SLOVENSKI STANDARD
SIST EN 300 392-3-1 V1.3.1:2010

01-oktober-2010

Prizemni snopovni radio (TETRA) - Govor in podatki (V+D) - 3. del: Medsebojno delovanje na medsistemskem vmesniku (ISI) - 1. poddel: Splošna zasnova

Terrestrial Trunked Radio (TETRA) - Voice plus Data (V+D) - Part 3: Interworking at the Inter-System Interface (ISI) - Sub-part 1: General design

Ta slovenski standard je istoveten z: EN 300 392-3-1 Version 1.3.1

ICS:

33.070.10	Prizemni snopovni radio (TETRA)	Terrestrial Trunked Radio (TETRA)

SIST EN 300 392-3-1 V1.3.1:2010 **en**

ETSI EN 300 392-3-1 V1.3.1 (2010-08)

European Standard (Telecommunications series)

Terrestrial Trunked Radio (TETRA); Voice plus Data (V+D); Part 3: Interworking at the Inter-System Interface (ISI); Sub-part 1: General design

Reference
REN/TETRA-03192

Keywords
interworking, radio, TETRA, V+D

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Sous-Préfecture de Grasse (06) N° 7803/88

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Contents

Intellectual Property Rights 5
Foreword 5
1 Scope 7
2 References 7
2.1 Normative references 7
2.2 Informative references 8
3 Definitions and abbreviations 9
3.1 Definitions 9
3.2 Abbreviations 10
4 ISI standardization methodology 11
4.1 3 stage methodology 11
4.1.1 Stage 1 description 11
4.1.2 Stage 2 description 12
4.1.3 Stage 3 description 12
4.2 Usage of Specification and Description Language (SDL) 12
5 Usage of Private Signalling System 1 (PSS1) for TETRA 13
5.1 PSS1 functionality 13
5.2 Protocol stack for signalling information 13
5.3 Generic Functional Protocol (GFP) 14
5.4 Protocol stack for user information 15
6 TETRA SwMI roles using ISI 15
6.1 Management configurations 15
6.1.1 Migration and group attachment configurations 15
6.1.1.1 SwMI roles for migration and group attachment 15
6.1.1.2 SwMI databases 16
6.1.1.3 Migration scenarios 17
6.1.1.4 Group attachment scenarios 18
6.1.2 Group linking configurations 18
6.2 Call configurations 20
6.2.1 Group call configuration 20
6.2.2 Individual call configuration 22
6.2.3 Transit 23
6.3 User information encoding at the ISI 23
7 Introduction to ISI ANFs 23
7.1 ANF-ISIMM 24
7.2 ANF-ISIIC 24
7.3 ANF-ISIGC 24
7.4 ANF-ISISDS 24
7.5 ANF-ISISS 24
8 ISI Generic Functional Protocol (ISI GFP) 24
8.1 Protocol model 24
8.2 Services provided by the protocol model entities 25
8.3 Addressing and transport 26
8.3.1 Addressing 26
8.3.2 Transport of ROSE APDUs 27
8.3.2.1 Call related ROSE APDUs 27
8.3.2.2 Call unrelated ROSE APDUs 27
8.3.2.2.1 Protocol for the establishment of a call independent signalling connection 27
8.3.2.2.2 Use of a call independent signalling connection already established 36
8.3.2.2.3 Clearing of a call independent signalling connection already established 36
8.4 Remote Operations Service Entity (ROSE) requirements and operation definition 36

8.4.1 General 36
8.4.2 Return-result 40
8.4.3 Return-error 40
8.4.4 Reject 41
8.5 Segmentation Service Element (SSE) 41
8.5.1 Procedures 41
8.5.1.1 Requirements for the segmentation procedure 42
8.5.1.2 Requirements for the re-assembly procedure 42
8.5.2 Segment encoding 43
8.6 Co-ordination Function 44

9 Security over the ISI 44
9.1 ITSI authentication 45
9.2 End-to-end encryption 45
9.3 End-to-end key management via ISI 45

Annex A (normative): Security - supporting encryption over ISI 46

A.1 Overview 46

A.2 Encryption 47
A.2.1 ISI relation to air interface and end-to-end encryption 47
A.2.2 Air interface encryption key management via ISI 47
A.2.2.1 Secret Key of individual subscriber (K) 47
A.2.2.2 Derived Cipher Key (DCK) 48
A.2.2.3 Common Cipher Key (CCK) 48
A.2.2.4 Static Cipher Key (SCK) 48
A.2.2.5 Group Cipher Key (GCK) 48

Annex B (informative): Maximum length of a ROSE APDU or a SSE segment encoded in a facility information element 49

B.1 PSS1 FACILITY message 49

B.2 PSS1 basic call message 50

B.3 Example of the encoding of an ANF-ISIMM MIGRATION PDU in a ROSE Invoke ROSE APDU in a call PISN FACILITY PDU 51

Annex C (informative): Change requests 53

History 54

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Foreword

This European Standard (Telecommunications series) has been produced by ETSI Technical Committee Terrestrial Trunked Radio (TETRA).

The present document is part 3, sub-part 1 of a multi-part deliverable covering the Terrestrial Trunked Radio (TETRA); Voice plus Data (V+D), Release 2 as identified below:

EN 300 392-1: "General network design";

EN 300 392-2: "Air Interface (AI)";

EN 300 392-3: "Interworking at the Inter-System Interface (ISI)";

EN 300 392-3-1: "General design";

EN 300 392-3-2: "Additional Network Feature Individual Call (ANF-ISIIC)";

EN 300 392-3-3: "Additional Network Feature Group Call (ANF-ISIGC)";

EN 300 392-3-4: "Additional Network Feature Short Data Service (ANF-ISISDS)";

EN 300 392-3-5: "Additional Network Feature for Mobility Management (ANF-ISIMM)";

TS 100 392-3-6: "Speech format implementation for circuit mode transmission";

TS 100 392-3-7: "Speech Format Implementation for Packet Mode Transmission";

TS 100 392-3-8: "Generic Speech Format Implementation";

ETS 300 392-4: "Gateways basic operation";

EN 300 392-5: "Peripheral Equipment Interface (PEI)";

EN 300 392-7: "Security";

EN 300 392-9: "General requirements for supplementary services";

EN 300 392-10: "Supplementary services stage 1";

EN 300 392-11: "Supplementary services stage 2";

EN 300 392-12: "Supplementary services stage 3";

ETS 300 392-13: "SDL model of the Air Interface (AI)";

ETS 300 392-14: "Protocol Implementation Conformance Statement (PICS) proforma specification";

TS 100 392-15: "TETRA frequency bands, duplex spacings and channel numbering";

TS 100 392-16: "Network Performance Metrics";

TR 100 392-17: "TETRA V+D and DMO specifications";

TS 100 392-18: "Air interface optimized applications".

NOTE: Part 3, sub-parts 6 and 7 (Speech format implementation), part 4, sub-part 3 (Data networks gateway), part 10, sub-part 15 (Transfer of control), part 13 (SDL) and part 14 (PICS) of this multi-part deliverable are in status "historical" and are not maintained.

National transposition dates	
Date of adoption of this EN:	2 August 2010
Date of latest announcement of this EN (doa):	30 November 2010
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	31 May 2011
Date of withdrawal of any conflicting National Standard (dow):	31 May 2011

1 Scope

The present document defines the general aspects of interworking at the Inter-System Interface (ISI) for Terrestrial Trunked Radio (TETRA) system supporting Voice plus Data (V+D). Those specify the general concepts which are the basis of the ISI operation between TETRA systems. It introduces the Additional Network Features (ANFs) used at the ISI, and specifies:

- the general protocol mechanism, called ISI Generic Functional Protocol (ISI GFP), upon which the definition of each ANF is based; and
- the security requirements for the ISI.

The ISI GFP specification applies to any TETRA Switching and Management Infrastructure (SwMI) which supports the ISI. The security requirements for the ISI only apply to SwMIs which support authentication or encryption over the ISI.

Besides the ISI general design, the present sub-part, interworking at the Inter-System Interface comprises the following other sub-parts:

- Additional Network Feature - ISI Individual Call (ANF-ISIIC);
- Additional Network Feature - ISI Group Call (ANF-ISIGC);
- Additional Network Feature - ISI Short Data service (ANF-ISISDS); and
- Additional Network Feature - ISI Mobility Management (ANF-ISIMM).

2 References

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the reference document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at http://docbox.etsi.org/Reference.

NOTE: While any hyperlinks included in this clause were valid at the time of publication ETSI cannot guarantee their long term validity.

2.1 Normative references

The following referenced documents are necessary for the application of the present document.

[1] ETSI EN 300 392-1: "Terrestrial Trunked Radio (TETRA); Voice plus Data (V+D); Part 1: General network design".

[2] ETSI EN 300 392-2: "Terrestrial Trunked Radio (TETRA); Voice plus Data (V+D); Part 2: Air Interface (AI)".

[3] ETSI EN 300 392-3-2: "Terrestrial Trunked Radio (TETRA); Voice plus Data (V+D); Part 3: Interworking at the Inter-System Interface (ISI); Sub-part 2: Additional Network Feature Individual Call (ANF-ISIIC)".

[4] ETSI EN 300 392-3-3: "Terrestrial Trunked Radio (TETRA); Voice plus Data (V+D); Part 3: Interworking at the Inter-System Interface (ISI); Sub-part 3: Additional Network Feature Group Call (ANF-ISIGC)".

[5] ETSI EN 300 392-3-4: "Terrestrial Trunked Radio (TETRA); Voice plus Data (V+D); Part 3: Interworking at the Inter-System Interface (ISI); Sub-part 4: Additional Network Feature Short Data Service (ANF-ISISDS)".

[6] ETSI EN 300 392-3-5: "Terrestrial Trunked Radio (TETRA); Voice plus Data (V+D); Part 3: Interworking at the Inter-System Interface (ISI); Sub-part 5: Additional Network Feature for Mobility Management (ANF-ISIMM)".

[7] ETSI TS 100 392-3-8: "Terrestrial Trunked Radio (TETRA); Voice plus Data (V+D); Part 3: Interworking at the Inter-System Interface (ISI); Sub-part 8: Generic Speech Format Implementation".

[8] ETSI EN 300 392-7: "Terrestrial Trunked Radio (TETRA); Voice plus Data (V+D); Part 7: Security".

[9] ETSI EN 300 392-9: "Terrestrial Trunked Radio (TETRA); Voice plus Data (V+D); Part 9: General requirements for supplementary services".

[10] ETSI ETS 300 402-1: "Integrated Services Digital Network (ISDN); Digital Subscriber Signalling System No. one (DSS1) protocol; Data link layer; Part 1: General aspects [ITU-T Recommendation Q.920 (1993), modified]".

[11] ETSI ETS 300 402-2: "Integrated Services Digital Network (ISDN); Digital Subscriber Signalling System No. one (DSS1) protocol; Data link layer; Part 2: General protocol specification [ITU-T Recommendation Q.921 (1993), modified]".

[12] ISO/IEC 11572: "Information technology - Telecommunications and information exchange between systems - Private Integrated Services Network - Circuit mode bearer services - Inter-exchange signalling procedures and protocol".

[13] ISO/IEC 11582: "Information technology - Telecommunications and information exchange between systems - Private Integrated Services Network - Generic functional protocol for the support of supplementary services - Inter-exchange signalling procedures and protocol".

[14] ITU-T Recommendation G.704: "Synchronous frame structures used at 1544, 6312, 2048, 8448 and 44 736 kbit/s hierarchical levels".

[15] ITU-T Recommendation Q.931: "ISDN user-network interface layer 3 specification for basic call control".

[16] ITU-T Recommendation X.690: "Information technology - ASN.1 encoding rules: Specification of Basic Encoding Rules (BER), Canonical Encoding Rules (CER) and Distinguished Encoding Rules (DER)".

[17] ITU-T Recommendation X.219: "Remote Operations: Model, notation and service definition".

[18] ITU-T Recommendation X.229: "Remote Operations: Protocol specification".

2.2 Informative references

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

[i.1] ETSI EN 300 395-1: "Terrestrial Trunked Radio (TETRA); Speech CODEC for full-rate traffic channel; Part 1: General description of speech functions".

[i.2] ITU-T Recommendation I.130: "Method for the characterization of telecommunication services supported by an ISDN and network capabilities of an ISDN".

[i.3] ITU-T Recommendation Z.100: "Specification and description language (SDL)".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in ISO/IEC 11582 [13] and the following apply:

call independent signalling connection: signalling connection established between ANF-ISI entities located in different Switching and Management Infrastructures that does not have an associated user-information connection

call independent: property of information which is conveyed across the Q reference point in a message that does not use a call reference which has an associated user-information connection

NOTE: In TETRA standards, the term call unrelated is used with the same meaning as call independent.

call unrelated: See the definition of the term "call independent".

co-ordination Function: entity which provides co-ordination between different ANF-ISI entities, ROSE, SSE and GFT Control for different TETRA basic and supplementary services

destination SwMI: Switching and Management Infrastructure where the receiving ANF-ISI entity is located (in the context of a single one-way exchange of information between two ANF-ISI entities located in different Switching and Management Infrastructures)

Generic Functional Transport Control (GFT Control) entity: entity that exists within a Switching and Management Infrastructure and provides a range of services to the ANF-ISI entities and ROSE via the co-ordination Function

NOTE: The services are defined in clause 6 of ISO/IEC 11582 [13].

group attached SwMI: Switching and Management Infrastructure different from the home SwMI of the group considered in which at least one individual subscriber member of the group is attached to that group

Group TETRA Subscriber Identity (GTSI): TETRA Subscriber Identity assigned to a group

home SwMI: Switching and Management Infrastructure in which the subscription of a given user is registered

NOTE: That user is defined as being a subscriber (see below the definition of that term).

invocation: an action taken by the user or by the service provider to execute a specific service function within real time

Location Area (LA): area within radio coverage of a base station or group of base stations within which a Mobile Station (MS) is allowed to operate

Mobile Network Identity (MNI): identity that is broadcast by all TETRA base stations to uniquely identify the SwMI

NOTE: It consists of the Mobile Country Code (MCC) and the Mobile Network Code (MNC).

Mobile Station (MS): physical grouping that contains all of the mobile equipment that is used to obtain TETRA services

NOTE: By definition, a mobile station contains at least one Mobile Radio Stack (MRS).

originating SwMI: in the context of a TETRA call, Switching and Management Infrastructure where the calling user is registered (which implies that this user is located in that SwMI) or Switching and Management Infrastructure which originates a Call independent signalling connection

segmentation: act of generating two or more PDUs derived from an initial one

service user: abstract representation of the totality of those entities in a single system that makes use of a service through a single access point

Short Subscriber Identity (SSI): network specific portion of a TSI

NOTE: A SSI is only unique within one TETRA sub-domain (one TETRA network).

source SwMI: Switching and Management Infrastructure where the sending ANF-ISI entity is located (in the context of a single one-way exchange of information between two ANF-ISI entities located in different Switching and Management Infrastructures)

subscriber: user of a telecommunication service, based on a contract with the provider of the service

NOTE 1: The subscriber may be an individual or a group: in the first case it is identified by an ITSI, in the second, by a GTSI.

NOTE 2: The individual subscriber is able to access an SwMI either through a MS or Line Station.

supplementary service: modifies or supplements a basic bearer service or a basic teleservice

NOTE: A supplementary service cannot be offered to a customer as a stand-alone service. It should be offered in combination with a bearer service or a teleservice.

Switching and Management Infrastructure (SwMI): all of the TETRA equipment for a Voice plus Data (V+D) network

NOTE: The SwMI enables users to communicate with each other.

terminating SwMI: in the context of a TETRA call, Switching and Management Infrastructure where the calling user is registered (which implies that this user is located in that SwMI) or Switching and Management Infrastructure which terminates a Call independent signalling connection

TETRA Subscriber Identity (TSI): global TETRA network address that is to identify an individual or a group subscriber within the domain of all TETRA networks

user: entity using the services of a telecommunications network via an externally accessible service access point

NOTE: An individual user may be a person or an application process.

visited SwMI: Switching and Management Infrastructure different from the home SwMI in which a given subscriber is currently registered

NOTE: The definition of this term implies that the given subscriber is mobile and has moved away from his home SwMI (to register in this visited SwMI). Therefore, it cannot apply to a group.

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

AC	Authentication Centre
ANF	Additional Network Feature
ANF-ISI	all Additional Network Features of the Inter-System Interface
APDU	Application Protocol Data Unit
ASN.1	Abstract Syntax Notation One
BS	Base Station
C	Conditional
CCK	Common Cipher Key
C-LDB	Controlling Linking DataBase
DCK	Derived Cipher Key
E.1	E-carrier signal level 1, 2 048 kbit/s
ECMA	European Computer Manufacturers Association
GCK	Group Cipher Key
GFP	Generic Functional Protocol
GFT	Generic Functional Transport
G-HDB	Group Home DataBase
GTSI	Group TETRA Subscriber Identity
G-VDB	Group Visited DataBase
HAC	Home Authentication Centre
HDB	Home DataBase
HDLC	High-level Data Link Control
I-HDB	Individual Home DataBase

ISI	Inter-System Interface
ITSI	Individual TETRA Subscriber Identity
I-VDB	Individual Visited DataBase
K	authentication Key
LA	Location Area
LAPD	Link Access Procedure for the D-Channel
LS	Line Station
M	Mandatory
MCC	Mobile Country Code
MM	Mobility Management
MNC	Mobile Network Code
MNI	Mobile Network Identity
MRS	Mobile Radio Stack
MS	Mobile Station
NFE	Network Facility Extension
O	Optional
OTAR	Over The Air Re-keying
PC	Protocol Control
PDU	Protocol Data Unit
PINX	Private Integrated Network eXchange
PISN	Private Integrated Services Network
PSS1	Private Signalling System 1
ROSE	Remote Operation Service Element
RS	Random Seed
SAP	Service Access Point
SCK	Static Cipher Key
SDL	Specification and Description Language
SDS	Short Data Service
SSE	Segmentation Service Element
SSI	Short Subscriber Identity
SwMI	TETRA Switching and Management Infrastructure
TSI	TETRA Subscriber Identity
V+D	Voice plus Data
VAC	Visitor Authentication Centre
(V)ASSI	Visiting Alias Short Subscriber Identity
VDB	Visitor DataBase
(V)GSSI	Visiting Group Short Subscriber Identity

4 ISI standardization methodology

4.1 3 stage methodology

The ISI Additional Network Features (ANFs), listed in clause 7, are standardized using the modelling method defined in ITU-T Recommendation I.130 [i.2].

4.1.1 Stage 1 description

Stage 1 description defines the services which the standardized ANF entity provides to the concerned service users, e.g. SwMI entities in the case of TETRA. The services are visible at the Service Access Points (SAPs). The stage 1 description is intended to allow an understanding of the services independently from the implementation.

For normal point to point services the service model is shown in figure 1.

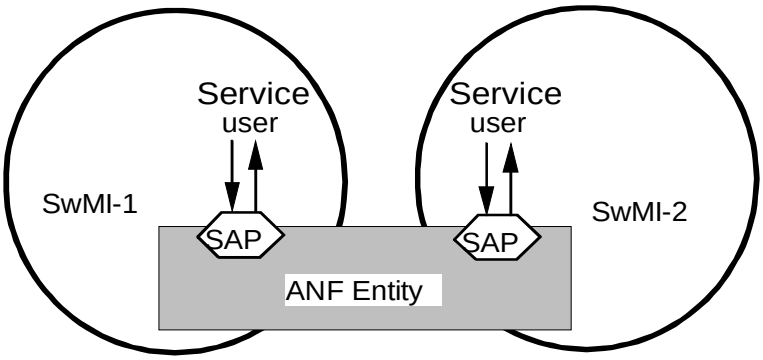

Figure 1: Service model for point to point services

For point to multipoint services the service model is shown in figure 2.

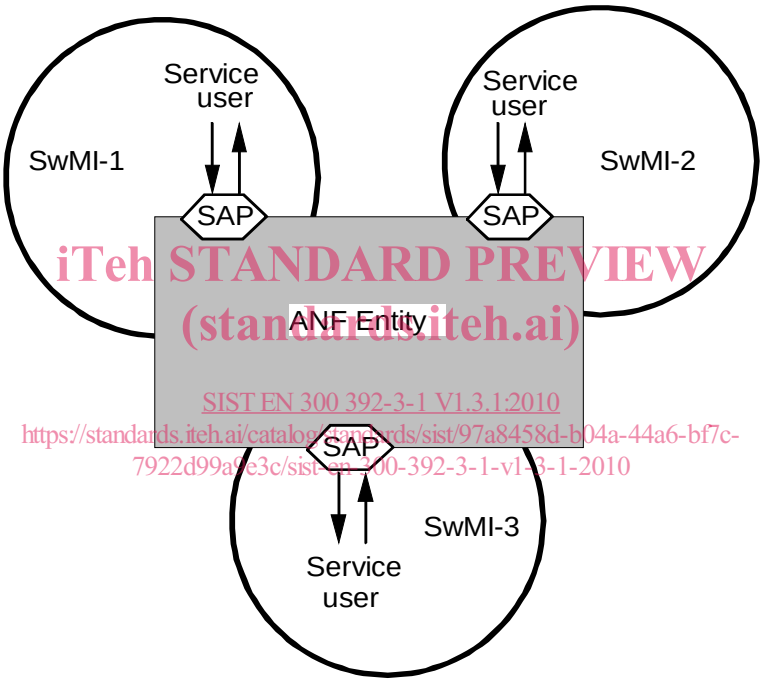

Figure 2: Service model for point to multipoint services

4.1.2 Stage 2 description

Stage 2 description identifies the functional capabilities and the information flows needed to support the service as described in stage 1.

4.1.3 Stage 3 description

Stage 3 description gives a precise specification of the signalling protocols for the ANF services, i.e. the encoding rules for the information flows and the corresponding procedures.

4.2 Usage of Specification and Description Language (SDL)

SDL defined in ITU-T Recommendation Z.100 [i.3] is used to identify and represent the behaviour of the concerned ANF in providing services.

5 Usage of Private Signalling System 1 (PSS1) for TETRA

5.1 PSS1 functionality

The TETRA ISI application is built on top of the PSS1 protocol stack for interconnecting Private Integrated services Network eXchanges (PINXs) to form Private Integrated Services Network (PISN). PSS1 is the ISO term; the PSS1 protocol is also known, informally, as QSIG, generic term created by the European Computer Manufacturers Association (ECMA) which developed most of the signalling protocols comprised in the PSS1 protocol.

TETRA uses the standard functionalities defined for PSS1:

- signalling for the support of circuit-mode basic services (see note);
- Generic Functional Protocol (GFP) originally defined for the support of supplementary services.

NOTE: The definition of PSS1 basic call in ISO/IEC 11572 [12] is as follows:

"The basic call is a single invocation of a basic service. Signalling procedures are used for establishing, maintaining and clearing a circuit-mode call at an interface between two PINXs. These signalling procedures are defined in terms of messages exchanged over a signalling carriage mechanism connection within the signalling channel of the Inter-PINX link. The result of successful basic call establishment is a connection for the purpose of user information transfer".

5.2 Protocol stack for signalling information

Figure 3 shows how the protocols for TETRA ANF which apply at the ISI are built on top of the PSS1 protocol stack. The Remote Operation Service Element (ROSE) is used to convey ANF-ISI Protocol Data Units (PDU).

For the TETRA ANF-ISIIC and ANF-ISIGC protocols, figure 3 has to be supplemented with a direct interface to PSS1 protocol control for basic call. In addition, basic call correlation shall be ensured for the delivery of the corresponding PDUs by ANF-ISIIC and ANF-ISIGC through the protocol stack shown on figure 3, e.g. the ANF-ISIIC SETUP PDU shall have to be sent in the PSS1 SETUP message for establishing the PISN call to be used by the invoked ANF-ISIIC.

NOTE 1: The PSS1 basic call protocol is defined in ISO/IEC 11572 [12].

NOTE 2: The term "basic call correlation" has been used in the preceding paragraph as implicitly defined in notes to tables 3, 5, 7, and 9 of ISO/IEC 11582 [13].

Basic call correlation shall also be ensured for the delivery of specific supplementary service PDUs through ANF-ISISS, depending of the definition of those supplementary services.