ETSI TS 100 392-3-10 V1.1.1 (2018-05)

Terrestrial Trunked Radio (TETRA);
Voice plus Data (V+D);
Part 3: Interworking at the Inter-System Interface (ISI);
Sub-part 10: General design, PSS1 over E.1

Reference

DTS/TCCE-03238

Keywords

management, mobility, TETRA

ETSI

650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° 7803/88

Important notice

The present document can be downloaded from:
http://www.etsi.org/standards-search

The present document may be made available in electronic versions and/or in print. The content of any electronic and/or print versions of the present document shall not be modified without the prior written authorization of ETSI. In case of any existing or perceived difference in contents between such versions and/or in print, the only prevailing document is the print of the Portable Document Format (PDF) version kept on a specific network drive within ETSI Secretariat.

Users of the present document should be aware that the document may be subject to revision or change of status. Information on the current status of this and other ETSI documents is available at
https://portal.etsi.org/TB/ETSIDeliverableStatus.aspx

If you find errors in the present document, please send your comment to one of the following services:
https://portal.etsi.org/People/CommiteeSupportStaff.aspx

Contents

Intellectual Property Rights

Essential patents

IPRs essential or potentially essential to normative deliverables may have been declared to ETSI. The information pertaining to these essential IPRs, if any, is publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: *"Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards"*, which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (https://ipr.etsi.org/).

Pursuant to the ETSI IPR Policy, no investigation, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

Trademarks

The present document may include trademarks and/or tradenames which are asserted and/or registered by their owners. ETSI claims no ownership of these except for any which are indicated as being the property of ETSI, and conveys no right to use or reproduce any trademark and/or tradename. Mention of those trademarks in the present document does not constitute an endorsement by ETSI of products, services or organizations associated with those trademarks.

Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee TETRA and Critical Communications Evolution (TCCE).

The present document is part 3, sub-part 10 of a multi-part deliverable covering the Terrestrial Trunked Radio (TETRA); Voice plus Data (V+D), as identified below:

Part 1: "General network design";

Part 2: "Air Interface (AI)";

Part 3: "Interworking at the Inter-System Interface (ISI)":

Sub-part 1: "General design";

Sub-part 2: "Additional Network Feature Individual Call (ANF-ISIIC)";

Sub-part 3: "Additional Network Feature Group Call (ANF-ISIGC)";

Sub-part 4: "Additional Network Feature Short Data Service (ANF-ISISDS)";

Sub-part 5: "Additional Network Feature for Mobility Management (ANF-ISIMM)";

Sub-part 6: "Speech format implementation for circuit mode transmission";

Sub-part 7: "Speech Format Implementation for Packet Mode Transmission";

Sub-part 8: "Generic Speech Format Implementation";

Sub-part 9: "Transport layer independent, General design";

Sub-part 10: "General design, PSS1 over E.1";

Sub-part 11: "General design, SIP/IP";

Sub-part 12: "Transport layer independent Additional Network Feature Individual Call (ANF-ISIIC)";

Sub-part 13: "Transport layer independent Additional Network Feature Group Call (ANF-ISIGC)";

Sub-part 14: "Transport layer independent Additional Network Feature Short Data Service (ANF-ISISDS)";

Sub-part 15: Transport layer independent Additional Network Feature, Mobility Management (ANF-ISIMM)";

Part 4: "Gateways basic operation";

Part 5: "Peripheral Equipment Interface (PEI)";

Part 7: "Security";

Part 9: "General requirements for supplementary services";

Part 10: "Supplementary services stage 1";

Part 11: "Supplementary services stage 2";

Part 12: "Supplementary services stage 3";

Part 13: "SDL model of the Air Interface (AI)";

Part 14: "Protocol Implementation Conformance Statement (PICS) proforma specification";

Part 15: "TETRA frequency bands, duplex spacings and channel numbering";

Part 16: "Network Performance Metrics";

Part 17: "TETRA V+D and DMO specifications";

Part 18: "Air interface optimized applications";

NOTE 1: 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.

NOTE 2: Some parts are also published as Technical Specifications such as ETSI TS 100 392-2 and those may be the latest version of the document.

The present document is based on ETSI EN 300 392-3-1 [i.2]. The main differences are:

- General information about ISI is included in ETSI TS 100 392-3-9 [2].
- Information about ISI APDU to PSSI message mapping is added.
- Signalling sequences are added.

For all subparts in the TETRA specification ETSI EN 300 392-3, "Interworking at the Inter-System Interface (ISI)", the terms ISI and TETRA ISI are equivalent.

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

"**must**" and "**must not**" are **NOT** allowed in ETSI deliverables except when used in direct citation.

1 Scope

The present document defines the transport of the Inter-System Interface (ISI) using PSS1 as transport layer. It specifies:

- the PSS1 signalling used for transport of ISI APDUs; and
- the general protocol mechanism, called ISI Mediation Function which coordinates the communication between TETRA systems.

The ISI Mediation Function applies to any TETRA Switching and Management Infrastructure (SwMI) which supports the ISI.

2 References

2.1 Normative 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 referenced document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at https://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.

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

[1] 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".

[2] ETSI TS 100 392-3-9: "Terrestrial Trunked Radio (TETRA); Voice plus Data (V+D); Part 3: Interworking at the Inter-System Interface (ISI); Sub-part 9: Transport layer independent, General design".

[3] ETSI TS 100 392-3-12: "Terrestrial Trunked Radio (TETRA); Voice plus Data (V+D); Part 3: Interworking at the Inter-System Interface (ISI); Sub-part 12: Transport layer independent Additional Network Feature Individual Call (ANF-ISIIC)".

[4] ETSI TS 100 392-3-13: "Terrestrial Trunked Radio (TETRA); Voice plus Data (V+D) Part 3: Interworking at the Inter-System Interface (ISI) Sub-part 13: Transport layer independent Additional Network Feature Group Call (ANF-ISIGC)".

[5] ETSI TS 100 392-3-14: "Terrestrial Trunked Radio (TETRA); Voice plus Data (V+D); Part 3: Interworking at the Inter-System Interface (ISI); Sub-part 14: Transport layer independent Additional Network Feature Short Data Service (ANF-ISISDS)".

[6] ETSI TS 100 392-3-15: "Terrestrial Trunked Radio (TETRA); Voice plus Data (V+D); Part 3: Interworking at the Inter-System Interface (ISI); Sub-part 15: Transport layer independent Additional Network Feature, Mobility Management (ANF-ISIMM)".

[7] 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]".

[8] 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]".

[9] 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".

[10] 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".

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

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

[13] ETSI EN 300 172: "Private Integrated Services Network (PISN); Inter-exchange signalling protocol; Circuit-mode basic services [ISO/IEC 11572 (2000) modified]".

[14] ISO/IEC 11571: "Information technology - Telecommunications and information exchange between systems - Private Integrated Services Networks - Addressing".

2.2 Informative 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 referenced document (including any amendments) applies.

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

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

[i.2] ETSI TS 100 392-3-1: "Terrestrial Trunked Radio (TETRA); Voice plus Data (V+D); Part 3: Interworking at the Inter-System Interface (ISI); Sub-part 1: General design".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in ISO/IEC 11582 [10] and the following apply:

call independent: property of information which is conveyed between SwMIs on a signalling connection which is not related to an audio call

call independent signalling connection: signalling connection established between ANF-ISI entities located in different Switching and Management Infrastructures is not related to audio calls

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 [10].

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

ISI Mediation Function: entity which provides to different ANF-ISI entities the services that are not supported by the transport layer protocol

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 uniquely identifies 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

PISN number: number that unambiguously identifies the addressed PINX or an addressable entity associated with that PINX as defined in ISO/IEC 11571 [14]

segmentation: act of generating two or more PDUs derived from one ISI PDU

semi-permanent connection: logical connection between two network nodes (SwMIs)

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: service which 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

terminating SwMI: in the context of a TETRA call, Switching and Management Infrastructure where the called 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.

user information: TETRA coded speech

visited SwMI: TETRA network which MNI is not equal to the user's or the group's MNI

3.2 Abbreviations

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

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
C	Conditional
E.1	E-carrier signal level 1, 2 048 kbit/s
ECMA	European Computer Manufacturers Association
GFP	Generic Functional Protocol
GFT	Generic Functional Transport
GTSI	Group TETRA Subscriber Identity
HDLC	High-level Data Link Control
ISI	Inter-System Interface
ISIIC	Inter System Interface Individual Call
ISIGC	Inter System Interface Group Call
ISIMM	Inter System Interface Mobility Management
ISISDS	Inter System Interface Short Data Service
ISISS	Inter System Interface Supplementary Services
ISSI	Individual Short Subscriber Identity
ITSI	Individual TETRA Subscriber Identity
LAPD	Link Access Procedure for the D-Channel
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
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
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
TX	Transmit
V+D	Voice plus Data

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

4.1 PSS1 Functionality

The TETRA ISI application can use the PSS1 protocol stack for interconnecting Private Integrated 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.

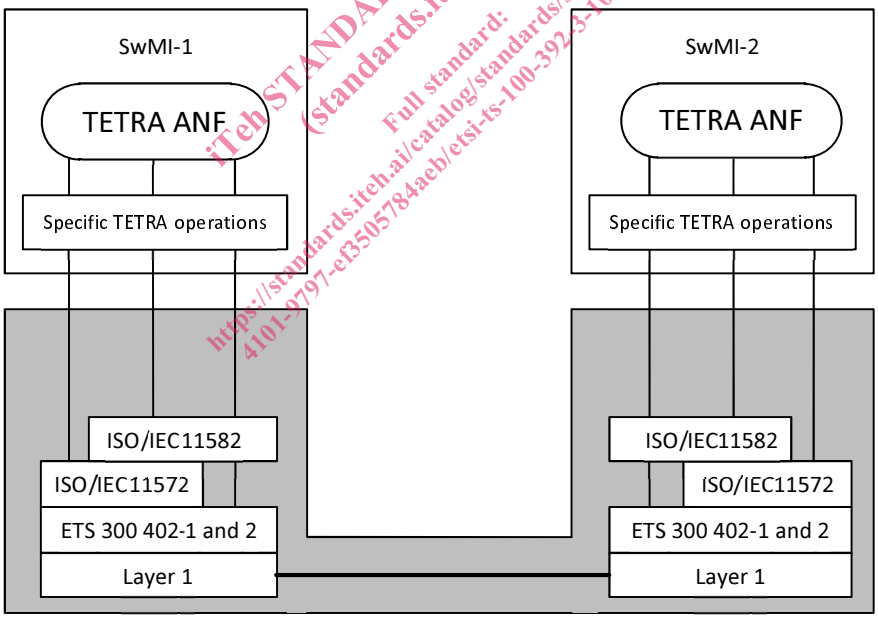
TETRA uses the standard functionalities defined for PSS1:

- 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 is in ISO/IEC 11572 [9].

4.2 Protocol stack for signalling information

Figure 4.1 shows how the protocols for TETRA ANF, which apply at the ISI, are built on top of the PSS1 protocol stack. The ISI APDU is used to convey ANF-ISI Protocol Data Units (PDU). The definition of ISI APDUs and the handling of ISI APDUs in ETSI TS 100 392-3-9 [2] is a subset of the ROSE protocol description [i.1] and are treated as ROSE APDUs in the PSS1 messages.



NOTE: Layer 2 protocol depends on the type of the inter-connection.

Figure 4.1: PSS1 protocol stack for TETRA

The protocol stack shown in figure 4.1 is for signalling information exchange on the common signalling channel i.e. D-channel. LAPD framing as defined in ETSI ETS 300 402-1 [7] and ETSI ETS 300 402-2 [8] and E.1, refer to Recommendation ITU-T G.704 [11], common signalling channel 16 shall be used. Protocol stack for user information exchange is presented in clause 4.4.

4.3 Generic Functional Protocol (GFP)

The GFP as defined in ISO/IEC 11582 [10] shall be used for all TETRA ANFs of the ISI (ANF-ISI).

ISI operations shall be used to convey ANF-ISI information in Facility information elements, as described in clause 5. These Facility information elements shall be included in PSS1 messages in accordance with ISO/IEC 11582 [10]. The specification given in clause 7.1.1.1 of ISO/IEC 11582 [10] as to when an SwMI can send a PSS1 FACILITY message at the earliest shall be understood as follows:

- such message can be sent by a receiving SwMI after it has sent a PSS1 CALL PROCEEDING message (following reception of a PSS1 SETUP message);
- such message can be sent by a source SwMI after it has received one of the following PSS1 messages: FACILITY, PROGRESS, ALERTING, CONNECT.

When the call independent signalling connection is used, it shall be connection oriented.

NOTE: This is in line with the choice made for the definition of all existing supplementary services of the PSS1 protocols.

4.4 Protocol stack for user information

Call control manages transportation of user information e.g. TETRA coded speech on B_Q channels as presented in figure 4.2. In this protocol stack the E.1 channels are 64 kbit/s channels supporting unrestricted digital information, refer to Recommendation ITU-T G.704 [11].

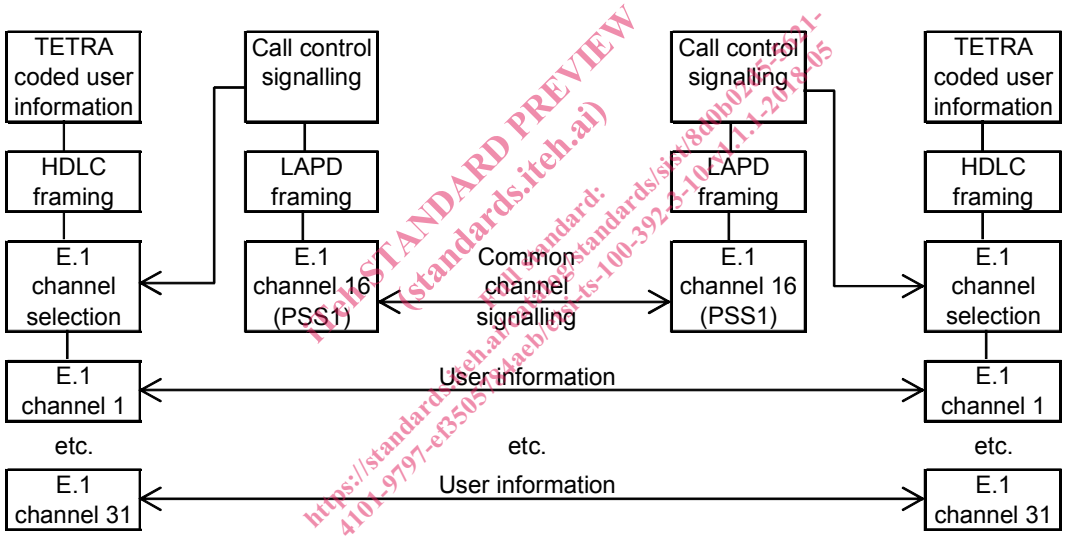


Figure 4.2: User information protocol stack

For speech transmission the TETRA coded user information is speech frames that shall be carried in an B_Q channel using HDLC frames, refer to ETSI TS 100 392-3-8 [1], annex B. The call control negotiates the B_Q channel for each call instance and locally select the negotiated B_Q channel. The mapping between TETRA ISI channels and B_Q channels is defined in ETSI TS 100 392-3-8 [1], annex A. Call control signalling (ETSI TS 100 392-3-12 [3] and ETSI TS 100 392-3-13 [4]), LAPD framing (ETSI ETS 300 402-1 [7] and ETSI ETS 300 402-2 [8]) and E.1 common signalling channel 16 are presented in figure 4.1 for call control.

All or a sub-set of B_Q channels 1 to 15 and 17 to 31 shall be considered to be available for user information transport as negotiated at the PSS1 connection negotiation. It can be assumed that the B_Q channels are physically connected at the same time as the LAPD connection is set-up on the common control channel and there shall be no additional E.1 channel set-up signalling at the link layer.

4.5 User information encoding at the ISI

Whether in a group call or in an individual call, the user information shall be sent over ISI user information connections, which will be considered as B_Q channels by the PSS1 protocols used to establish these calls.