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Part 12-14: Late Entry (LE)

ETSI

European Telecommunications Standards Institute

ETSI Secretariat

Postal address: F-06921 Sophia Antipolis CEDEX - FRANCE
Office address: 650 Route des Lucioles - Sophia Antipolis - Valbonne - FRANCE
X.400: c=fr, a=atlas, p=etsi, s=secretariat - **Internet:** secretariat@etsi.fr

Tel.: +33 92 94 42 00 - Fax: +33 93 65 47 16

Contents

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Foreword

This draft European Telecommunication Standard (ETS) has been produced by the Radio Equipment and Systems (RES) Technical Committee of the European Telecommunications Standards Institute (ETSI), and is now submitted for the Public Enquiry phase of the ETSI standards approval procedure.

This ETS is a multi-part standard as follows:

Part 1:   "General network design".

Part 2:   "Air Interface (AI)".

Part 3:   "Inter-working", (DE/RES-06001-3).

Part 4:   "Gateways", (DE/RES-06001-4).

Part 5:   "Terminal equipment interface", (DE/RES-06001-5).

Part 6:   "Line connected stations", (DE/RES-06001-6).

Part 7:   "Security".

Part 8:   "Management services", (DE/RES-06001-8).

Part 9:   "Performance objectives", (DE/RES-06001-9).

Part 10:   "Supplementary Services (SS) Stage 1".

Part 11:   "Supplementary Services (SS) Stage 2".

Part 12:   "Supplementary Services (SS) Stage 3".

Part 13:   "SDL Model of the Air Interface".

Part 14:   "PICS Proforma", (DE/RES-06001-14).

Part 15:   "Inter-working - Extended Operations", (DE/RES-06001-15)
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Proposed transposition dates	
Date of latest announcement of this ETS (doa):	3 months after ETSI publication
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1 Scope

This European Telecommunication Standard (ETS) defines the stage 3 specifications of the Supplementary Service Late Entry (SS-LE) for the Trans-European Trunked Radio (TETRA).

SS-LE allows radio users to be informed of and, if they are concerned, to join an already existing point-to-multipoint speech call.

Man-Machine Interface (MMI) and charging principles are outside the scope of this ETS.

Supplementary Service stage 3 specification is preceded by the stage 1 and the stage 2 specifications of the service. Stage 1 describes the functional capabilities from the user's point of view. Stage 2 defines the functional behaviour in terms of functional entities and information flows. Stage 3 gives a precise description of the Supplementary Service from the implementational point of view. It defines the protocols for the service and the encoding rules for the information flows. It defines the processes for the functional entities and their behaviour. The described protocols and behaviour apply for the Switching and Management Infrastructure (SwMI), for the Mobile Station (MS) and for the Line Station (LS) and can be applied over the Inter System Interface (ISI) between TETRA systems.

2 Normative references

This ETS incorporates, by dated or undated reference, provisions from other publications. 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 revisions of, any of these publications apply to this European Telecommunications Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

[1]   CCITT Recommendation I.130 (1988): "Method for the characterization of telecommunication services supported by an ISSN and network capabilities of an ISDN".

[2]   ETS 300 392-2: "Radio Equipment and Systems (RES), Trans-European Trunked Radio (TETRA), Voice plus Data (V+D), Part 2: Air Interface (AI)".

[3]   ITU-T Recommendation Z.100 (1993): "Specification and Description Language (SDL)".

3 Definitions and abbreviations

3.1 Definitions

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

authorized user: An identified user who is able to define and interrogate the SS-LE parameters. The definition procedure and principles for authorized user are outside the scope of SS-LE.

forced LE: The user should join the ongoing multipoint call as soon as he receives a late entry indication. If the user is already engaged in another communication, the user has to join the highest priority call.

LE acknowledgement: Indication sent in LE messages by a SwMI to inform a member who would like to join the call that he has to inform the SwMI of his entering the call.

LE broadcast: Indication sent by a SwMI to inform members of a multipoint call which are currently not already involved in this call that they can join directly an existing communication (a channel is already allocated in this cell).

LE paging: Indication sent by a SwMI to inform members of a multipoint call which are currently not already involved in this call that they need to ask for a communication channel for that call if they wish to participate the call (a channel is not yet allocated in this cell).

system 1: A TETRA system in which SS-LE can be defined and invoked. System 1 is the TETRA system which has same Mobile Network Identity (MNI) as the TETRA group identity to which SS-LE is defined.

system 2: A TETRA system to which SS-LE can be extended and invoked. System 2 is a TETRA system which has a different MNI as the TETRA group identity to which SS-LE is defined.

user A: Calling party in a call.

user B: In a group call a party that receives the SS-LE indications about an ongoing call.

3.2   Abbreviations

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

CC	Call Control
CCA	Call Control (functional entity Agent)
FE	Functional Entity
GTSI	Group TETRA Subscriber Identity
ISI	Inter-System Interface
ITSI	Individual TETRA Subscriber Identity
LE	Late Entry
LS	Line Station
MS	Mobile Station
SS	Supplementary Service

> NOTE: The abbreviation SS is only used when referring to a specific supplementary service.

SwMI   Switching and Management Infrastructure

4   Supplementary Service Late Entry (SS-LE) Stage 3 specification

4.1   Functional model

4.1.1   Functional model description

The functional model shall comprise the following Functional Entities (FEs):

- FE1   user B functional entity;
- FE2   SS-LE functional entity;
- FE3   authorized user's functional entity.

> NOTE: A member of a group is authorized to interrogate the SS-LE for the group. For such interrogation, the INTERROGATE/INTERROGATE-ACK information flow is applicable and is used in the MS/LS as defined for FE3.

- FE4   SS-LE functional entity in visited system;
- FE5   user A's (Calling party's) functional entity;
- CC   Call Control;
- CCA   Call Control Agent.

The following relationships shall exist between these FEs:

- ra   between FE1 and FE2;
- rb   between FE2s' in different systems;
- rc   between FE2 and FE3;
- rd   between FE2 and FE5;
- re   between FE1 and FE4;
- rf   between FE3 and FE4.

Figure 1 shows these FEs and relationships for the operational part and figure 2 for the management part.
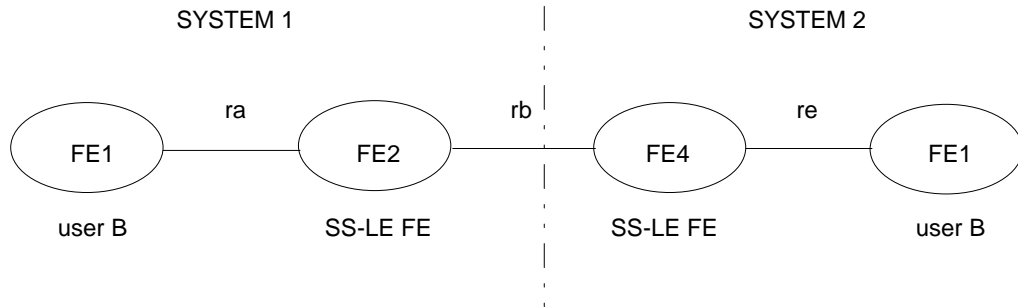
Figure 1: Functional model for the operational part of SS-LE
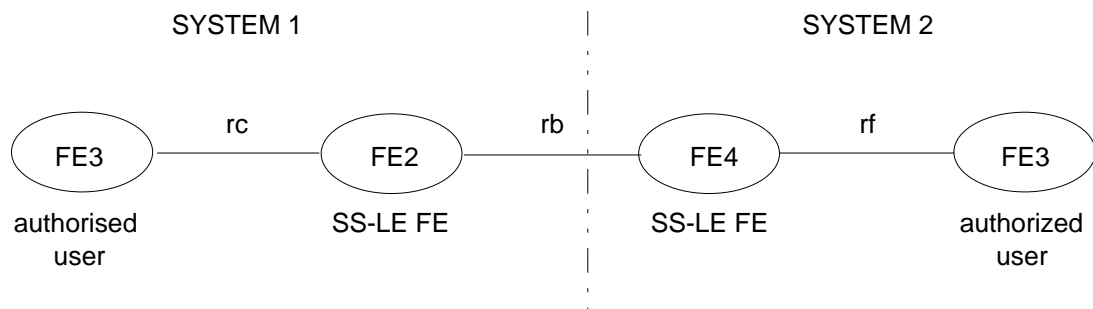
Figure 2: Functional model for the management part of SS-LE
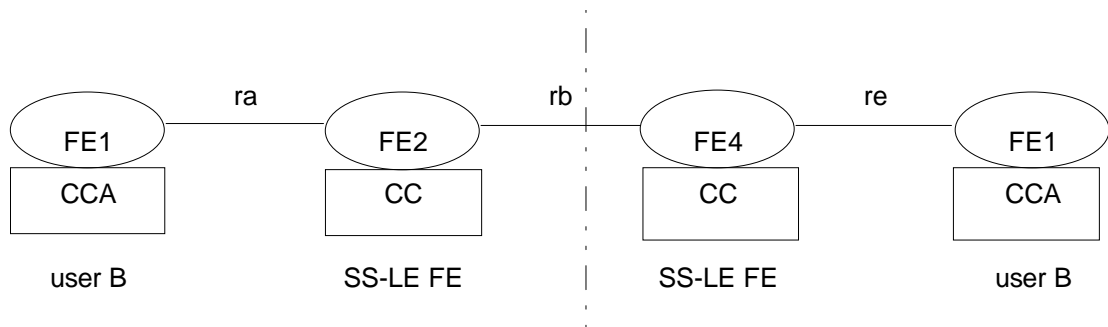
Figure 3: The relationships with a basic service.

4.2 SS-LE Service Description

4.2.1 Mapping of FEs to Circuit Mode Control Entities (CMCE) sub-entities

Functional Entities (FEs, CCs and CCAs) correspond to sub-entities in CMCE described in ETS 300 392-2 [2] according to the following rules:

- FE1: supplementary service sub-entity in CMCE in user B's MS/LS;
- FE2: supplementary service sub-entity in CMCE in SwMI in system 1;
- FE3: supplementary service sub-entity in CMCE in authorized user's MS/LS;
- FE4: supplementary service sub-entity in CMCE in SwMI in system 2;
- FE5: supplementary service sub-entity in CMCE in user A's MS/LS;
- CC: CC sub-entity in CMCE in SwMI;
- CCA: CC sub-entity in CMCE in MS/LS.

4.3 Protocol structure and protocol stack

Figure 4 shows the general position of the layer 3 supplementary services sub-entity within the CMCE and the TNSS-SAP in both the MS/LS and in the SwMI protocol stack. The SS-LE specific definition, operation and interrogation information elements shall be conveyed in a SS FACILITY element within the SS sub-entity. The FACILITY element is then conveyed in a suitable CMCE PDU (see ETS 300 392-2 [2], subclause 14.7) between the MS/LS and the SwMI or over the ISI. This ETS is only normative for the protocol architecture and user application SAPs within the mobile station/Line station but gives an informative description of the protocol and the SAPs within the SwMI.

CMCE-MS	Circuit Mode Control Entity, Mobile Station
CMCE-SwMI	Circuit Mode Control Entity, SwMI Station
LCMC-SAP	Mobile Link Entity - Circuit Mode Control Service Access Point
MLE	Mobile Link Entity
TNCC-SAP	TETRA Network - Call Control Service Access Point
TNSDS-SAP	TETRA Network - Short Data Service Service Access Point
TNSS-SAP	TETRA Network - Supplementary Service Service Access Point

Figure 4: System view

5 SS-LE service description

5.1 General

Clause 5 describes SS-LE specific services offered by the CMCE at the supplementary services SAP (TNSS-SAP) of the TETRA V+D layer 3 service boundary. The specific SS-LE services shall be carried as arguments within the following 3 general generic SS primitives:

a)   TNSS-SERVICE;
b)   TNSS-INFO;
c)   TNSS-ERROR.

For a detailed description of the generic SS primitives refer to ETS 300 392-2 [2], subclause 12.3. The flow of the generic SS primitives shall be as illustrated in figure 5.
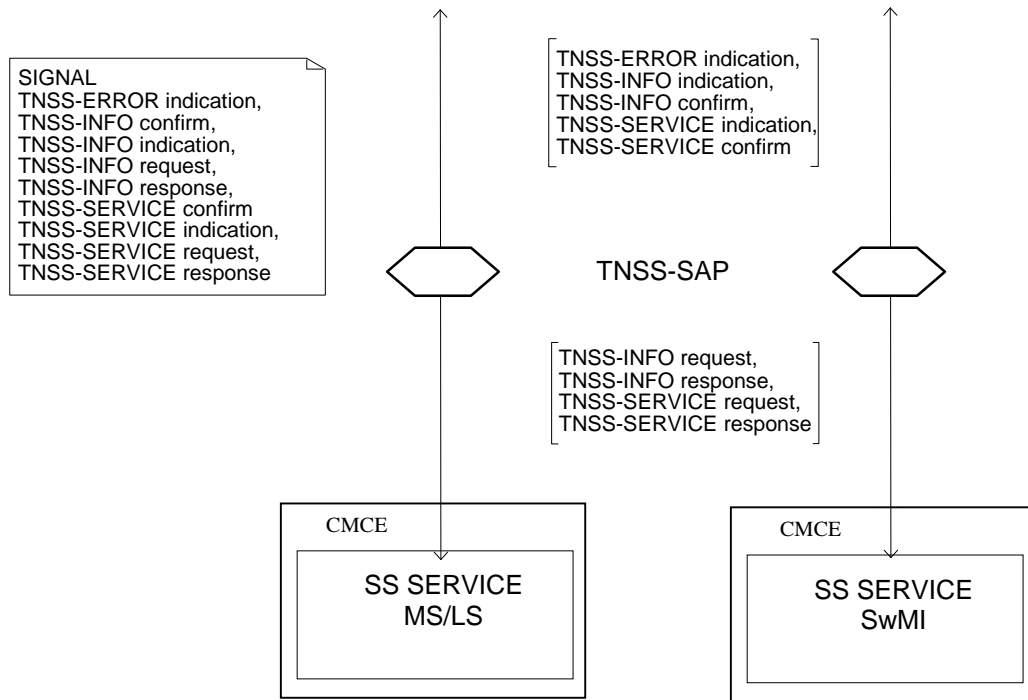
Figure 5: General supplementary services provided at the TNSS-SAP

The TNSS-SERVICE shall enable an invoking entity to request, and to be informed about, an operation to be performed by the performing entity.

The TNSS-INFO shall enable an entity to be informed of ongoing transactions.

The TNSS-ERROR shall enable a performing entity to return the negative reply of a unsuccessfully performed operation to the invoking entity.

5.1.1 SS-LE services offered over the TNSS-SAP

5.1.1.1 SS-LE primitives

The primitives shall as operation argument contain the following SS-LE sub-arguments.

- DEFINE request;
- DEFINE-ACK confirm;
- INFORM1 indication;
- INFORM2 indication;
- INFORM2-ACK response;
- INFORM3 indication;
- INFORM3-ACK response;
- INFORM4 indication;
- INTERROGATE request;
- INTERROGATE-ACK confirm.

5.1.1.2 DEFINE request

DEFINE request primitive shall be offered from application to FE3 over TNSS-SAP. The primitive shall contain the SS-LE information elements listed in table 1.

Defined group number type shall indicate the number of defined group TETRA identity elements, that shall follow the element. The element shall also indicate whether the following defined group TETRA identity elements shall be interpreted as one group number, a list of 2-10 group numbers or a range of group numbers. In case of range first and last element of the range shall be given.

Defined group TETRA identity element is a repeatable element that shall appear and shall be interpreted as indicated by defined group number type element. There shall be at least one defined group TETRA identity in a DEFINE primitive. Each defined group TETRA identity element shall comprise of any of the following:

- address type identifier and Short Number Address (SNA);
- address type identifier and Short Subscriber Identity (SSI);
- address type identifier and SSI and address extension.

The partial elements of defined group TETRA identity element shall always be in the order given above. Thus, address type shall be the first element which is always followed by any other partial element, except address extension. Address extension shall always follow SSI, if address extension is used. Omitted address extension shall imply that the address extension shall be the address extension of authorized user. SNA, if used, shall refer to a SNA defined for authorized user.

The SS-LE definition shall be requested to all group numbers given as defined group TETRA identity according to the parameters listed after the element defined group TETRA identity.

Table 1: DEFINE request contents

Element	C/O/M	Remark
SS type	M	:= SS-LE
LE Message type	M	:= DEFINE
Defined group number type	M	
Defined group TETRA identity	M	Repeatable
Address type identifier	M	
Short Number Address	C	
Short Subscriber Identity	C	
Address extension	C	
LE type	O	
LE used over ISI	O	note
Basic service type	O	
Repetition rate	O	
NOTE: The element should indicate if SS-LE should or should not be invoked over the Inter-System Interface (ISI)		

5.1.1.3 DEFINE-ACK confirm

DEFINE-ACK confirm primitive shall be offered from FE3 to application over TNSS-SAP. The primitive shall contain the SS-LE information elements listed in table 2.

Defined group number type shall indicate the number of defined group TETRA identity elements, that shall follow the element. The element shall also indicate whether the following defined group TETRA identity elements shall be interpreted as one group number, a list of 2-10 group numbers or a range of group numbers. In case of range first and last element of the range shall be given.

Defined group TETRA identity element is a repeatable element that shall appear and shall be interpreted as indicated by defined group number type element. There shall be at least one defined group TETRA identity in a DEFINE primitive. Defined group TETRA identity element shall always have address type as first partial element. Address type shall be followed by SNA or SSI. Address extension shall always follow SSI, if address extension is used. Omitted address extension shall imply that the address extension shall be the address extension of authorized user. SNA, if used, shall refer to a SNA defined for authorized user.

It is required that result for definition apply for all group numbers given as defined group TETRA identity. If the result for definition element would be different, FE3 shall deliver separate DEFINE-ACK primitives to application.

Table 2: DEFINE-ACK confirm contents

Element	C/O/M	Remark
SS type	M	:= SS-LE
LE Message type	M	: = DEFINE
Defined group number type	M	
Defined group TETRA identity	M	Repeatable
Address type identifier	M	
Short Number Address	C	
Short Subscriber Identity	C	
Address extension	C	
Result for definition	M	

5.1.1.4 INFORM1 indication

INFORM1 indication primitive shall be offered from FE1 to application over TNSS-SAP. The primitive shall contain the SS-LE information elements listed in table 3.

Table 3: INFORM1 indication contents

Element	C/O/M	Remark
SS type	M	:= SS-LE
LE Message type	M	:= INFORM1
Called group number	M	
Call identifier	M	
SS-LE Indication	M	LE Broadcast

5.1.1.5 INFORM2 indication

INFORM2 indication primitive shall be offered from FE1 to application over TNSS-SAP. The primitive shall contain the SS-LE information elements listed in table 4. The SS-LE indication of type LE acknowledgement shall imply, that application shall send INFORM2-ACK, if it participates in the call.

Table 4: INFORM2 indication contents

Element	C/O/M	Remark
SS type	M	:= SS-LE
LE Message type	M	:= INFORM2
Called group number	M	
Call identifier	M	
SS-LE Indication	M	LE acknowledgement

5.1.1.6 INFORM2-ACK confirm

INFORM2-ACK confirm primitive shall be offered from application to FE1 over TNSS-SAP. Application shall send the primitive only if the subscriber joins the call.

Application should discard any other LE acknowledgement requests to the same call item:

- while it is making the response to the received LE acknowledgement request; and

- after sending the LE acknowledgement response for the same call item.

However, if the subscriber receives another LE acknowledgement indication after leaving the call and if the user participates in the group call again, application shall send a new LE acknowledgement response.

If the subscriber leaves the acknowledged call, e.g. due to another call, the application can send a U-RELEASE information flow to SwMI to indicate that the user leaves the call. Thus, U-RELEASE can be sent within a group call to indicate a "negative" acknowledgement in case of LE acknowledgement, which the user has acknowledged in that call item. The sending of U-RELEASE should also release the call in the MS.

If LE paging is changed to LE acknowledgement within a call item and if the application has sent LE paging response for that call, the sent LE paging response shall be considered also as LE acknowledgement.

In case of LE acknowledgement, the acknowledgement shall be sent in the allocated traffic channel, if any. If the traffic channel is allocated for the call, the application shall send INFORM2-ACK to FE1 after the MS has moved to the traffic channel.

The primitive shall contain the SS-LE information elements listed in table 5.

Table 5: INFORM2-ACK confirm contents

Element	C/O/M	Remark
SS type	M	:= SS-LE
LE message type	M	:= INFORM2
Called group number	M	
Call identifier	M	
Subscriber number	M	

5.1.1.7 INFORM3 indication

INFORM3 indication primitive shall be offered from FE1 to application over TNSS-SAP. The primitive shall contain the SS-LE information elements listed in table 6. The SS-LE indication of type LE paging shall imply, that application shall send INFORM3-ACK, if the subscriber wishes to participate in the call.

Table 6: INFORM3 indication contents

Element	C/O/M	Remark
SS type	M	:= SS-LE
LE Message type	M	:= INFORM3
Called group number	M	
Call identifier	M	
SS-LE Indication	M	LE paging

5.1.1.8 INFORM3-ACK response

INFORM3-ACK response primitive shall be offered from application to FE1 over TNSS-SAP. The application shall send the primitive only if the subscriber wishes to join the call. The primitive shall contain the SS-LE information elements listed in table 7.

Application should discard any other LE paging requests to the same call item while it is making the response to the received LE paging request or while it is waiting for an INFORM1 or INFORM2 information flow after sending the LE paging response.

Table 7: INFORM3-ACK response contents

Element	C/O/M	Remark
SS type	M	:= SS-LE
LE Message type	M	:= INFORM3
Called group number	M	
Call identifier	M	

5.1.1.9 INTERROGATE request

INTERROGATE request primitive shall be offered from application to FE3 over TNSS-SAP. The primitive shall contain the SS-LE information elements listed in table 8. The interrogation shall be requested to all given group numbers.

Interrogated group number type shall indicate the number of interrogated group TETRA identity elements, that shall follow the element. The element shall also indicate whether the following interrogated group TETRA identity elements shall be interpreted as one group number, a list of 2-10 group numbers or a range of group numbers. In case of range first and last element of the range shall be given.

Interrogated group TETRA identity element is a repeatable element that shall appear and shall be interpreted as indicated by interrogated group number type element. There shall be at least one interrogated group TETRA identity in a INTERROGATE primitive. Interrogated group TETRA identity element shall always have address type as first partial element. Address type shall be followed by SNA or SSI. Address extension shall always follow SSI, if address extension is used. Omitted address extension shall imply that the address extension shall be the address extension of authorized user. SNA, if used, shall refer to a SNA defined for authorized user.

Table 8: INTERROGATE request contents

Element	C/O/M	Remark
SS type	M	:= SS-LE
LE message type	M	:= INTERROGATE
Interrogated group number type	M	
Interrogated group TETRA identity	M	Repeatable
Address type identifier	M	
Short Number Address	C	
Short Subscriber Identity	C	
Address extension	C	

5.1.1.10 INTERROGATE-ACK confirm

INTERROGATE-ACK confirm primitive shall be offered from FE3 to application over TNSS-SAP. The primitive shall contain the SS-LE information elements listed in table 9.

Interrogated group number type shall indicate the number of interrogated group TETRA identity elements, that shall follow the element. The element shall also indicate whether the following interrogated group TETRA identity elements shall be interpreted as one group number, a list of 2-10 group numbers or a range of group numbers. In case of range first and last element of the range shall be given.

Interrogated group TETRA identity element is a repeatable element that shall appear and shall be interpreted as indicated by interrogated group number type element. There shall be at least one interrogated group TETRA identity in a INTERROGATE primitive. Interrogated group TETRA identity element shall always have address type as first partial element. Address type shall be followed by SNA or SSI. Address extension shall always follow SSI, if address extension is used. Omitted address extension shall imply that the address extension shall be the address extension of authorized user. SNA, if used, shall refer to a SNA defined for authorized user.

It is required that result for interrogation and any following elements in the primitive apply for all group numbers given as interrogated group TETRA identity. If the elements would be different, FE3 shall deliver separate INTERROGATE-ACK primitives to application.

Table 9: INTERROGATE-ACK confirm contents

Element	C/O/M	Remark
SS type	M	:= SS-LE
LE message type	M	:= INTERROGATE
Interrogated group number type	M	
Interrogated group TETRA identity	M	Repeatable
Address type identifier	M	
Short Number Address	C	
Short Subscriber Identity	C	
Address extension	C	
Result for interrogation	M	note 1
LE type	O	
LE used over ISI	O	note 2
Basic service type	O	
Repetition rate	O	
NOTE 1: If the interrogation request failed, the reason is specified here.		
NOTE 2: The element should indicate if SS-LE should or should not be invoked over the ISI.		

5.1.2 Parameter description

Address Extension =

   Mobile Country Code (MCC) + Mobile Network Code (MNC).
   See ETS 300 392-1 [4] clause 7.

Address type Identifier =

   0   Short Number address (SNA)
   1   Short Subscriber Identity (SSI)
   2   TETRA Subscriber Identity (TSI = SSI + Address Extension)
        See ETS 300 392-1 [4] clause 7.

Call identifier, see ETS 300 392-2 [2], subclause 14.

Basic service type =

   0   Multipoint circuit mode speech call
   1   Multipoint circuit mode data call

Defined group number type =

   0   subscriber number, 1 subscriber number following of any allowed type
   1   range of numbers, 2 subscriber numbers following of any allowed type
   2   list of subscriber numbers, 2-10 subscriber numbers following of any allowed type

Defined group TETRA identity, shall be any of the following:

   -    Address type identifier + Short Number Address (SNA)
   -    Address type identifier + Short Subscriber Identity (SSI)
   -    Address type identifier + Short Subscriber Identity (SSI) + Address extension
        See ETS 300 392-1 [4] clause 7.

Called group number = TETRA subscriber identity (TSI).

LE used over ISI =

   0   applied over ISI
   1   not applied over ISI

LE type =

    0   LE paging
    1   No LE paging

Interrogated group number type, as defined group number type.

Interrogated group TETRA identity, as defined group TETRA identity.

Repetition rate =

    0   any rate
    1   low
    2   normal
    3   high

Result for definition =

    0   accepted
    1   rejected for any reason
    2   user not Authorized
    3   unknown TETRA identity
    4   parameters not valid
    5   insufficient information
    6   invalid basic service

Result for interrogation, as Result for definition.

Short Number Address (SNA), see ETS 300 392-1 [4] clause 7.

Short Subscriber Identity (SSI), see ETS 300 392-1 [4] clause 7.

SS-LE Indication =

    0   LE broadcast
    1   LE acknowledgement
    2   LE paging

5.1.3 Mapping of SS-LE primitives to TNSS primitives

Table 10 shows the mapping of the SS-LE primitives to TNSS primitives.

Table 10: Mapping of the SS-LE primitives to TNSS primitives

SS-LE primitive	TNSS-SERVICE request	TNSS-SERVICE confirm	TNSS-SERVICE indication	TNSS-SERVICE response	TNSS-INFO indication	TNSS-ERROR indication	Remark
DEFINE	in FE3	-		-	-	-	
DEFINE-ACK	-	with successful definition in FE3		-	-	with unsuccessful definition in FE3	note 1
INFORM1					in FE1		
INFORM2			in FE1				
INFORM2-ACK				in FE1			note 2
INFORM3			in FE1				
INFORM3-ACK				in FE1			note 2
INTERROGATE	in FE3/FE1	-		-	-	-	
INTERROGATE-ACK	-	with successful interrogation in FE3/FE1		-		with unsuccessful interrogation in FE3/FE1	note 3
NOTE 1:	For this purpose the definition is considered successful if the value for "Result for definition" is "accepted".						
NOTE 2:	Application shall return the INFORM2-ACK/INFORM3-ACK to FE1 only if the subscriber shall join or request to join the ongoing call.						
NOTE 3:	For this purpose the interrogation is considered successful if the value for "Result for interrogation" is "accepted".						

5.2 SS-LE protocol states

5.2.1 Protocol states of FE1

5.2.1.1 State IDLE

IDLE shall be the normal state of FE1. In this state FE1 shall receive all the SS-LE indications related to an ongoing call. FE1 shall send the SS-LE indications to the application. FE1 shall receive the responses to LE acknowledgement and to LE paging, in state IDLE, too. FE1 shall send the received responses to FE2.

The behaviour of FE1 and application collocated to FE1 is described in:

annex A: Reception of SS-LE broadcast indications in MS/LS in Layer 3;
annex B: Reception of SS-LE acknowledgement indications in MS/LS in Layer 3;
annex C: Reception of SS-LE paging indications in MS/LS in Layer 3.

5.2.2 Protocol states of FE2

5.2.2.1 State IDLE

IDLE should be the normal state of FE2. In this state FE2 should receive the definition and interrogation requests from FE3. FE2 should verify the received definition or interrogation requests. If FE2 accepts the interrogation request, FE2 should fetch the interrogated data and sends it to FE3. If FE2 accepts the definition requests, FE2 should save the new definition data to the database, start the sending of SS-LE messages (INFORM1, INFORM2 or INFORM3) if the group call in ongoing and FE2 should acknowledge the service request to FE3.

FE2 should receive call invocation messages in order to invoke the SS-LE, if defined for the call. At the reception of call invocation FE2 should determine the used SS-LE type and invoke the SS-LE if the service is defined for the group. After that, FE2 should move to the state SS-LE ACTIVE.

5.2.2.2   State SS-LE ACTIVE

SS-LE ACTIVE should be the state in which FE2 should start the sending of SS-LE invocations and the sending should be ongoing. In state SS-LE ACTIVE FE2 sends the SS-LE indications:

-        in case of LE broadcast, FE2 should send INFORM1 information flows;
-        in case of LE acknowledgement, FE2 should send INFORM2 information flows;
-        in case of LE paging, FE2 should send INFORM2 information flows.

If the SS-LE should be invoked in another TETRA system(s) over ISI, FE2 should send the INFORM4 messages to the TETRA system(s).

After sending the SS-LE indications, FE2 should set the timer T1. The timer is set with a value corresponding to low, normal or high, as defined for the group. Each time when the timer T1 expires, FE2 should send new SS-LE indications.

At the reception of LE acknowledgement or LE paging responses from FE1s, FE2 notifies these responses. In the case of LE paging response, FE2 should change the SS-LE type to LE broadcast or LE acknowledgement in that area.

At the reception of call release indication, FE2 should stop the service and the sending of all SS-LE indications related to the call.

5.2.3   Protocol states of FE3 (authorized user)

5.2.3.1   State IDLE

IDLE shall be the normal state of FE3. In this state FE3 shall receive the definition or interrogation requests from the user. FE3 shall verify the requests and if it accepts them, FE3 shall send them to FE2. In IDLE state FE3 shall also receive the acknowledgements and responses for the definition or interrogation requests. At the reception of these information flows, FE3 shall send them to the application.

5.2.4   Protocol states of FE4

5.2.4.1   State IDLE

IDLE should be the normal state of FE4. In this state FE4 should receive the information flows from FE3 or FE1 to be delivered to FE2 in another system. And, FE4 should also receive the information flows from FE2 to be delivered to FE1 or FE3 located in this system.

At the reception of SS-LE invocations (INFORM4s) from another system, FE4 should determine the LE type to be applied, send the correct SS-LE invocations and move to SS-LE ACTIVE state.

5.2.4.2   State SS-LE ACTIVE

SS-LE ACTIVE should be the state in which FE4 should start the sending of SS-LE invocations and the sending should be ongoing. In state SS-LE ACTIVE FE4 should send the SS-LE indications:

-        in case of LE broadcast, FE4 should send INFORM1 information flows;
-        in case of LE acknowledgement, FE4 should send INFORM2 information flows;
-        in case of LE paging, FE4 should send INFORM2 information flows.

After sending the SS-LE indications, FE4 should set the timer T1. The timer should be set with a value corresponding to low, normal or high, as defined for the group if defined. Each time when the timer T1 expires, FE4 should send new SS-LE indications.

At the reception of LE acknowledgement or LE paging responses from FE1s, FE4 should notify these responses. In the case of acknowledged group call, FE4 should send the acknowledgements to system 1. In the case of LE paging response, FE4 should change the SS-LE type to LE broadcast or LE acknowledgement in that area.

At the reception of call release indication, FE4 should stop the service and the sending of all SS-LE indications related to the call.

5.3 Procedures

5.3.1 Procedures for FE1

5.3.1.1 Verification in FE1

At the reception of SS-LE INFORM1, INFORM2 or INFORM3 request, FE1 shall inform application about the received LE indication. In case of LE acknowledgement or LE paging FE1 shall send INFORM2-ACK /INFORM3-ACK to FE2 if the application indicates that the subscriber joins (LE acknowledgement) or wishes to join (LE paging) the ongoing call.

5.3.2 Procedures for FE2

5.3.2.1 Verification in FE2 (for definition)

At the reception of SS-LE DEFINE request, FE2 should verify that the request is authorized and that the parameters are in the correct range. The parameters should correspond to the FACILITY element definitions given in subclause 5.5. After making the checks, FE2 should either continue to carry out the request, or FE2 should reject it.

The SNA should refer to authorized user's SNA definitions, if applied. FE2 should replace the SNA in the definition saved to database in SwMI by the complete TETRA subscriber identity, GSSI. If applied in definition, the SNA should be defined for the authorized user, if not, FE2 should not accept it.

If address extension is not applied with SSI, that should imply that the address extension should be the address extension of authorized user. FE2 should save the definition to the database in SwMI by using the complete TETRA subscriber identity, GSSI.

If the definition is requested for a group number range or a list of group numbers, the "Result for definition" can be different for different subscriber numbers. In that case, FE2 should send separate acknowledgements (FACILITY elements) to FE3. If e.g. the user has requested the definition for a list of two group numbers, and the request is accepted for one group number but the request is rejected for the other, FE2 should send two separate acknowledgements back to FE3. See annex D for examples.

5.3.2.2 Verification in FE2 (for interrogation)

At the reception of SS-LE INTERROGATE request, FE2 should verify that the request is authorized and that the parameters are in the correct range. The parameters should correspond to the FACILITY ELEMENT definitions given in subclause 5.5. After making the checks, FE2 should either continue to carry out the request, or FE2 should reject it.

The SNA should refer to authorized user's SNA definitions, if applied. If applied in interrogation, the SNA should be defined for the authorized user, if not, FE2 should not accept it.

If address extension is not applied with SSI, that should imply that the address extension should be the address extension of authorized user.

If FE2 should prepare and send an interrogation request for authorized user. See annex D for example of INTERROGATE-ACK.

If the user has interrogated the SS-LE for a subscriber number range or list, and if any of the parameters listed below are different for any of these numbers, FE2 should send separate INTERROGATE-ACKs to FE3. The parameters that should cause separate INTERROGATE-ACKs, if the values are different:

- result for interrogation;
- LE type;
- LE used over ISI;
- basic service type;
- repetition rate.

5.3.2.3 Save to database in FE2

When DEFINE request is accepted, FE2 should save the changes to database.

5.3.2.4 Record ack in FE2

When any FE1 acknowledges the SS-LE acknowledgement request, FE2 should save the information until the call is released or the situation for the subscriber has changed.

NOTE: System specific implementations may be used to indicate the received acknowledgements to a pre-defined user or calling party with D-INFO information flow.

5.3.3 Procedures for FE3

5.3.3.1 Verification in FE3

At the reception of SS-LE DEFINE and INTERROGATE request from application, FE3 may verify that the parameters are correct. After making the checks, FE1 shall either continue to carry out the request, or FE3 shall reject it.

FE3 shall construct the SS-LE definition (DEFINE) FACILITY element according to the user's request. The definition can be made to:

- one group number;
- a list of group numbers;
- a range of group numbers.

The SS-LE can be defined differently for different basic services: The SS-LE can be defined to be different for multipoint circuit mode speech calls and multipoint circuit mode data calls.

See annex D for an example of DEFINE FACILITY element contents.

The SNA should refer to authorized user's SNA definitions, if applied. The SSI without address extension should imply that the address extension is equal to the address extension of authorized user.

FE3 shall construct the SS-AP interrogation (INTERROGATE) FACILITY element for authorized user according to the user's request. The user can interrogate the defined SS-LE of:

- one group number;
- a list of group numbers;
- a range of group numbers.

5.3.4 Procedures for FE4

5.3.4.1 Routeing address in FE4

At the reception of any information flow to be routed over ISI to another TETRA system, FE4 should add the routeing address to the request; at the reception of any information flow received over ISI from another TETRA system, FE4 should add the routeing address to request and address the SS-LE information flow with a valid group address in that system.

5.4 Protocol timers

5.4.1 Protocol timers for FE2 and FE4

5.4.1.1 Protocol timer T1

FE2 and FE4 should use timer T1 to supervise the repetition rate for sending SS-LE indications to FE1s (user Bs).

5.5 PDU Descriptions

The SS-FACILITY element which shall be used to convey the supplementary service information to and from MS/LS and over the ISI can be transported in any call control PDU if inside a call or in a D-FACILITY or U-FACILITY PDU if the information is call-unrelated. Nevertheless, INFORM1, INFORM2 and INFORM3 information flows shall always be conveyed by the D-SETUP PDU. The element coding used is in accordance with the general rules specified in ETS 300 392-2 [2], clause 14.

The specific SS-FACILITY element coding (independently of bearer PDU) for SS-LE is detailed in the following clauses.

The information contained in the following argument description tables correspond to the following key:

Length: length of the sub-argument in bits;
type: element type (1, 2 or 3) described in ETS 300 392-2 [2];
C/O/M: conditional/optional/mandatory;
Remark: comment;

5.5.1 DEFINE request

DEFINE information flow shall be offered from FE3 to FE2 and to FE4. The flow shall be offered to FE4 only if FE3 is in TETRA system 2.

>   NOTE: If the acknowledgements are different for different "defined subscriber numbers" FE2 shall send several DEFINE-ACKs to FE3.

DEFINE shall contain the SS-LE information described in table 11.

Table 11: DEFINE PDU contents

Element	Length	type	C/O/M	Value	Remark
SS-type	6	1	M		:= LE := 011000_2
Action type	4	1	M		:= Definition := 0011_2
Defined subscriber type	4	1	M		
Defined party type identifier	2	1	M		Repeatable
Defined party short number	8	1	C		Repeatable, note 1
Defined party SSI	24	1	C		Repeatable, note 1
Defined party extension	24	1	C		Repeatable, note 1
LE type	1	1	O		
LE used over ISI	1	2	O		
Basic service type	1	2	O		note 2
Repetition rate	2	2	O		
NOTE 1: Shall be conditional on the value of Defined Party Type Identifier (DPTI). DPTI = 0; defined Party SNA. DPTI = 1; defined Party SSI. DPTI = 2; defined Party SSI + defined Party Extension. At least one defined party shall be given.					
NOTE 2: Default shall be multipoint circuit mode speech and data calls. The default value shall be used if the element is omitted.					

5.5.2 DEFINE-ACK

DEFINE-ACK information flow shall be offered from FE2 to FE3 and to FE4. The flow shall be offered to FE4 only if FE3 is in TETRA system 2.

DEFINE-ACK shall contain the SS-LE information described in table 12.

Table 12: DEFINE-ACK PDU contents

Element	Length	Type	C/O/M	Value	Remark
SS-type	6	1	M		:= LE := 011000_2
Action type	4	1	M		:= Definition := 0011_2
Defined subscriber type	4	1	M		
Defined party type identifier	2	1	M		Repeatable
Defined party short number	8	1	C		Repeatable, note 1
Defined party SSI	24	1	C		Repeatable, note 1
Defined party extension	24	1	C		Repeatable, note 1
Result for definition	3	1	M		
NOTE 1: Shall be conditional on the value of Defined Party Type Identifier (DPTI).					
DPTI = 0; defined Party SNA.					
DPTI = 1; defined Party SSI.					
DPTI = 2; defined Party SSI + defined Party Extension.					
At least one defined party shall be given.					

5.5.3 INFORM1

INFORM1 information flow shall be offered from FE2/FE4 to FE1. INFORM1 shall contain the SS-LE information described in table 13.

Table 13: D-SETUP PDU contents

Information element	Length	Type	C/O/M	Value	Remark
PDU type					note
Call identifier					note
Call time-out					note
Hook method selection					note
Simplex/duplex selection					note
Basic service information					note
Transmission grant					note
Transmission request permission					note
Call priority					note
Notification indicator	6	2	O	000000_2	LE broadcast
Temporary address					note
Calling party type identifier					note
Calling party address SSI					note
Calling party extension					note
External subscriber number					note
Facility					note
Proprietary					note
NOTE : See ETS 300 392-2 [2], clause 14.					

5.5.4 INFORM2

INFORM2 information flow shall be offered from FE2/FE4 to FE1. INFORM2 shall contain the SS-LE information described in table 14.

Table 14: INFORM2 PDU contents

Information element	Length	Type	C/O/M	Value	Remark
PDU type					note
Call identifier					note
Call time-out					note
Hook method selection					note
Simplex/duplex selection					note
Basic service information					note
Transmission grant					note
Transmission request permission					note
Call priority					note
Notification indicator	6	2	O	000001_2	LE acknowledgement
Temporary address					note
Calling party type identifier					note
Calling party address SSI					note
Calling party extension					note
External subscriber number					note
Facility					note
Proprietary					note
NOTE: See ETS 300 392-2 [2], clause 14.					

5.5.5 INFORM2-ACK

INFORM2-ACK information flow shall be offered from FE1 to FE2 and to FE4. The flow shall be sent by FE1 to indicate that MS/LS participates the call.

INFORM2-ACK shall be sent in the traffic channel allocated for the call, if the traffic channel is allocated.

FE2 shall send only once the LE acknowledgement response (INFORM2-ACK) for one call item. However, if FE1 leaves the call a new LE acknowledgement response shall be sent if requested. If LE paging is changed to LE acknowledgement, the LE paging response replaces the LE acknowledgement response for the subscriber.

INFORM2-ACK shall contain the SS-LE information described in table 15.

Table 15: INFORM2-ACK PDU contents

Element	Length	Type	C/O/M	Value	Remark
SS-type	6	1	M		:= LE := 011000_2
Action type	4	1	M		:= Operation := 1001_2
LE type	1	1	M	0	LE acknowledgement
Call identifier	14	1	M		

5.5.6   INFORM3

INFORM3 information flow shall be offered from FE2/FE4 to FE1. INFORM3 shall contain the SS-LE information described in table 16.

Table 16: INFORM3 PDU contents

Information element	Length	Type	C/O/M	Value	Remark
PDU type					note 1
Call identifier					note 1
Call time-out					note 1
Hook method selection					note 1
Simplex/duplex selection					note 1
Basic service information					note 1, note 2
Transmission grant					note 1
Transmission request permission					note 1
Call priority					note 1
Notification indicator	6	2	O	000010_2	LE paging
Temporary address					note 1
Calling party type identifier					note 1
Calling party address SSI					note 1
Calling party extension					note 1
External subscriber number					note 1
Facility					note 1
Proprietary					note 1
NOTE 1: See ETS 300 392-2 [2], clause 14.					
NOTE 2: The communication type in basic service information element can be: point-to-multipoint, point-to-multipoint acknowledged or broadcast.					

5.5.7   INFORM3-ACK

INFORM3-ACK information flow shall be offered from FE1 to FE2 and to FE4. The flow shall be sent by FE1 to indicate that a subscriber (MS/LS) requests for the participation of the call.

INFORM3-ACK shall contain the SS-LE information described in table 17.

Table 17: INFORM3-ACK PDU contents

Element	Length	Type	C/O/M	Value	Remark
SS-type	6	1	M		:= LE := 011000_2
Action type	4	1	M		:= Operation := 1001_2
LE type	1	1	M	1	LE paging
Call identifier	14	1	M		

5.5.8 INFORM4

INFORM4 information flow shall be offered from FE2 to FE4. The flow shall be offered from FE2 to FE4 to indicate that SS-LE should be invoked for the call in TETRA system 2.

INFORM4 shall contain the SS-LE information described in table 18.

Table 18: INFORM4 PDU contents

Information element	Length	Type	C/O/M	Value	Remark
PDU type					note 1
Call identifier					note 1
Call time-out					note 1
Hook method selection					note 1
Simplex/duplex selection					note 1
Basic service information					note 1
Transmission grant					note 1
Transmission request permission					note 1
Call priority					note 1
Notification indicator	6	2	O		note 2
Temporary address					note 1
Calling party type identifier					note 1
Calling party address SSI					note 1
Calling party extension					note 1
External subscriber number					note 1
Facility					note 1
Proprietary					note 1
NOTE 1: See ETS 300 392-2 [2], clause 14.					
NOTE 2: LE broadcast, LE acknowledgement and LE paging can be used to indicate that SS-LE should be invoked in TETRA system 2.					

5.5.9 INTERROGATE

INTERROGATE information flow shall be offered from FE3 to FE2, possibly via FE4. INTERROGATE shall contain the SS-LE information described in table 19.

Table 19: INTERROGATE PDU contents

Element	Length	Type	C/O/M	Value	Remark
SS-type	6	1	M		:= LE := 011000_2
Action type	4	1	M		:= Interrogation := 0101_2
Interrogated subscriber type	4	1	M		
Interrogated party type identifier	2	1	M		Repeatable
Interrogated party short number	8	1	C		Repeatable, note
Interrogated party SSI	24	1	C		Repeatable, note
Interrogated party extension	24	1	C		Repeatable, note
NOTE: Shall be conditional on the value of Interrogated Party Type Identifier (IPTI). IPTI = 0; Interrogated Party SNA. IPTI = 1; Interrogated Party SSI. IPTI = 2; Interrogated Party SSI + Interrogated Party Extension. At least one Interrogated party shall be given.					

5.5.10 INTERROGATE-ACK

INTERROGATE-ACK information flow shall be offered from FE2 to FE3, possibly via FE4.

> NOTE: If definitions/responses are different for different "Interrogated subscriber numbers" FE2 shall send several INTERROGATE-ACKs to FE3.

INTERROGATE-ACK shall contain the SS-LE information described in table 20.

Table 20: INTERROGATE-ACK PDU contents

Element	Length	Type	C/O/M	Value	Remark
SS-type	6	1	M		:= LE := 011000_2
Action type	4	1	M		:= Interrogation := 0101_2
Interrogated subscriber type	4	1	M		
Interrogated party type identifier	2	1	M		Repeatable
Interrogated party short number	8	1	C		Repeatable, note 1
Interrogated party SSI	24	1	C		Repeatable, note 1
Interrogated party extension	24	1	C		Repeatable, note 1
Result for interrogation	3	1	M		
LE type	1	1	O		note 2
LE used over ISI	1	2	O		
Basic service type	1	2	O		note 3
Repetition rate	2	2	O		note 3
NOTE 1: Shall be conditional on the value of Interrogated Party Type Identifier (IPTI). IPTI = 1; Interrogated Party SSI. IPTI = 2; Interrogated Party SSI + Interrogated Party Extension. At least one Interrogated party shall be given.					
NOTE 2: The field appears only if the "Result for interrogation" has the value "accepted".					
NOTE 3: If the user defined different LE types for different basic service types FE2 shall duplicate the fields Basic service type and repetition rate. The repetition rate shall follow immediately the Basic service(s) it defines.					

5.5.11 Element coding

5.5.11.1 Action type

Action type shall indicate the type of the action as described in table 21. With SS-LE only Definition, Operation and Interrogation shall be used.

Table 21: Action type contents

Element	Length	Value	Remark
Action type	4	0000_2	SS-Service not supported
		0001_2	Activation
		0010_2	Deactivation
		0011_2	Definition
		0100_2	Registration
		0101_2	Interrogation
		0110_2	Cancellation
		0111_2	Invocation
		1000_2	Information
		1001_2	Operation
		1010_2	Reserved
		...	etc.
		1111_2	Reserved

5.5.11.2 Basic service type

Basic service type shall indicate to which the SS-LE shall be applied. Table 22 describes the element Basic service type.

Default shall be multipoint circuit mode speech and data calls. The default value shall apply if the element is omitted.

Table 22: Basic service type contents

Element	Length	Value	Remark
Basic service type	1	0	Multipoint circuit mode speech call
		1	Multipoint circuit mode data call

5.5.11.3 Called party GTSI

Called party GTSI shall specify the TETRA subscriber identity, GTSI, of the ongoing group call to which SS-LE is invoked. Table 23 describes the element Called party GTSI.

Table 23: Called party GTSI contents

Element	Length	Value	Remark
Short subscriber identity (SSI)	24		See ETS 300 392-1 [4] clause 7.
Country code	10		See ETS 300 392-1 [4] clause 7.
Network code	14		See ETS 300 392-1 [4] clause 7.

5.5.11.4 Defined party extension

The purpose of the defined Party Extension element shall be to indicate to the SwMI the extended part of the TSI address of the defined user. The element is described in table 24.

Table 24: Defined party extension element contents

Element	Length	Value	Remark
Country Code	10		See ETS 300 392-1 [11] clause 7.
Network Code	14		See ETS 300 392-1 [11] clause 7.

5.5.11.5 Defined party SNA

The purpose of the defined party SNA element shall be to indicate to the SwMI the SNA of the defined user. The SNA shall refer to a short number defined for the FE3, that requested the SS-LE definition or interrogation. The element is described in table 25.

Table 25: Defined party SNA element contents

Element	Length	Value	Remark
Defined Party Short Number Address	8	$0\text{-}255_{10}$	See ETS 300 392-1 [11] clause 7.

5.5.11.6 Defined party SSI

The purpose of the defined party SSI element shall be to indicate to the SwMI the SSI address of the defined user. The element is described in table 26.

Table 26: Defined party SSI element contents

Element	Length	Value	Remark
Short subscriber identity	24		See ETS 300 392-1 [11] clause 7.

5.5.12 Defined party type identifier

The purpose of the defined party type identifier element shall be to indicate the type of address which shall follow in the PDU. The element is described in table 27.

Table 27: Defined party type identifier element contents

Element	Length	Value	Remark
Defined Party Type Identifier	2	00_2	Short Number Address (SNA)
		01_2	Short Subscriber Identity (SSI)
		10_2	TETRA Subscriber Identity (TSI)
		11_2	Reserved.

5.5.12.1 Defined subscriber type

Defined subscriber type shall indicate if following subscriber number or numbers shall be one number, range of number or a list of these numbers.

The element shall indicate how many "defined subscriber number" elements shall follow this element. There shall be 1-10 defined subscriber elements and the numbers can be interpreted as a single subscriber number, a list of subscriber numbers or a range of subscriber numbers. In case of range two subscriber number element follow; in case of list up to ten subscriber number elements can follow. The element shall also indicate how the subscriber numbers are interpreted, e.g. if two subsequent numbers shall be considered as a list of two numbers or as a range where the first number is the element in the range and the second element in the last element in the range.

One "defined subscriber number" element shall include all elements of one of the following:

- defined party type identifier and defined party short number (SNA);
- defined party type identifier and defined party SSI;
- defined party type identifier, defined party SSI and defined party extension.

Defined subscriber type element is described in table 28.

Table 28: Defined subscriber type contents

Element	Length	Value	Remarks
Defined subscriber type	4	0000_2	Subscriber number, 1
		0001_2	Range of subscriber numbers, 2
		0010_2	List of subscriber numbers, 2
		0011_2	List of subscriber numbers, 3
		0100_2	List of subscriber numbers, 4
		0101_2	List of subscriber numbers, 5
		0110_2	List of subscriber numbers, 6
		0111_2	List of subscriber numbers, 7
		1000_2	List of subscriber numbers, 8
		1001_2	List of subscriber numbers, 9
		1010_2	List of subscriber numbers, 10
		1011_2	- (not used)
		...	etc.
		1111_2	- (not used)
NOTE:	The number in Remark column indicates how many Subscriber number elements shall be present.		

5.5.12.2 Interrogated party extension

See defined party extension.

5.5.12.3 Interrogated party SNA

See defined party SNA.

5.5.12.4 Interrogated party SSI

See defined party SSI.

5.5.13 Interrogated party type identifier

See defined party type identifier.

5.5.13.1 Interrogated subscriber type

See defined subscriber type.

5.5.13.2 LE type for acknowledgement response

Shall indicate the response type for LE acknowledgement. Table 29 describes the element.

Table 29: LE type for acknowledgement response

Element	Length	Value	Remark
LE type	1	0	LE acknowledgement
		1	LE paging

5.5.13.3 LE type for acknowledgement response

See LE type for Acknowledgement.

5.5.13.4 LE type for definition

LE type for definition shall define the SS-LE type applied for the given group number(s). LE type for definition can have the value LE paging or No LE paging. If the LE type is omitted, FE2 is can choose the applied SS-LE type, e.g. according to the congestion in the system.

If LE paging is defined for a subscriber number, FE2 shall invoke LE paging for the calls invoked to that number. When the Paging response is received, the LE should be changed to LE broadcast or LE acknowledgement depending on the Communication type element in Basic service Information of the ongoing call. If the LE type is "No LE paging" FE2 should invoke the SS-LE depending on the Communication type element in Basic service Information of the ongoing call from the call invocation. Table 30 describes the element LE type.

> NOTE: Any exceptions to the LE type, that is used for a call, are outside the scope of this ETS.

Table 30: LE type

Element	Length	Value	Remark
LE type	1	0	LE paging
		1	No LE paging

5.5.13.5 LE type for interrogation

See LE type for definition.

5.5.13.6 Notification indicator

Notification indicator shall indicate the LE type applied for the call. If the type is LE acknowledgement or LE paging, the type shall imply for a response to FE2 (FE4) from a subscriber that joins or wishes to join the call.

However, in case of a call invocation that is sent over the Inter System Interface to another TETRA system (TETRA system 2), the usage of any SS-LE related notification indicator value, LE broadcast, LE acknowledgement or LE paging, shall imply that SS-LE should be invoked in the receiving TETRA system for the call item. If the Notification indicator does not have any of the three SS-LE related values, SS-LE should not be invoked in the receiving TETRA system for the call. Table 31 describes the element Notification indicator.

> NOTE: Notification indicator having the value SS-LE indication can be applied to the very first D-SETUP PDUs sent for the call. This should be used especially for LE acknowledgement.

Table 31: Notification indicator contents

Element	Length	Value	Remark
Notification indicator	6	000000_2	LE broadcast
		000001_2	LE acknowledgement
		000010_2	LE paging
		000011_2	Not defined in this ETS.
		000100_2	Not defined in this ETS.
		... etc.	... etc.
		111111_2	Not defined in this ETS.

5.5.13.7   Repetition rate

Shall indicates the relative repetition rate according to which the SS-LE indications are sent. Table 32 describes the element Repetition rate.

Table 32: Repetition rate contents

Element	Length	Value	Remark
Repetition rate	2	00_2	any rate
		01_2	low
		10_2	normal
		11_2	high

5.5.13.8   Result for definition

Result for definition shall indicate whether the previously made request was successful or unsuccessful. If the request was unsuccessful, the reason shall be indicated by the element. Table 33 describes the element Result for definition/interrogation.

Table 33: Result for definition contents

Element	Length	Value	Remark
Result for definition	3	000_2	accepted
		001_2	rejected for any reason
		010_2	user not authorized
		011_2	unknown TETRA identity
		100_2	parameters not valid
		101_2	insufficient information
		110_2	invalid basic service(s)
		111_2	- (not used)

5.5.13.9   Result for interrogation

See Result for definition.

6   SS-LE FE behaviour

The figures contained in this clause are intended to illustrate typical SS-LE specific FE behaviour in terms of information flows sent and received.

The behaviour of each FE is shown using the Specification and Description Language (SDL) (see ITU-T Recommendation Z.100 [3]). Notice, however, that due to simplicity there are deviations from syntactical rules.

The convention used in the figures below is that within MS/LS (FE1, FE3 and FE5):

-          primitives are received from or sent to the application and they are represented as output/input signals to the left;

-          PDUs are received from or sent to the SwMI and they are represented as output signals to the right.

6.1 Behaviour of FE1

6.1.1 Service interaction for FE1 (SS entity in user B)

Service interaction for FE1 (SS entity in user B) is show in figure 6.
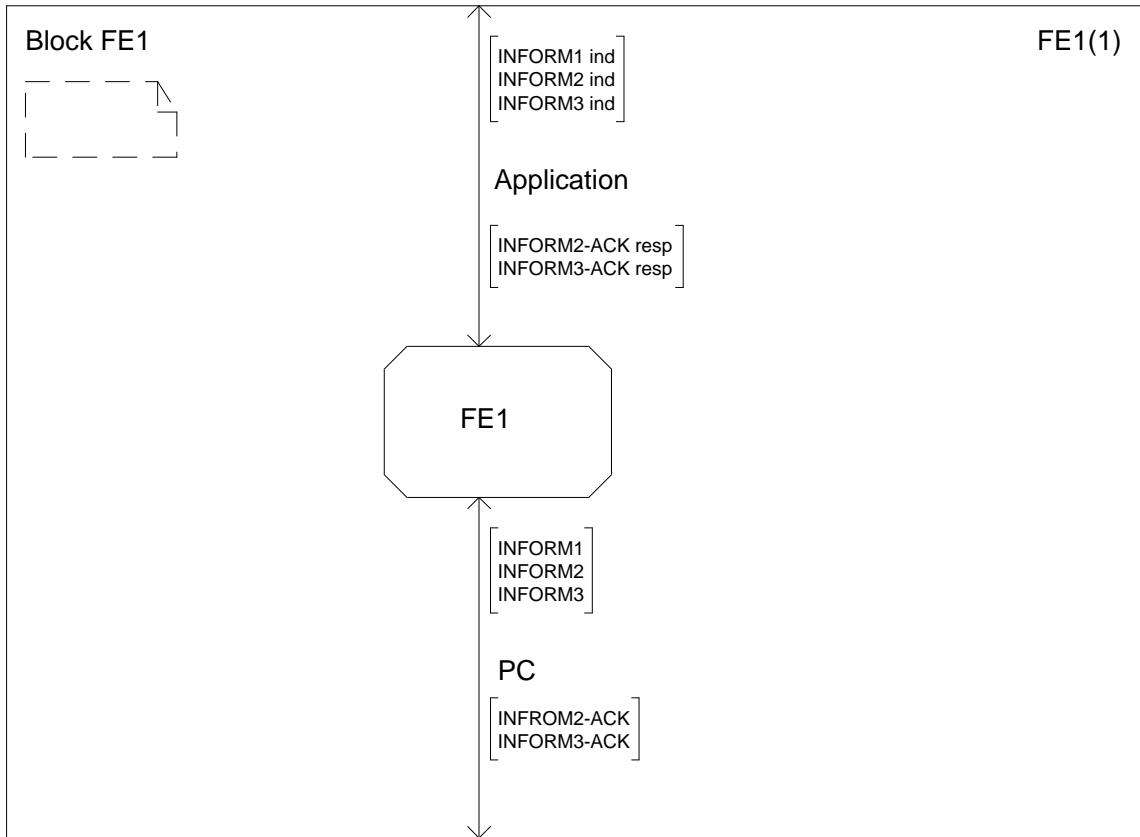
Figure 6: Service interaction for FE1.

6.1.1.1 Process description of FE1 (SS entity in user B)

Process description of FE1 (SS entity in user B) in state IDLE is given in figure 7.
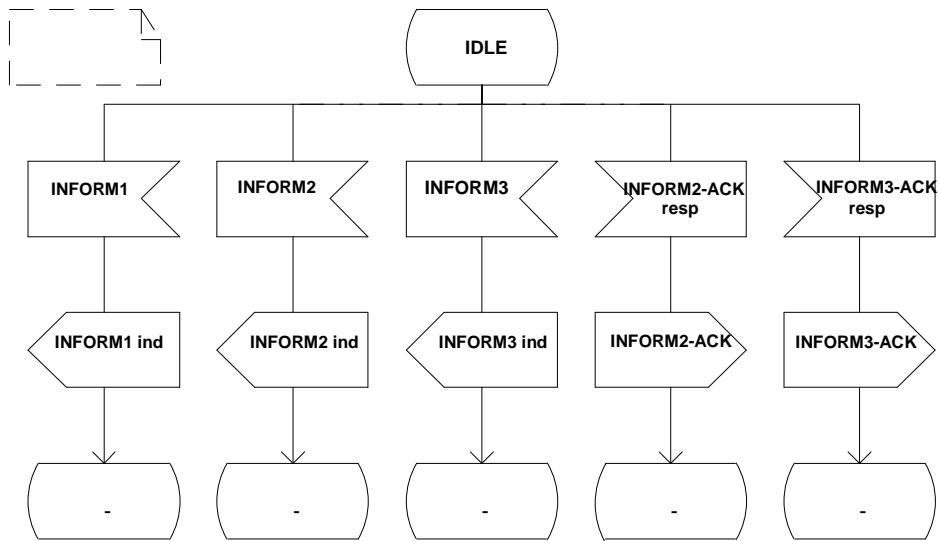
Figure 7: Process description of FE1.

NOTE: Protocol Control (PC) has to duplicate received address type, received TETRA address and Notification indicator from D-SETUP SDU to SS entity (FE1).

6.1.1.2 Service interaction for FE2 (SS entity in SwMI in system 1)

Service interaction for FE2 (SS entity in SwMI in system 1) is shown in figure 8.

Figure 8: Service interaction for FE2.

CC shall send only U-SETUP and U-RELEASE information flows to FE2 when the call is invoked or released.

6.1.1.3 Process description of FE2 (SS entity in SwMI)

Process description of FE2 (SS entity in SwMI) for state IDLE is shown in figure 9.

Figure 9: Process description of state IDLE of FE2.

Process description of FE2 (SS entity in SwMI) for state SS-LE ACTIVE is shown in figure 10.

Figure 10: Process description of state SS-LE ACTIVE of FE2.

6.1.1.4 Service interaction for FE3 (SS entity in authorized user)

Service interaction for FE3 (SS entity in authorized user) is shown in figure 11.

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┌──────────────────────────────────────────────────────────────────┐
│  Block FE3                                    ▲            pAGE1(1)│
│                                          ┌────│─────────┐          │
│   ┌ ─ ─ ─ ┐                              │ DEFINE-ACK con│         │
│   ┌ ─ ─ ─ ┐┐                             │ INTERROGATE-ACK con│    │
│   │       ││                                                       │
│   └ ─ ─ ─ ┘                                  Application          │
│                                                                    │
│                                          ┌────│─────────┐          │
│                                          │ DEFINE req    │         │
│                                          │ INTERROGATE req│        │
│                                              ▼                     │
│                                        ╭──────────╮               │
│                                        │          │               │
│                                        │   FE3    │               │
│                                        │          │               │
│                                        ╰──────────╯               │
│                                              ▲                     │
│                                          ┌───│──────────┐          │
│                                          │ DEFINE-ACK    │         │
│                                          │ INTERROGATE-ACK│        │
│                                                                    │
│                                              PC                    │
│                                                                    │
│                                          ┌───│──────────┐          │
│                                          │ DEFINE        │         │
│                                          │ INTERROGATE   │         │
│                                              ▼                     │
└──────────────────────────────────────────────────────────────────┘
```

Figure 11: Service interaction for FE3.

6.1.1.5   Process description of FE3 (SS entity in authorized user)

Process description of FE3 (SS entity in authorized user) for state IDLE is shown in figure 12.

Figure 12: Process description of FE3

6.1.1.6 Service interaction for FE4 (SS entity in SwMI in system 2)

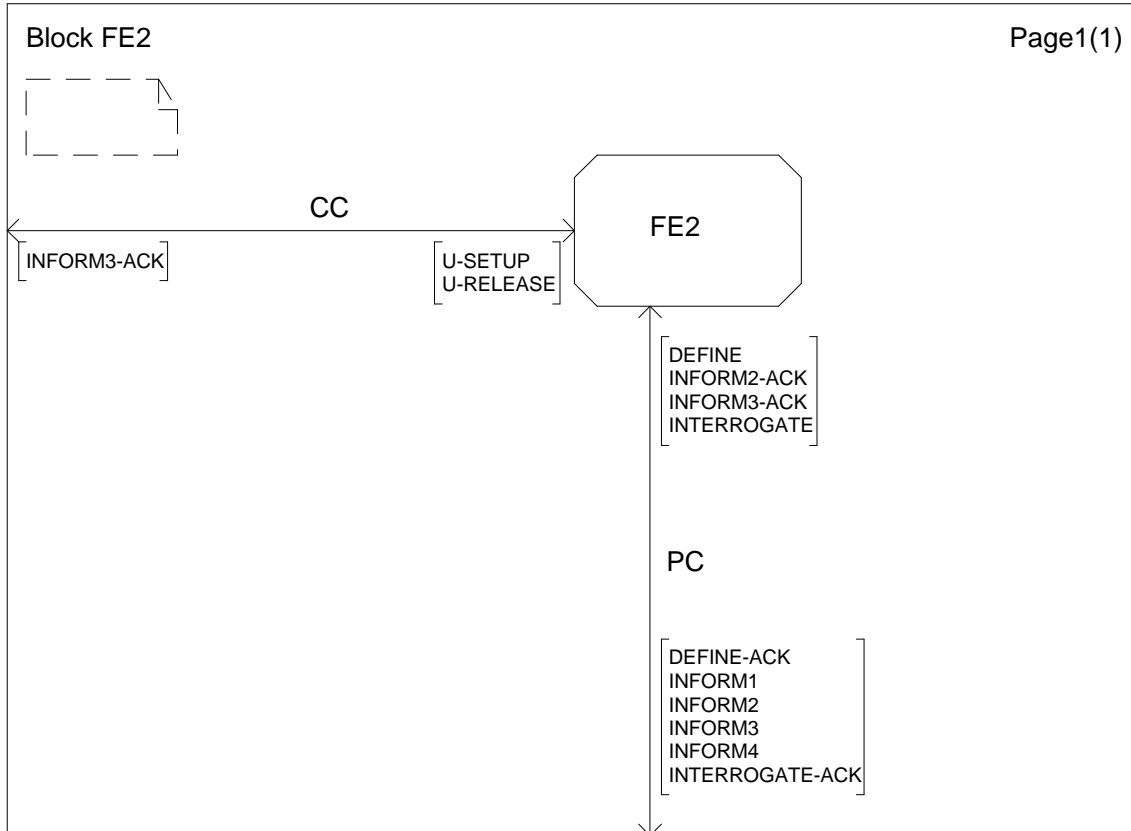Service interaction for FE4 (SS entity in SwMI in system 2) is shown in figure 13.

Block FE4   Page1(1)

```
                                    CC                        ┌────────────┐
                                                             │            │
                                                             │    FE4     │
                                                             │            │
        INFORM3-ACK                      D-RELEASE           └────────────┘
                                                                   │
                                                                   │ DEFINE
                                                                   │ DEFINE-ACK
                                                                   │ INFORM2-ACK
                                                                   │ INFORM3-ACK
                                                                   │ INFORM4
                                                                   │ INTERROGATE
                                                                   │ INTERROGATE-ACK
                                                                   │
                                                                  PC
                                                                   │
                                                                   │ DEFINE
                                                                   │ DEFINE-ACK
                                                                   │ INFORM1
                                                                   │ INFORM2
                                                                   │ INFORM2-ACK
                                                                   │ INFORM3
                                                                   │ INTERROGATE
                                                                   │ INTERROGATE-ACK
```

Figure 13: Service interaction for FE4.

CC shall send only U-SETUP and U-RELEASE information flows to FE4 when the call released.

6.1.1.7   Process description of FE4 (SS entity in SwMI in system 2)

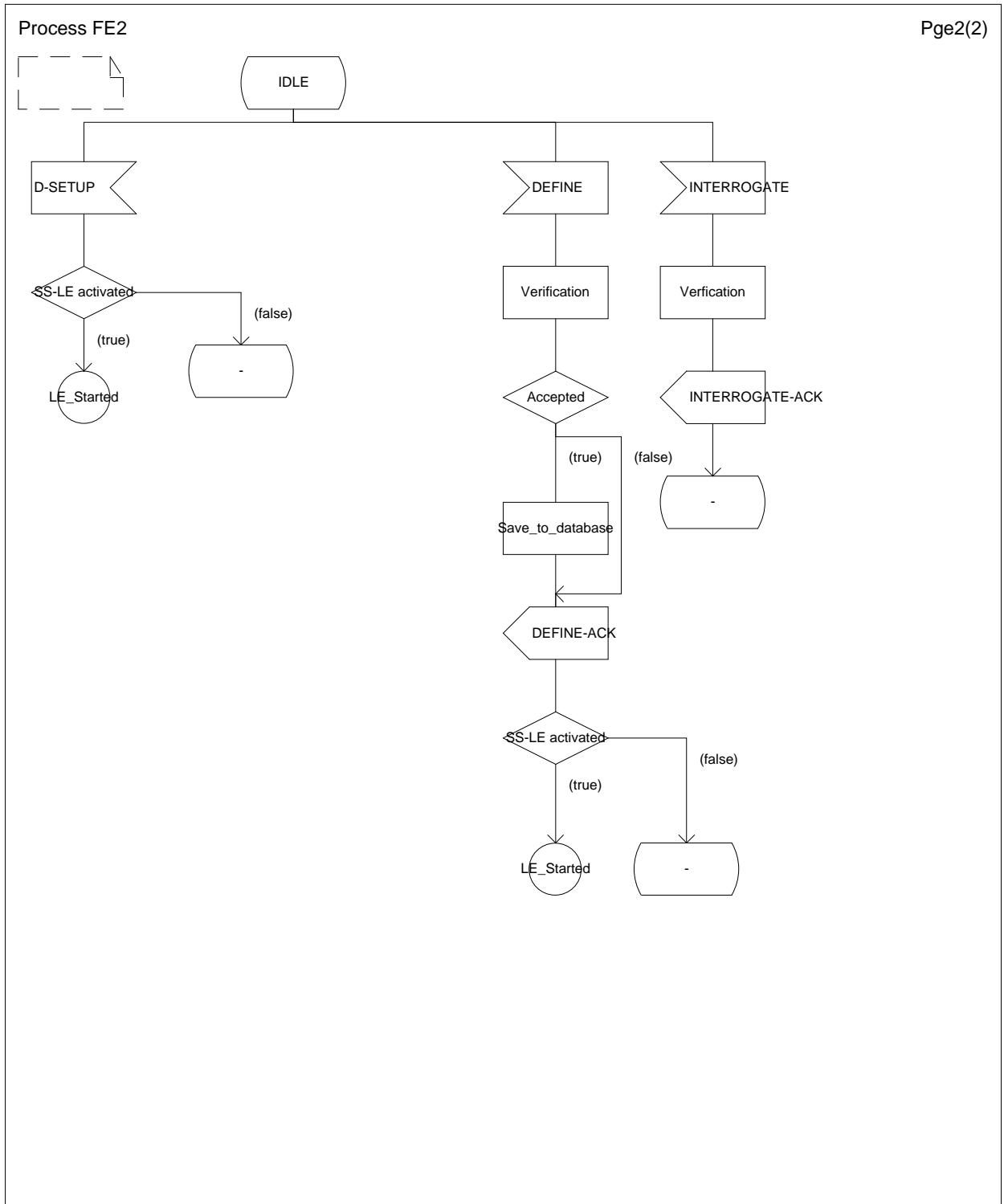Process description of FE4 (SS entity in SwMI in system 2) for state IDLE is shown in figure 14.
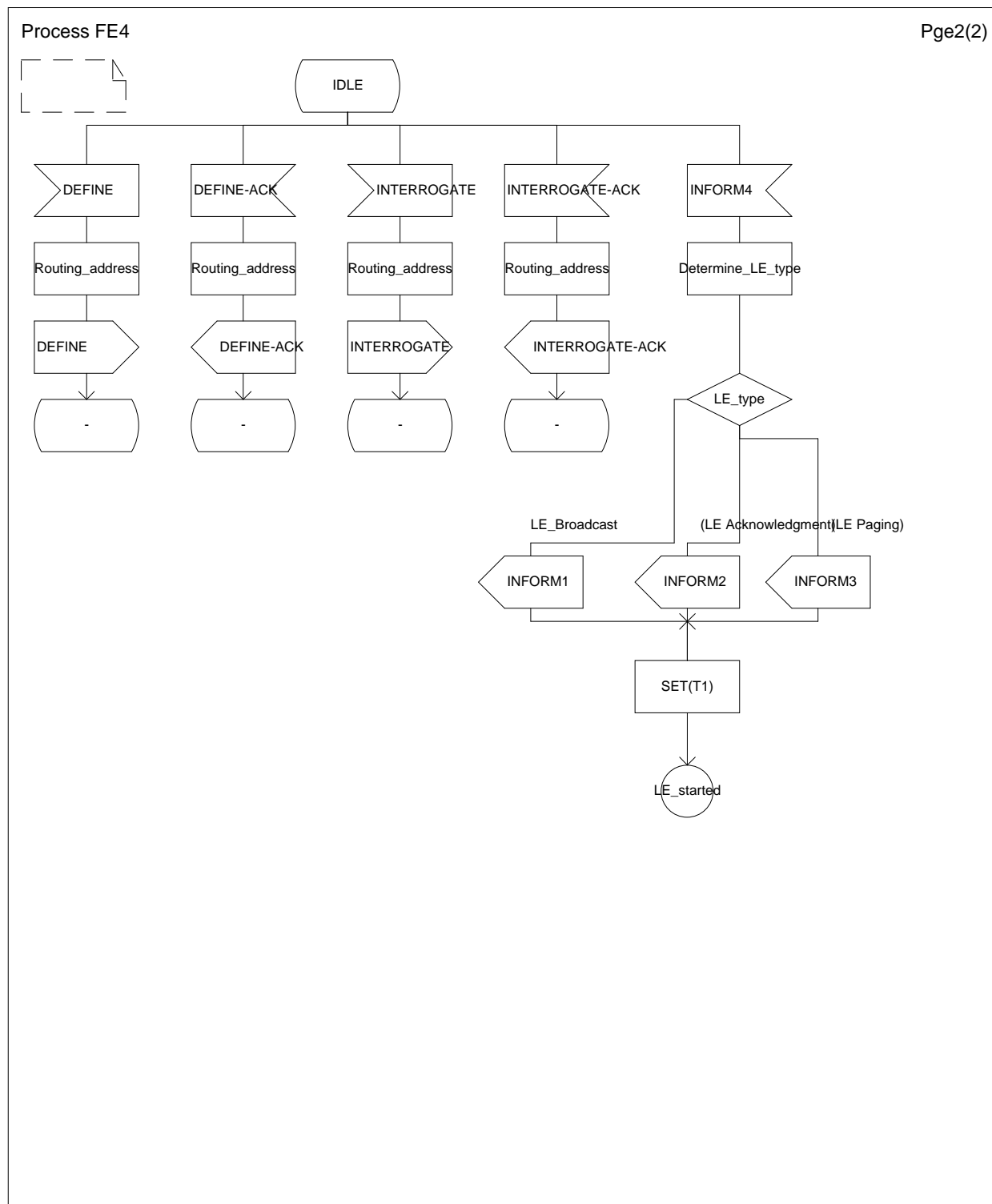
Figure 14: Process description of state IDLE of FE4

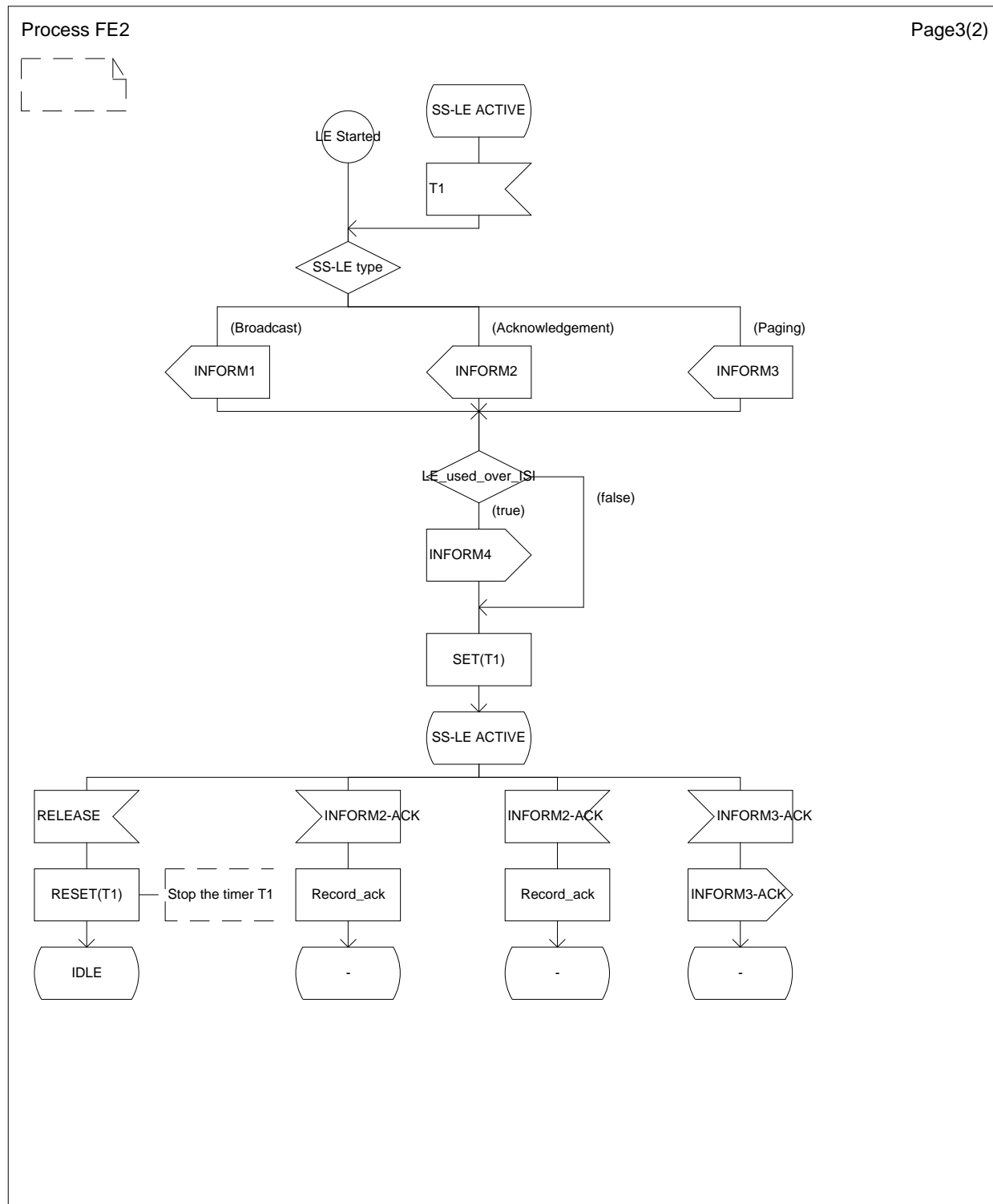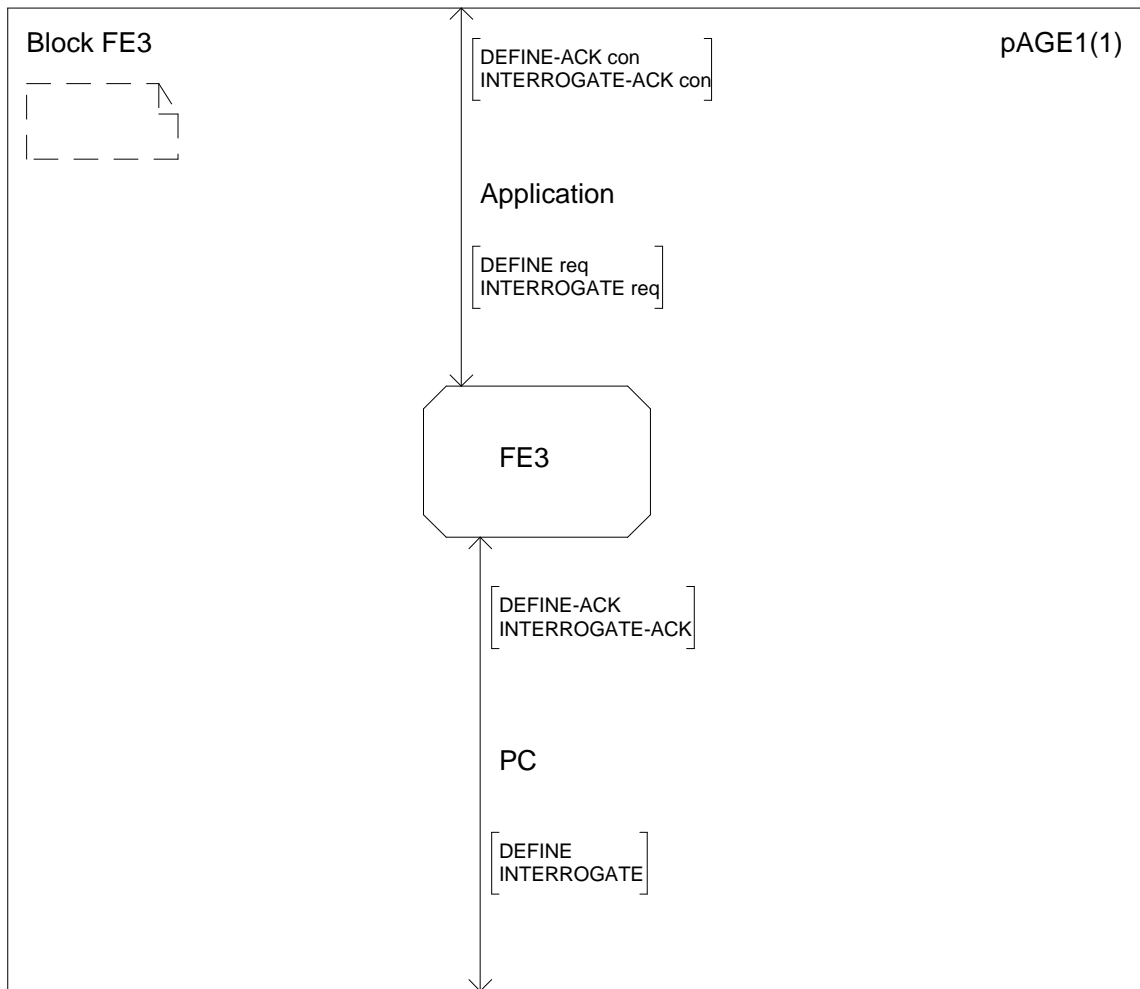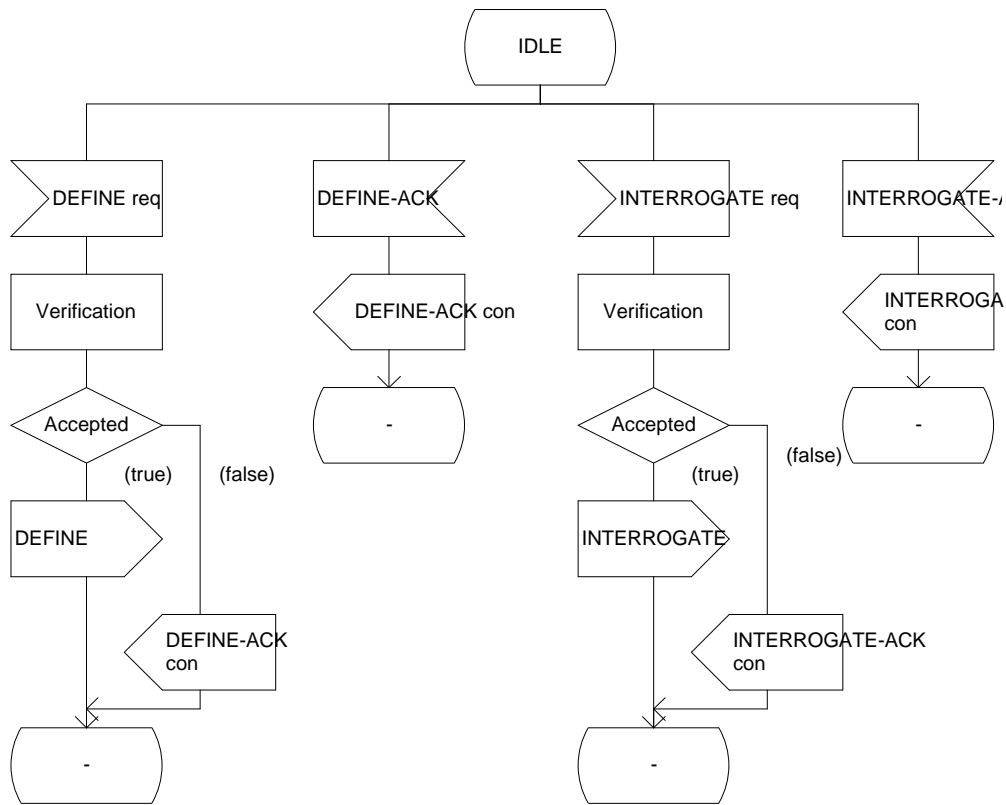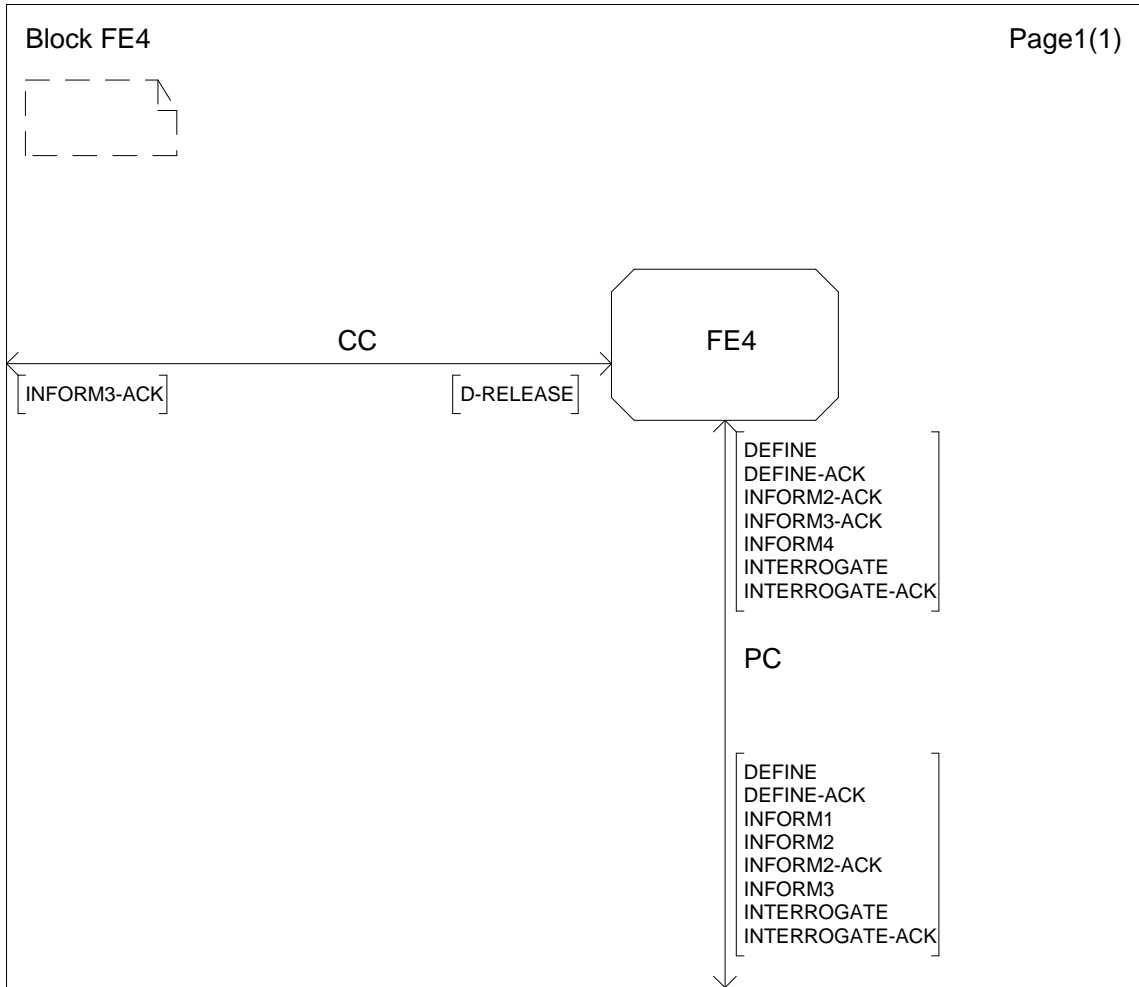Process description of FE4 (SS entity in SwMI in system 2) for SS-LE ACTIVE is shown in figure 15.

Figure 15: Process description of state SS-ACTIVE of FE4

6.2 Inter-working considerations

In order to enable the SS-LE to extend to several TETRA systems over the ISI, the FEs (FE2s and FE4s) in different TETRA systems shall be able to send and receive call related and call unrelated supplementary service information flows over the ISI.

Annex A (informative): Reception of SS-LE broadcast indications in MS/LS in layer 3

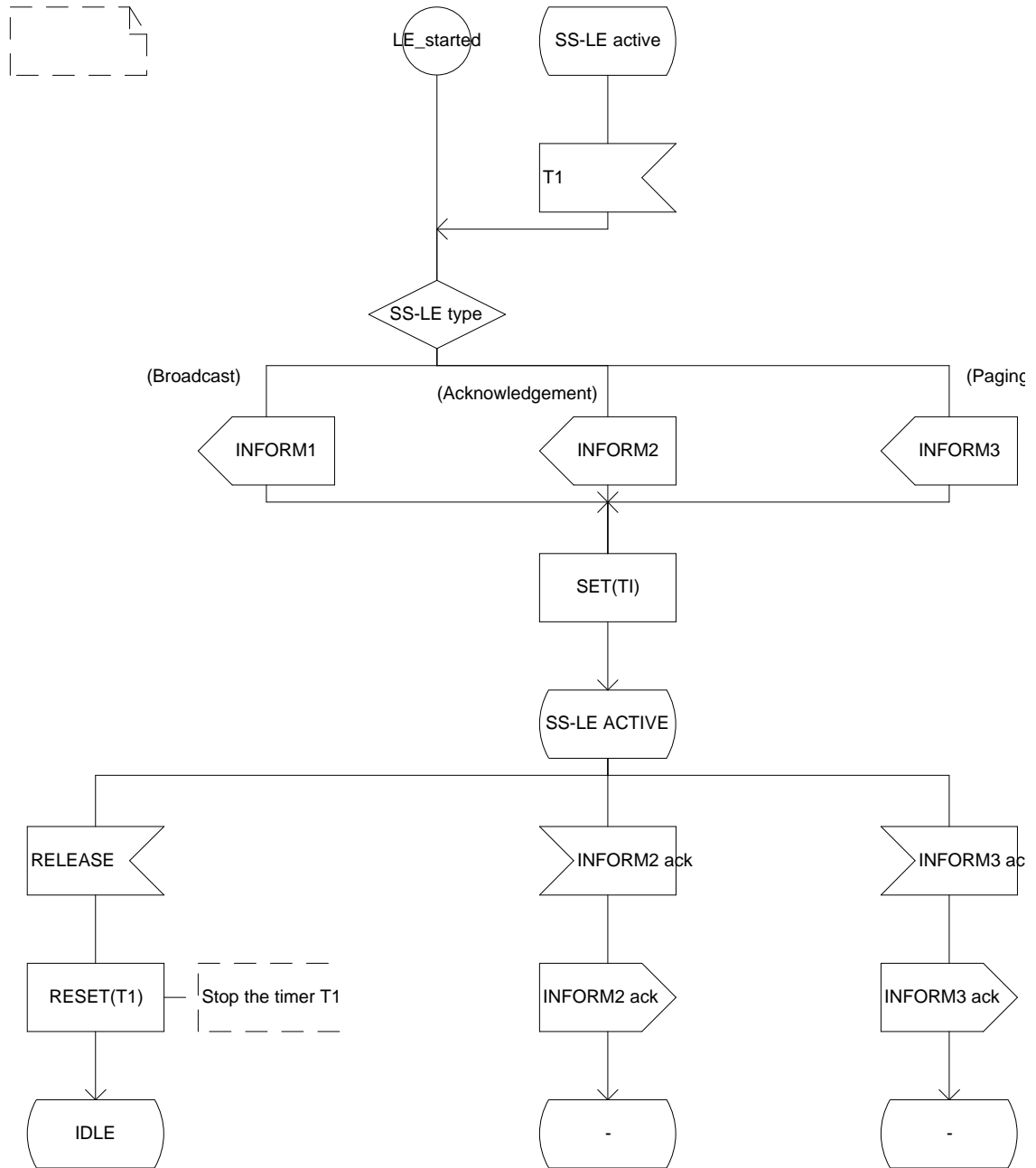LE broadcast is used to inform a subscriber about an ongoing call.

The INFORM1 information flow, that is used in case of LE broadcast, should be conveyed by D-SETUP PDU can be sent with or without information about the traffic channel allocated for the call. If the traffic channel is given, the MS may move to it. If the traffic channel is not given, the MS should, however, consider that the call is ongoing and act upon that.

Figure A.1 shows the reception of SS-LE broadcast indication in MS/LS in Layer 3:

1) protocol control in Layer 3 receives the D-SETUP PDU that conveys LE broadcast indication;

2) at the reception of such D-SETUP PDU, Protocol control in MS/LS should duplicate the D-SETUP PDU and send it to both Call Control (CC) and Supplementary Service (SS) sub-entities in CMCE in Layer 3. The Protocol control should also provide SS sub-entity with the information about the called party (group identity of the invoked call);

3) CC sub-entity continues the call invocation procedure normally (e.g. sends the TNCC-SETUP indication to the application) and SS sub-entity sends the TNSS-INFO conveying the INFORM1 information flow to application.
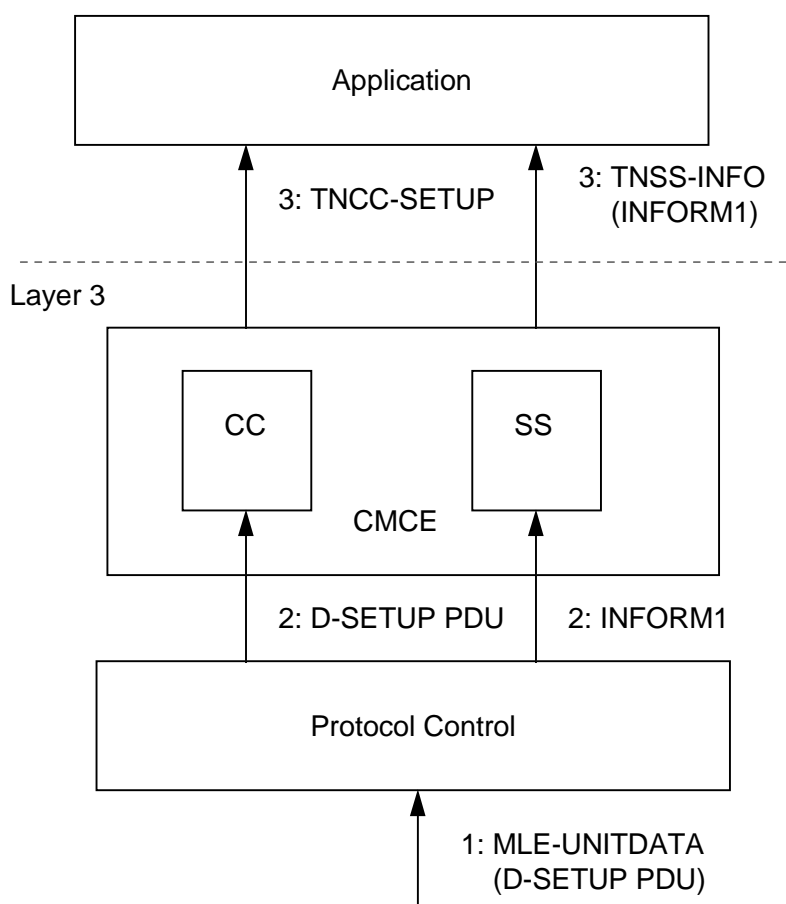
Figure A.1: The reception of SS-LE broadcast indication in MS/LS in layer 3

Annex B (informative): Reception of SS-LE acknowledgement indications in MS /LS in layer 3

LE acknowledgement is used to inform a subscriber about an ongoing call and request an acknowledgement response if the subscriber participates the call.

The INFORM2 information flow that should be conveyed by D-SETUP PDU can be sent with or without information about the traffic channel allocated for the call. If the traffic channel is given, the application in MS should send the LE acknowledgement after moving to the traffic channel, if it sends the acknowledgement response. If the traffic channel is not given, the MS should, however, consider that the call is ongoing and send the acknowledgement from the current channel, if it participates the call.

Figure B.1 shows the reception of SS-LE acknowledgement indication and sending of LE acknowledgement response in MS/LS in layer 3:

1)   protocol control in layer 3 receives the D-SETUP PDU that conveys the LE acknowledgement indication;

2)   at the reception of such D-SETUP PDU, protocol control in MS/LS should duplicate the D-SETUP PDU and send it to both CC and SS sub-entities in CMCE in layer 3. The protocol control should also provide SS sub-entity with the information about the called party (group identity of the invoked call);

3)   CC sub-entity continues the call invocation procedure normally (e.g. sends the TNCC-SETUP indication to the application) and SS sub-entity sends the TNSS-INFO conveying the INFORM2 information flow to application;

4)   if the subscriber joins the call, application sends an acknowledgement (INFORM2-ACK) to SS sub-entity;

5)   SS sub-entity should make the SS-FACILITY element containing the INFORM2-ACK information flow and send it to protocol control;

6)   protocol control sends the MLE-UNITDATA containing the INFORM2 SS-FACILITY element to MLE to be sent to SwMI.
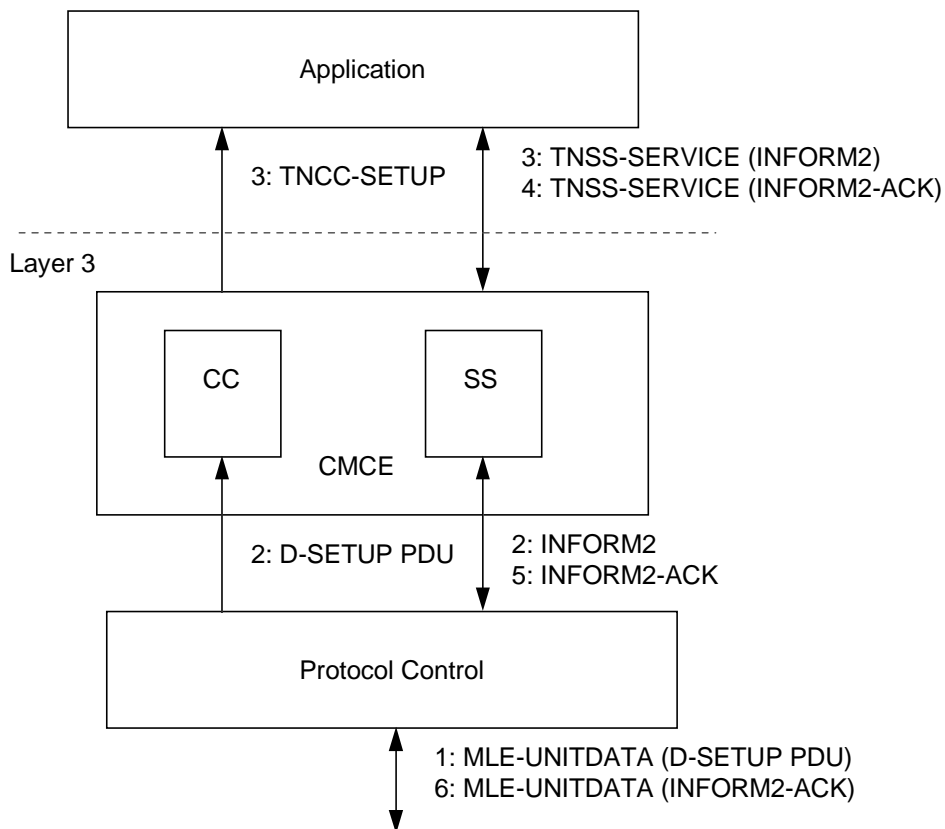
**Figure B.1: The reception of SS-LE acknowledgement indication and sending of
the LE acknowledgement response in MS/LS in layer 3**

At the reception of the first LE acknowledgement request application should discard any
following LE acknowledgements for the same call item when application is preparing the
acknowledgement or after sending the acknowledgement until the call is released. Thus, MS should send
only one LE acknowledgement response during the call item. Also, if the LE type is changed form
LE paging to LE acknowledgement, the LE paging response sent by MS should be considered as
LE acknowledgement response and the MS should not send (any new) LE acknowledgement response.

Annex C (informative): Reception of SS-LE paging indications in MS/LS in layer 3

LE paging is used to inform a subscriber about an ongoing call and request a paging response if the subscriber participates the call.

The INFORM3 information flow that should be conveyed by D-SETUP PDU should normally be sent without information about the allocated traffic channel. The MS should send the Paging response to SwMI if it wishes to participate the call. When MS has sent the paging response, the LE paging is ended and SwMI should send D-SETUP (with LE broadcast or LE acknowledgement indication) to inform MS about the ongoing call, so that it can participate it.

Figure C.1 shows the reception of SS-LE paging indication and sending of LE paging response in MS/LS in Layer 3:

1) protocol control in layer 3 receives the D-SETUP PDU that conveys the LE paging indication;

2) at the reception of such D-SETUP PDU, protocol control in MS/LS should duplicate the D-SETUP PDU and send it to both CC and SS sub-entities in CMCE in layer 3. The protocol control should also provide SS sub-entity with the information about the called party (group identity of the invoked call);

3) CC sub-entity continues the call invocation procedure normally (e.g. sends the TNCC-SETUP indication to the application) and SS sub-entity sends the TNSS-INFO conveying the INFORM3 information flow to application;

4) if the subscriber joins the call, application sends an acknowledgement (INFORM3-ACK) to SS sub-entity;

5) SS sub-entity should make the SS-FACILITY element containing the INFORM3-ACK information flow and send it to protocol control;

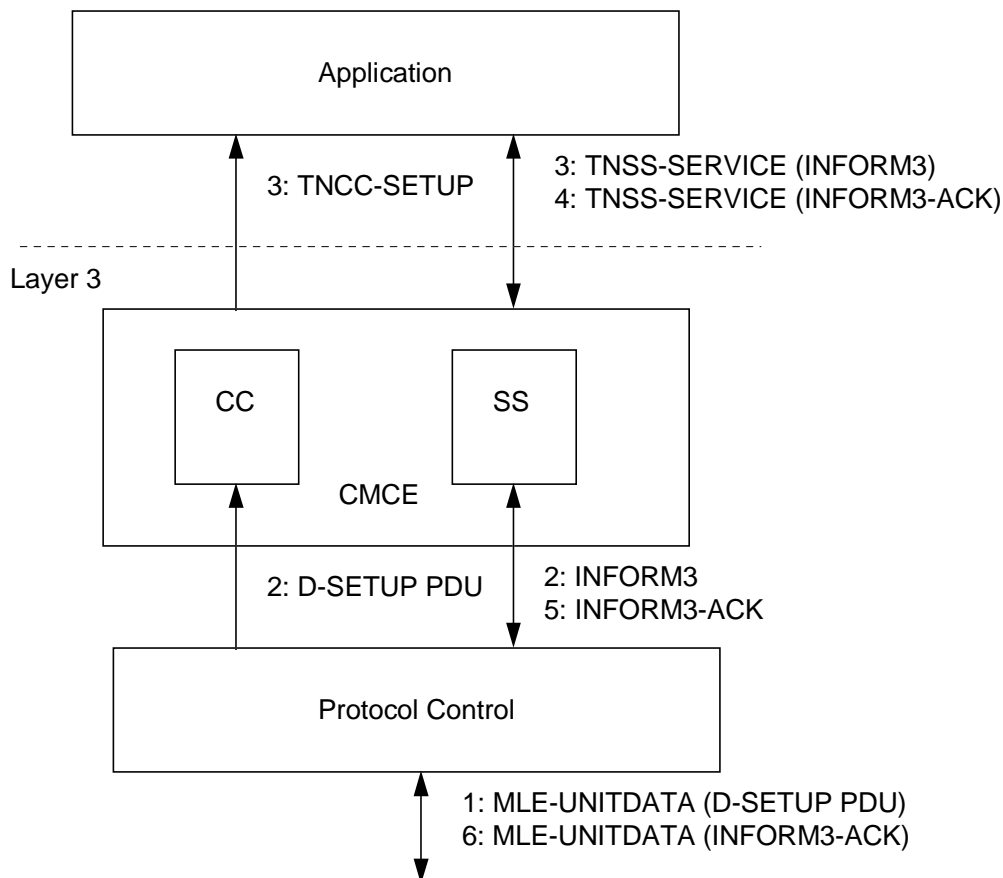6) protocol control sends the MLE-UNITDATA containing the INFORM3 SS-FACILITY element to MLE to be sent to SwMI.

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                    ┌─────────────────────────────────────┐
                    │                                     │
                    │            Application              │
                    │                                     │
                    └─────────────────────────────────────┘
                         ▲                    ▲
                         │   3: TNCC-SETUP    │   3: TNSS-SERVICE (INFORM3)
                         │                    │   4: TNSS-SERVICE (INFORM3-ACK)
    - - - - - - - - - - -│- - - - - - - - - - │- - - - - - - - - -
    Layer 3              │                    ▼
                    ┌─────────────────────────────────────┐
                    │    ┌────────┐      ┌────────┐        │
                    │    │        │      │        │        │
                    │    │   CC   │      │   SS   │        │
                    │    │        │      │        │        │
                    │    └────────┘      └────────┘        │
                    │         ▲    CMCE       ▲            │
                    └─────────────────────────────────────┘
                         │                    │
                         │  2: D-SETUP PDU    │  2: INFORM3
                         │                    │  5: INFORM3-ACK
                    ┌─────────────────────────────────────┐
                    │                                     │
                    │          Protocol Control           │
                    │                                     │
                    └─────────────────────────────────────┘
                                 ▲
                                 │  1: MLE-UNITDATA (D-SETUP PDU)
                                 │  6: MLE-UNITDATA (INFORM3-ACK)
                                 ▼
```

Figure C.1: The reception of SS-LE paging indication and sending of the LE paging response in MS/LS in layer 3

At the reception of the LE paging request application should send the response if needed, and wait for the D-SETUP indicating the allocated traffic channel. Application should discard any following LE paging request for the same call item until it has received the D-SETUP with channel allocation. At the reception of that D-SETUP, the LE paging ends at the MS. The SwMI should also change the LE type to LE broadcast or LE acknowledgement. If MS receives any subsequent LE paging requests later, it should send a response back to SwMI, as they should be used after the previously allocated traffic channel has been released and the SwMI is sending the LE paging requests to be informed about the current need of traffic channels.

Annex D (informative):   Examples of SS-FACILITY elements

D.1   Example of DEFINE SS-FACILITY element contents

Table D.1 gives one example of the elements in a SS-LE DEFINE SS-FACILITY element that FE3 should construct. It describes a definition made to a group number list with two group numbers where LE broadcast is defined for only multipoint circuit mode speech call. The SS-LE should not be invoked in system 2 (in other TETRA network over ISI) and the repetition rate for sending the LE broadcast messages is normal. The first interrogated subscriber number is a SNA and the second subscriber number is a SSI address (without extension).

Table D.1: An example of the elements in a SS-LE DEFINE SS-FACILITY element

SS-type (~ SS-LE)
Action type (~ Definition)
Argument type (~ Request)
Defined subscriber type (~ list, 2)
Defined party type identifier (~ DPTI = 0 = SNA)
Defined party short number (~ the SNA form a subscriber number)
Defined party type identifier (~ DPTI = 1 = SSI)
Defined party short number (~ the SSI form a subscriber number)
LE type (~ LE broadcast)
LE Used over ISI (~ SS-LE not applied in system 2)
Basic service type (~ Multipoint circuit mode speech call)
Repetition rate (~ normal)

D.2   Examples of DEFINE-ACK SS-FACILITY element contents

Example 1 and 2 gives examples of different DEFINE-ACK SS-FACILITY elements. It is possible that the authorized user has requested the definitions in one DEFINE request.

EXAMPLE 1:   An example of the elements in a SS-LE DEFINE-ACK SS-FACILITY element, when the definition is accepted for a group number. The subscriber number is a short number address (SNA), see table D.2.

Table D.2: DEFINE-ACK for an accepted definition request

SS-type (~ SS-LE)
Action type (~ Definition)
Argument type (~ Acknowledgement)
Defined subscriber type (~ subscriber number, 1)
Defined party type identifier (~ DPTI = 0 = SNA)
Defined party short number (~ the SNA form a subscriber number)
Result for definition (~ accepted)

EXAMPLE 2:   An example of the elements in a SS-LE DEFINE-ACK SS-FACILITY element, when the definition is rejected for a group number. The subscriber number is a SSI address (without extension), see table D.3.

Table D.3: DEFINE-ACK for a rejected definition request

SS-type (~ SS-LE)
Action type (~ Definition)
Argument type (~ Acknowledgement)
Defined subscriber type (~ subscriber number, 1)
Defined party type identifier (~ DPTI = 1 = SSI)
Defined party short number (~ the SSI form a subscriber number)
Result for definition (~ user not authorized)

D.3 Example of INTERROGATE-ACK SS-FACILITY element contents

Table D.4 gives one example of the elements in a SS-LE INTERROGATE-ACK SS-FACILITY element that FE2 should make. It describes the interrogation made to a group number list with two group numbers where LE broadcast is defined for only multipoint circuit mode speech calls. The SS-LE should not be invoked in system 2 (in other TETRA network over ISI) and the repetition rate for sending the LE broadcast messages should be normal. The first interrogated subscriber number is a short number address (SNA) and the second subscriber number is a SSI address (without extension).

Table D.4: An example of the elements in a SS-LE INTERROGATE-ACK SS-FACILITY element

SS-type (~ SS-LE)
Action type (~ Interrogation)
Argument type (~ Response)
Interrogated subscriber type (~ list, 2)
Interrogated party type identifier (~ IPTI = 0 = SNA)
Interrogated party short number (~ the SNA form a subscriber number)
Interrogated party type identifier (~ IPTI = 1 = SSI)
Interrogated party short number (~ the SSI form a subscriber number)
Result for interrogation (~ accepted)
LE type (~ LE broadcast)
LE Used over ISI (~ SS-LE not applied in system 2)
Basic service type (~ Multipoint circuit mode speech call)
Repetition rate (~ normal)

History

Document history		
September 1996	Public Enquiry	PE 114: 1996-09-23 to 1997-01-17