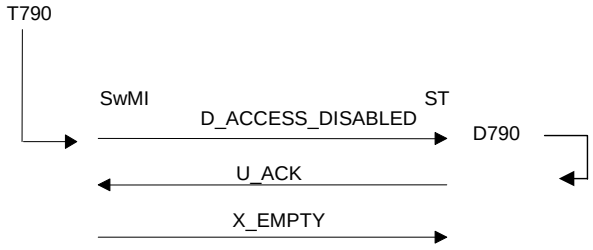


Figure 180: RT access disabling

The SwMI shall consider that the application transaction has been successfully executed on receipt of the U_ACK TSDU. It shall then know that the RT has understood the order sent in the D_ACCESS_DISABLED TSDU.

On receipt of the TSDU:

- When the serial number contained in the TSDU matches the RT's serial number, the RT shall accept the order with all the effects it has on sensitive data terminal data;
  It shall send the U_ACK TSDU to the SwMI then shut down when D790 expires;
- When the serial number contained in the TSDU does not match the RT's own serial number, the RT shall send the U_ACK TSDU to the SwMI, then resynchronise when D790 expires with an "intrusion" cause field, and shall ignore the received TSDU.

5.9.2.1.2 Unsuccessful case (U_ACK is not received by SwMI)

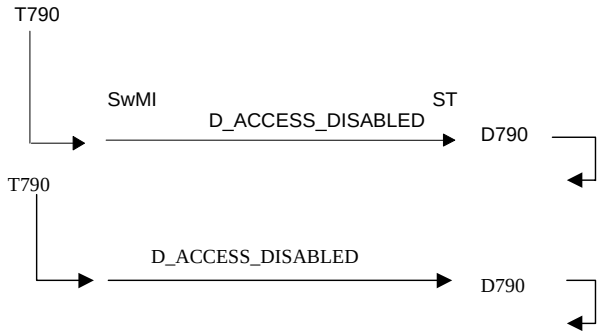


Figure 181: RT access disabling unsuccessful case

5.9.2.2 illustration of the second protocol

5.9.2.2.1 Successful case

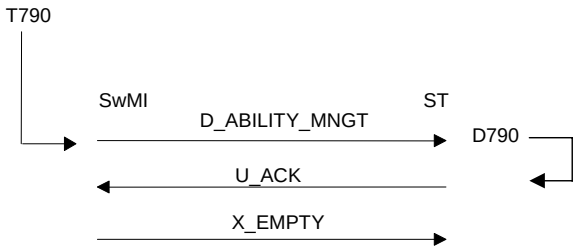


Figure 182: enhanced protocol

5.9.2.2.2 Unsuccessful case (ST side)

The ST may abort the transaction according to error detected on the reception of the first message.

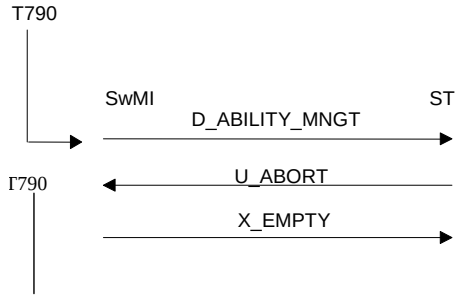


Figure 183: Unsuccessful case of enhanced protocol

The abort cause beared by the U_ABORT TSDU shall be one of the following ones:

- "unknown TSDU"
- " missing mandatory IE "

The error cases to be dealt with by the ST are :

- receiving a TSDU with an unknown CODOP : reject of the transaction by freeing the service emitting a U_ABORT TSDU with a cause "unknown TSDU"

- receiving a TSDU from baseline protocol for a enhanced terminal : reject of the transaction by freeing the service emitting a U_ABORT TSDU with a cause "unknown TSDU"

- receiving a TSDU from enhanced protocol for a baseline terminal : reject of the transaction by freeing the service emitting a U_ABORT TSDU with a cause "unknown TSDU"

- transaction for a non-ciphering terminal : reject of the transaction by freeing the service emitting a U_ABORT TSDU with a cause " missing mandatory IE "

- transaction with wrong parameters for a ciphering terminal : reject of the transaction by freeing the service emitting a U_ABORT TSDU with a cause " missing mandatory IE "

5.9.2.3 Immediate process

If the RT is on a TCH, the SwMI shall enforce return to the control channel then execute the application transaction.

If the application transaction is not successfully executed for the SwMI, the permanent process shall be initiated: the SwMI shall set T790.

If the application transaction is successfully executed for the SwMI, the permanent process shall be not initiated: the SwMI does not set T790.

5.9.2.4 Permanent process

If T790 expires, the SwMI shall again execute the application transaction to bar RT access.

T790 shall be reset if the transaction is unsuccessful. On expiry, the SwMI shall again attempt to execute the transaction.

T790 shall not be reset if the transaction is successful.

T790 shall be suspended because the RT is no longer present for the SwMI (T731 expiry), the SwMI shall initiate an application transaction immediately after the next RT registration transaction.

T790 may be interrupted because the RT has set-up a contact with the SwMI for another application transaction. The SwMI shall reject the transaction, then execute the application transaction to bar RT access (immediate process).

5.9.3 Traffic disabling

The RT shall be informed by executing an application transaction to disable RT traffic.Two different protocols can be used for this transaction according to the network configuration.

For the both protocols, this transaction shall be implemented by means of two different processes:

- an immediate process;
- a permanent process.

5.9.3.1 Illustration of the first protocol

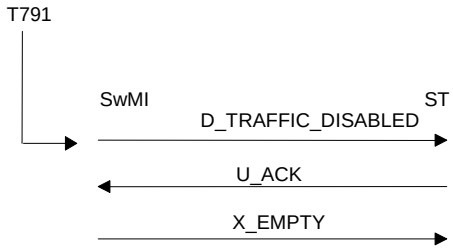


Figure 184: Traffic disabling

The SwMI shall consider that the application transaction has been successfully executed on receipt of the U_ACK TSDU. It then knows that the RT has understood the order sent in the D_TRAFFIC_DISABLED TSDU.

On receipt of the TSDU:

- if the serial number contained in the TSDU matches the RT's serial number, the RT shall accept the order with all the effects it has on the terminal then reply to the SwMI by means of a U_ACK TSDU;
- if the serial number contained in the TSDU does not match the RT's own serial number, the RT shall send the U_ACK TSDU to the SwMI, then shall realise a resynchronisation with "intrusion" in the cause field, and shall ignore the received TSDU.

5.9.3.2 Illustration of the second protocol

See 5.9.2.2 with T791 instead T790

5.9.3.3 Immediate process

If the RT is on a TCH, the SwMI shall switch back to the control channel then execute the transaction.

If the application transaction is not successfully executed for the SwMI, the permanent process shall be initiated: the SwMI shall set T791.

If the application transaction is successfully executed for the SwMI, the permanent process shall not be initiated: the SwMI does not set T791.

5.9.3.4 Permanent process

If T791 expires, the SwMI shall again execute the application transaction to disable RT traffic.

T791 is reset if the transaction is unsuccessful. On expiry, the SwMI shall again attempt to execute the transaction.

T791 is not reset if the transaction is successful.

T791 is suspended because the RT is no longer present for the SwMI (T731 expiry), the SwMI shall initiate an application transaction immediately after the next RT registration transaction.

T791 may be interrupted because the RT has set-up a contact with the SwMI for another application transaction. The SwMI shall reject the transaction, then execute the application transaction to disable RT traffic (immediate process).

5.9.4 Traffic enabling

The RT shall be informed by executing an application transaction to enable RT traffic.Two different protocols can be used for this transaction according to the network configuration.

For the both protocols, this transaction shall be implemented by means of two different processes:

- an immediate process;
- a permanent process.

5.9.4.1 Illustration of the first protocol

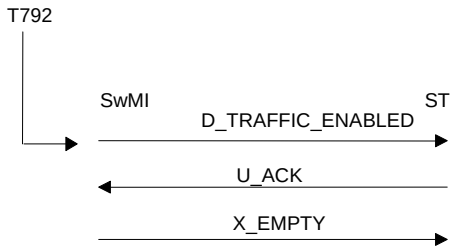


Figure 185: Traffic enabling

The SwMI shall consider that the application transaction has been successfully executed on receipt of the U_ACK TSDU. It then knows that the RT has understood the order sent in the TSDU.

On receipt of the D_TRAFFIC_ENABLED it shall immediately submit the order and all the effects it has on the terminal and reply U_ACK to the SwMI.

5.9.4.2 Illustration of the second protocol

See 5.9.2.2 with T792 instead T790

5.9.4.3 Immediate process

The RT can not be on TCH since it is traffic disabled.

The RT shall execute the application transaction to enable RT traffic.

If the application transaction is not successfully executed for the SwMI, the permanent process shall be initiated: the SwMI shall set T792.

If the application transaction is successfully executed for the SwMI, the permanent process shall not be initiated: the SwMI does not set T792.

5.9.4.4 Permanent process

If T792 expires, the SwMI shall again execute the application transaction to enable RT traffic.

T792 shall be reset if the transaction is unsuccessful. At time-out, the SwMI shall again attempt to execute the transaction.

T791 shall not be reset if the transaction is successful.

T791 is suspended because the RT is no longer present for the SwMI (T731 expiry), the SwMI shall initiate an application transaction to enable traffic immediately after the next RT registration transaction.

5.9.5 Service disabled

The RT shall be informed by executing an application transaction to bar RT service. Two different protocols can be used for this transaction according to the network configuration.

For the both protocols, this transaction shall be implemented by means of two different processes:

- an immediate process;
- a permanent process.

5.9.5.1 Illustration of the first protocol

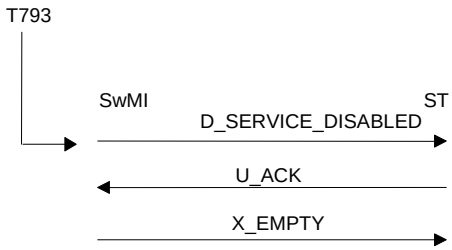


Figure 186: Service disabling

The SwMI shall consider that the application transaction has been successfully executed on receipt of the U_ACK TSDU. It then knows that the RT has understood the order sent in the TSDU.

On receipt of the TSDU:

- if the serial number contained in the TSDU matches the RT's serial number, the RT shall react in the same way as on receipt of the D_REGISTRATION_NAK (cause "RT registration barred");

- if the serial number contained in the TSDU does not match the RT's own serial number, the RT shall send the U_ACK TSDU to the SwMI, then shall realise a resynchronisation with "intrusion" in the cause field, and shall ignore the received TSDU.

5.9.5.2 Illustration of the second protocol

See 5.9.2.2 with T793 instead T790

5.9.5.3 Immediate process

If the application transaction is not successful for the SwMI, the permanent process shall be initiated: the SwMI shall set T793.

If the application transaction is successfully executed for the SwMI, the permanent process shall not be initiated: the SwMI shall not set T793.

5.9.5.4 Permanent process

If T793 (retransmission time-out) expires, the SwMI shall again execute the application transaction to disable RT service.

T793 shall be reset if the transaction is unsuccessful. On expiry, the SwMI shall again attempt to execute the transaction.

T793 shall not be reset if the transaction is successful.

T793 is suspended because the RT is no longer present for the SwMI (T731 expiry), the SwMI shall initiate an application transaction to disable service immediately after the next RT registration transaction.

T793 may be interrupted because the RT has set-up a contact with the SwMI for another application transaction. The SwMI shall reject the transaction, then execute the application transaction to bar RT service (immediate process).

5.9.6 Start forwarding

The RT shall use this application transaction:

- to inform the SwMI when its user decides to start forwarding calls;
- to update the SwMI databases if on dialoguing with the SwMI it realises that forwarding has not effectively started.

5.9.6.1 Successful case

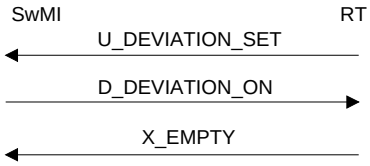


Figure 187: Start forwarding

The U_DEVIATION_SET TSDU shall contain information which codes the host address called by the RT.

The D_DEVIATION_ON TSDU shall inform the RT that the SwMI has accepted the forwarding request. The calls destined for the RT shall be addressed to the RT identified by the host address.

5.9.6.2 Unsuccessful case

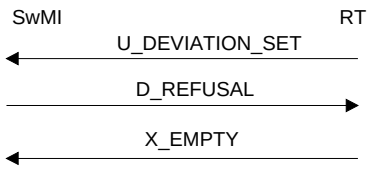


Figure 188: Start forwarding failure

The REFUSE cause shall be one of the following ones:

- "unknown calling party"
- "service barred calling party"
- "host address not valid"
- "Already forwarded"

5.9.7 Stop forwarding

The RT shall use this application transaction:

- to inform the SwMI when its user decides to stop forwarding calls;
- to update the SwMI databases if on dialoguing with the SwMI it realises that forwarding has not been effectively stopped.

5.9.7.1 Successful case

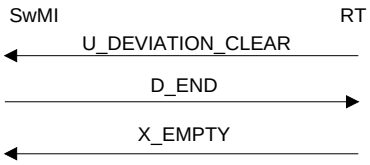


Figure 189: Stop forwarding sequence

The U_DEVIATION_CLEAR TSDU shall contain the RT request to stop routing calls addressed to the RT to the host terminal address.

The D_END TSDU shall inform the RT that the SwMI has accepted the stop forwarding request. The calls destined for the RT are no longer addressed to the RT identified by a host address when forwarding was initiated.

If, for the SwMI, the RT address was not forwarded, the SwMI shall execute the application transaction without any special indication to the RT.

5.9.7.2 Unsuccessful case

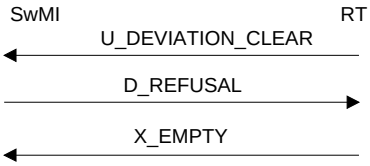


Figure 190: Stop forwarding failure

The REFUSE cause shall be:

- "unknown calling party"

5.10 Key delivery

5.10.1 Overview

The KEY DELIVERY application shall support the following functions:

- RNK DELIVERY: This function shall allow the SwMI to distribute the current BN RNK to the RT.
- TKK DELIVERY: This function shall allow the SwMI to distribute the TKK key to the RT.
- Generic KEY DELIVERY: This function shall allow the SwMI to distribute any key to the RT (optional), with or without authentication.

5.10.2 RNK delivery

The RNK key delivery transaction shall be implemented by means of two different processes:

- an immediate process;
- a permanent process.

5.10.2.1 Illustration

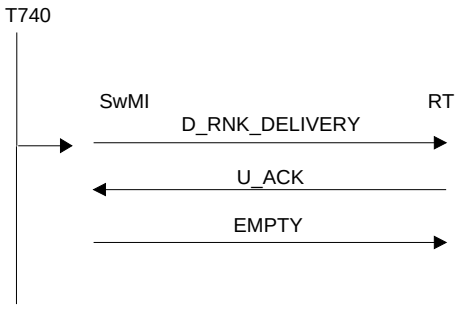


Figure 191: RNK delivery sequence

The SwMI shall consider that the application transaction has been successfully executed on receipt of the U_ACK TSDU. It then knows that the RT has received the D_RNK_DELIVERY TSDU.

On receipt of D_RNK_DELIVERY it shall store the RNK key then send the U_ACK TSDU.

5.10.2.2 Immediate process

If the application transaction is not successfully executed, the SwMI shall initiate the permanent process: it shall set T740.

5.10.2.3 Permanent process

If T740 expires (retransmission time-out), the SwMI shall again execute the RNK delivery application transaction.

T740 shall be set if the transaction is unsuccessful. On expiry, the SwMI shall attempt to execute the transaction again.

T740 is suspended because the RT is no longer present for the SwMI (T731 expiry) or after N741 attempts.

The SwMI shall restart the whole delivery process immediately after the next RT transaction.

T740 is interrupted because the SwMI has initiated an application transaction to disable RT traffic. The SwMI shall initiate a RNK delivery transaction immediately after the next application transaction to enable RT traffic.

5.10.3 TKK Delivery

The TKK key delivery transaction shall be implemented by means of two different processes:

- an immediate process;
- a permanent process.

5.10.3.1 Illustration

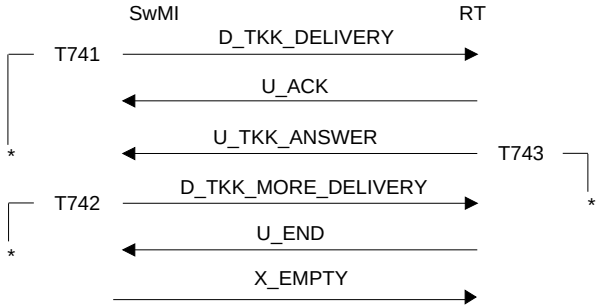


Figure 192: TKK delivery

The SwMI shall consider that the application transaction has been successfully executed on receipt of the U_END TSDU. It then knows that the RT has received the D_TKK_MORE_DELIVERY TSDU.

On receipt of a consistent D_TKK_MORE_DELIVERY TSDU, the RT shall store the TKK key then sends the U_END TSDU.

5.10.3.2 Unsuccessful case SwMI side

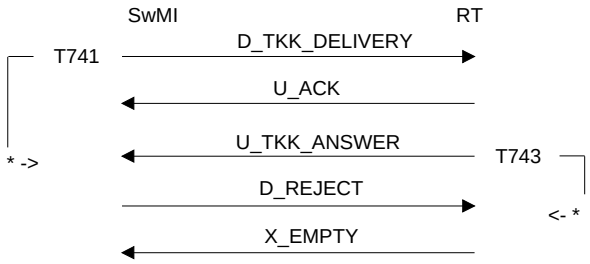


Figure 193: TKK delivery failure SwMI side

The REJECT cause should be one of the following ones:

- "authentication error": The RT shall end the transaction then change to maintenance service which may require re-configuration at the maintenance centre. The RT does not save this information in backup memory so that control channel selection then registration may be re-executed by switching off then on again.
- "HMSW access fault"
- "encryption error"
- "lack of resources"
- If T741 expires, the SwMI shall end the transaction by sending an empty DR and shall initiate the permanent transaction retransmission process: it shall set T744.
- If T742 expires, the SwMI shall initiate the permanent transaction retransmission process: it shall set T744.

5.10.3.3 Unsuccessful case RT side

If T743 expires, the RT shall generate an ABORT TSDU with "application event" in the cause field. T743 is designed to cover all internal SwMI exchanges.

If, on receipt of a D_TKK_MORE_DELIVERY TSDU, the RT detects an inconsistency, it shall execute resynchronisation with "intrusion" in the cause field.

5.10.3.4 Immediate process

If the application transaction is not successfully executed (case of REJECT and time-out expiry), the SwMI shall initiate the permanent process: it shall set T744.

If the application transaction is successfully executed, the SwMI shall not initiate the permanent process: it shall not set T744.

5.10.3.5 Permanent process

If T744 expires (retransmission time-out), the SwMI shall again execute the TKK delivery application transaction.

T744 is set if the transaction is unsuccessful. On expiry, the SwMI shall attempt to execute the transaction again.

T744 is suspended because the RT is no longer present for the SwMI (T731 expiry)attempts. The SwMI shall initiate a TKK delivery application transaction immediately after the next RT transaction.

T744 is interrupted because the SwMI has initiated an application transaction to disable RT traffic. The SwMI shall initiate a TKK delivery transaction immediately after the next application transaction to enable RT traffic.

5.10.4 Key Delivery (without authentication)

The key delivery transaction is an optional feature. If it is available, the key delivery transaction shall be implemented by means of two different processes:

- an immediate process;
- a permanent process.

5.10.4.1 Illustration

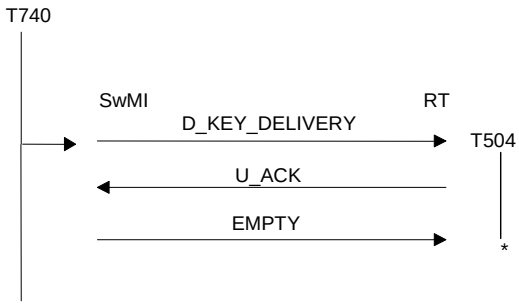


Figure 194: KEY delivery sequence with no segmentation

The D_KEY_DELIVERY TSDU may be segmented into several TPDU.

The SwMI shall consider that the application transaction has been successfully executed on receipt of the level 2 acknowledgement of the last TPDU containing the D_KEY_DELIVERY TSDU, the SwMI then shall send an X_EMPTY TPDU.

If the D_KEY_DELIVERY TSDU is segmented into several TPDUs, then:

- on receipt of the first TPDU, the RT shall send the TSDU U_ACK TSDU and shall set T747;
- on receipt of the last TPDU containing the D_KEY_DELIVERY TSDU, the RT shall store the received information, shall cancel T747 then shall set T504;
- if T747 expires, the RT shall end the transaction an X_EMPTY TSDU.

If the D_KEY_DELIVERY TSDU is not segmented, then:

- on receipt of the D_KEY_DELIVERY TSDU, the RT shall store the received information then shall send U_ACK TSDU and shall set T504;
- the RT shall not set T747.

5.10.4.2 Immediate process

If the application transaction is not successfully executed, the SwMI shall initiate the permanent process: it shall set T740.

5.10.4.3 Permanent process

If T740 expires (retransmission time-out), the SwMI shall again execute the KEY delivery application transaction. T740 shall be set if the transaction is unsuccessful. On expiry, the SwMI shall attempt to execute the transaction again.

T740 is suspended because the RT is no longer present for the SwMI (T731 expiry) or after N741 attempts.

The SwMI shall restart the whole delivery process immediately after the next RT transaction.

T740 is interrupted because the SwMI has initiated an application transaction to disable RT traffic. The SwMI shall initiate a KEY delivery transaction immediately after the next application transaction to enable RT traffic.

5.10.5 Key Delivery (with authentication)

The key delivery transaction is an optional feature. If it is available, the generic key delivery transaction shall be implemented by means of two different processes:

- an immediate process;
- a permanent process.

5.10.5.1 Illustration

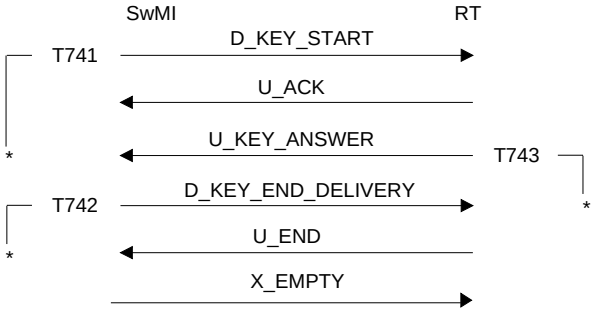


Figure 195: KEY delivery (with authentication)

The SwMI shall consider that the application transaction has been successfully executed on receipt of the U_END TSDU. It then knows that the RT has received the D_KEY_END_DELIVERY TSDU.

On receipt of a consistent D_KEY_END_DELIVERY TSDU, the RT shall store the key then sends the U_END TSDU.

5.10.5.2 Unsuccessful case SwMI side

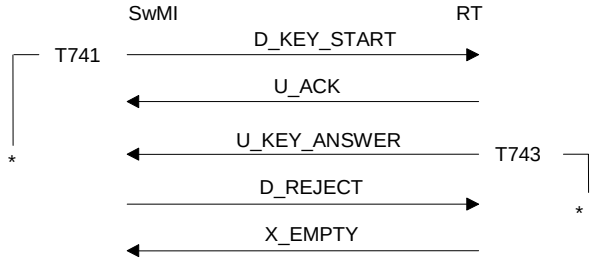


Figure 196: KEY delivery (with authentication) failure SwMI side

The REJECT cause should be one of the following ones:

- "authentication error": The RT shall end the transaction then change to maintenance service which may require re-configuration at the maintenance centre. The RT does not save this information in backup memory so that control channel selection then registration may be re-executed by switching off then on again.
- "HMSW access fault"
- "encryption error"
- "lack of resources"
- If T741 expires, the SwMI shall end the transaction by sending an empty DR and shall initiate the permanent transaction retransmission process: it shall set T744.
- If T742 expires, the SwMI shall initiate the permanent transaction retransmission process: it shall set T744.

5.10.5.3 Unsuccessful case RT side

If T743 expires, the RT shall generate an ABORT TSDU with an "application event" cause field. T743 is designed to cover all internal SwMI exchanges.

If, on receipt of a D_KEY_END_DELIVERY TSDU, the RT detects an inconsistency, it shall execute resynchronisation with an "intrusion" cause field.

5.10.5.4 Immediate process

If the application transaction is not successfully executed (case of REJECT and time-out expiry), the SwMI shall initiate the permanent process: it shall set T744.

5.10.5.5 Permanent process

If T744 expires (retransmission time-out), the SwMI shall again execute the key delivery application transaction. T744 is reset if the transaction is unsuccessful. On expiry, the SwMI shall attempt to execute the transaction again.

T744 is suspended because the RT is no longer present for the SwMI (T731 expiry) or after N744 attempts.

The SwMI shall restart the whole delivery process immediately after the next RT transaction.

T744 is interrupted because the SwMI has initiated an application transaction to disable RT traffic. The SwMI shall initiate a key delivery transaction immediately after the next application transaction to enable RT traffic.

5.11 Information delivery

5.11.1 Overview

This mechanism is implemented by the SwMI when it wishes to supply the RT with precise information which will modify it operating conditions. This message may contain several types of information.

The information distributed by this application shall be: loical and networg OGs.

These two types of information may be delivered in the same message, if necessary.

This transaction shall be implemented by means of the two different processes:
- immediate process;
- permanent process.

5.11.2 Illustration

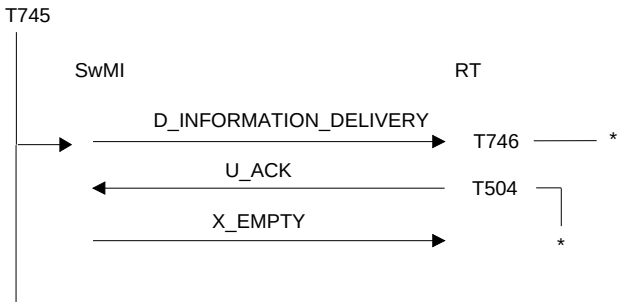


Figure 197: Information delivery sequence

The D_INFORMATION_DELIVERY TSDU may be segmented into several TPDU.

The SwMI shall consider that the application transaction has been successfully executed on receipt of the level 2 acknowledgement of the last TPDU containing the D_INFORMATION_DELIVERY TSDU, the SwMI then shall send an X_EMPTY TPDU.

If the D_INFORMATION_DELIVERY TSDU is segmented into several TPDUs, then:

- on receipt of the first TPDU, the RT shall send the TSDU U_ACK TSDU and shall set T746;
- on receipt of the last TPDU containing the D_INFORMATION_DELIVERY TSDU, the RT shall store the received information, shall cancel T746 then shall set T504;
- if T746 expires, the RT shall end the transaction an X_EMPTY TSDU.

If the D_INFORMATION_DELIVERY TSDU is not segmented, then:

- on receipt of the D_INFORMATION_DELIVERY TSDU, the RT shall store the received information then shall send U_ACK TSDU and shall set T504;
- the RT shall not set T746.

5.11.2.1 Immediate process

The delivery shall be considered as ended if the transaction is successful.
In case of failure, the SwMI shall set T745.

5.11.2.2 Permanent process

Whenever T745 expires, the SwMI shall attempt to execute the transaction. The delivery shall be considered as ended if the transaction is successful.

In case of failure, the SwMI shall set T745.

T745 is suspended because the RT is no longer present for the SwMI (T731 expiry) or after N745 attempts.

The SwMI shall restart the whole delivery process immediately after the next RT transaction.

T745 is interrupted because the SwMI has initiated an application transaction to disable RT traffic. The SwMI shall initiate a delivery transaction immediately after the next application transaction to enable RT traffic.

6. History

Date	Status	Comment
3 November 1995	First draft.	Version 0.0.1
11 December 1995	Clauses 1, 2, and 4 (general) added.	Version 0.0.2
02 February 1996	Formatting.	Version 0.0.3
15 March 1996	Corrections.	Version 0.0.4
11 April 1996	Formatting.	Version 0.0.5
16 April 1996	Review.	Version 0.1.0
30 April 1996	TETRAPOL Forum approval.	Version 1.0.0
20 June 1996	Formatting.	Version 1.0.1
31 July 1996	Generic key delivery added.	Version 1.0.3
15 November 1996	Update.	Version 1.0.4
16 December 1996	Update following review.	Version 1.1.0
24 March 1997	Update: data polling mode, group communication paging, channel saving, multi-BN keys, call of an RT in umbrella MOCH, removal of Partition information element and of functional coverage, broadcast of neighbouring cells information, dialogue initiation, etc.	Version 1.1.1
15 April 1997	Update after review, etc.	Version 1.2.0
25 June 1997	Tetrapol Forum approval.	Version 2.0.0
2 December 1997	Update : Broadcast open channel, crisis open channel, silent call, dch data transmission	Version 2.1.0
16 December 1997	Correction	Version 2.1.1
30 January 1998	Editorial correction	Version 2.1.2
15 February 1998	Update after review	Version 2.2.0
28 July 1998	Clarifications related to tests	Version 2.2.1
01 December 1998	Update: initialization of a dedicated channel, group activation wait indication	Version 2.2.2
15 january 1999	Update after internal review	Version 2.3.0
03 November 1999	Update, data message broadcast presentation to implicit adress	Version 2.3.1
18 December 2001	Update, object call messages. Rename of group activation wait indication	Version 2.3.2

20 November 2002	Update, object call	Version 2.3.3
20 November 2003	Update, channel saving for object call, New protocol of traffic enabling and access disabled	Version 2.3.4