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**Terrestrial Trunked Radio (TETRA);
Voice plus Data (V+D) and Direct Mode Operation (DMO);
Part 18: Air interface optimized applications;
Sub-part 1: Location Information Protocol (LIP)**

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Foreword

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

The present document is part 18, sub-part 1 of a multi-part deliverable covering the Terrestrial Trunked Radio (TETRA); the Voice plus Data (V+D), as identified below:

- ETSI EN 300 392-1: "General network design";
- ETSI EN 300 392-2: "Air Interface (AI)";
- ETSI EN 300 392-3: "Interworking at the Inter-System Interface (ISI)";
- ETSI ETS 300 392-4: "Gateways basic operation";
- ETSI EN 300 392-5: "Peripheral Equipment Interface (PEI)";
- ETSI EN 300 392-7: "Security";
- ETSI EN 300 392-9: "General requirements for supplementary services";
- ETSI EN 300 392-10: "Supplementary services stage 1";
- ETSI EN 300 392-11: "Supplementary services stage 2";
- ETSI EN 300 392-12: "Supplementary services stage 3";
- ETSI ETS 300 392-13: "SDL model of the Air Interface (AI)";
- ETSI ETS 300 392-14: "Protocol Implementation Conformance Statement (PICS) proforma specification";
- ETSI TS 100 392-15: "TETRA frequency bands, duplex spacings and channel numbering";
- ETSI TS 100 392-16: "Network Performance Metrics";
- ETSI TR 100 392-17: "TETRA V+D and DMO specifications";
- ETSI TS 100 392-18: "Air interface optimized applications".**
 - Sub-part 1: "Location Information Protocol (LIP)";**
 - Sub-part 2: "Net Assist Protocol (NAP)";
 - Sub-part 3: "Direct mode Over The Air Management protocol (DOTAM)".

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.

Modal verbs terminology

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1 Scope

The present document defines Location Information Protocol that is optimized for TETRA air interface. It defines services:

- Unsolicited location information reporting.
- Immediate location information reporting.
- Triggered location information reporting.

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 reference document (including any amendments) applies.

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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] IETF RFC 791: "Internet Protocol".
- [4] IETF RFC 3513: "Internet Protocol Version 6 (IPv6) Addressing Architecture".
- [5] ETSI TS 123 032: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); Universal Geographical Area Description (GAD) (3GPP TS 23.032)".

2.2 Informative references

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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 TR 102 021-4: "Terrestrial Trunked Radio (TETRA); User Requirement Specification TETRA Release 2.1; Part 4: Air Interface Enhancements".

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in ETSI EN 300 392-2 [2] and the following apply:

accuracy: requirement on error of location information in location information requests

location server: entity that collects and optionally stores location information and sends location information reports to its clients

TETRA domain: all entities that are addressed using TETRA defined addresses and understand the binary format of the Location Information Protocol

NOTE: This definition may cover entities that are not controlled by TETRA security features.

uncertainty: error estimation of location information in location information reports

3.2 Symbols

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

ra	relationship between original location information source and location information controlling entity
rb	relationship between original location information source and location information destination
rc	relationship between original location information source and location server
rd	relationship between location server and location information controlling entity
re	relationship between location server and location information destination
rf	relationship between the location server in the TETRA domain to the location information controlling entity outside the TETRA domain
rg	relationship between the location server in the TETRA domain to the location information destination entity outside the TETRA domain
rh	relationship between the location server in the TETRA domain to the location information source outside the TETRA domain

3.3 Abbreviations

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

C	Conditional
DMO	Direct Mode Operation
ENE	East North East
ESE	East South East
FE	Functional Entity
GSSI	Group Short Subscriber Identity
GTSI	Group TETRA Subscriber Identity
IPv4	Internet Protocol version 4
IPv6	Internet Protocol version 6
ISSI	Individual Short Subscriber Identity
ITSI	Individual TETRA Subscriber Identity
LIP	Location Information Protocol
M	Mandatory
M-bit	More-bit
MNI	Mobile Network Identity
MS	Mobile Station
NE	North East
NNE	North North East
NNW	North North West
NW	North West
O	Optional

O-bit	Optional-bit
PDU	Protocol Data Unit
REJ	Rejected
SAP	Service Access Point
SDS	Short Data Service
SDS-TL	Short Data Service - Transport Layer
SE	South East
SNDCP SAP	SubNetwork Dependent Convergence Protocol Service Access Point
SSE	South South East
SSI	Short Subscriber Identity
SSW	South South West
SU	Subscriber Unit
SW	South West
TMO	Trunked Mode Operation
TSI	TETRA Subscriber Identity
TxI	Transmit Inhibit
URL	Universal Resource Locator
WGS84	World Geodetic System 1984

NOTE: See <http://www.geoconcept.com/?498/WGS84>

WNW	West North West
WSW	West South West

4 Location information protocol

4.1 General

The Location Information Protocol (LIP) is a TETRA air interface optimized application layer protocol that can utilize various transport mechanisms.

The location information protocol may use SDS-TL service at SDS-TL SAP, refer to ETSI EN 300 392-2 [2], clauses 29.1.1 to 29.5.12 in the case of TETRA MS, though it does not use SDS-TL transport mechanisms to ensure delivery. The same protocol can use packet data at SNDCP SAP as defined in ETSI EN 300 392-2 [2], clause 28 in the case of TETRA MS.

The location information protocol is location determination technology independent, supports a wide variety of location applications and at the same time optimizes usage of air interface resources. The resource optimization considers both message size and the number of messages, particularly for location reporting. The message size optimization is a compromise between the number bits available and user needs, refer to ETSI TR 102 021-4 [i.1], clause 4.4. As a result the present document defines two basic location reports:

- short location report; and
- long location report.

The first is a general report with restricted information elements and with restricted resolution for some of them. The second provides more flexibility and resolution.

In addition to the location reports the present document defines "control messages" to set and modify MS behaviour and initiate sending of location reports.

The location information protocol can be used in various system configurations including:

- MS to MS communication.
- MS to location server communication.
- Location server to MS communication.

NOTE: Although LIP supports direct MS to individual MS communication; the use of it is discouraged as the optimized air interface usage may be compromised. One possibility to maintain air interface optimization is the use of a group address as the destination address.

4.2 Location information protocol system architecture

Location information may be needed in various entities of the TETRA network or outside the TETRA domain. Physical entities identified for the purpose of the present document are:

- Mobile Station (MS) and location accessory providing or using location information.
- Location server inside the TETRA domain collecting location information and providing it to clients.
- Location information transmission controller.
- Location server outside the TETRA domain.
- Entity outside the TETRA domain providing or using location information.

The functions and services that a location server provides to its clients are outside the scope of the present document and any configuration may be used e.g. a dispatcher station can act as a location server.

A location server outside the TETRA domain may communicate with entities in the TETRA domain using the protocol defined in the present document or e.g. a location server inside the TETRA domain may act as a protocol converter and communicate with the location server or client entities outside the TETRA domain using other protocols. The other protocols are outside the scope of the present document.

The location information exchange contains scenarios:

- MS to MS location information exchange without any action in any other entities.
- MS to location server inside the TETRA domain, where MS is the source of location information and the location server may send requests for it.
- Location server to MS, where the location server has location information of a third party, and MS asks for that location information or the location server distributes the third party location information to MS.
- Location server to MS, where the location server has location information of the requesting MS due a network based location determination, and MS asks for that location information.
- Location server sends location information to any entity outside the TETRA domain.
- Any entity outside the TETRA domain sends locations information to location server.
- Location server or MS may control location information sending triggers and define location information destination.
- Location information transmission controller may control location information sending rate.

Some of the scenarios contain security and privacy risks and may not be supported in all systems. Security and privacy issues are outside the scope of the present document.

For the purposes of the present document, the TETRA domain consists of entities that are addressable using TETRA addressing and understand the location information protocol LIP in the binary format of the protocol.

For the purposes of the present document, entities are considered to be outside the TETRA domain when they use and provide location information, but do not support the binary format used in the TETRA location information protocol LIP. They may use any other location information protocol. Any converters between LIP and any other location information protocol are outside the scope of the present document.

For the purposes of the present document protocol Functional Entities (FE) are used in some clauses instead of physical entities:

- | | |
|------|-----------------------------------|
| FE1: | Location information source. |
| FE2: | Location server. |
| FE3: | Location requester. |
| FE4: | Location information destination. |