



**Terrestrial Trunked Radio (TETRA);  
Voice plus Data (V+D): Designers' guide;  
Part 7: TETRA High-Speed Data (HSD);  
TETRA Enhanced Data Service (TEDS)**

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## Foreword

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

The present document is part 7 of a multi-part deliverable covering Terrestrial Trunked Radio (TETRA); Voice plus Data (V+D): Designers' guide, as identified below:

- |                           |   |
|---------------------------|---|
| ETSI ETR 300-1:           | "Overview, technical description and radio aspects";                      |
| ETSI TR 102 300-2:        | "Radio channels, network protocols and service performance";              |
| ETSI TR 102 300-3:        | "Direct Mode Operation (DMO)";  |
| ETSI ETR 300-4:           | "Network management";   |
| ETSI TR 102 300-5:        | "Guidance on numbering and addressing";                                   |
| ETSI TR 102 300-6:        | "Air-Ground-Air";   |
| <b>ETSI TR 102 300-7:</b> | <b>"TETRA High-Speed Data (HSD); TETRA Enhanced Data Service (TEDS)".</b> |

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## Modal verbs terminology

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# 1 Scope

The present document is aimed at a readership with a technical background wishing to have an overall understanding of the TEDS architecture, parameters and features for embarking on any of the following activities *before reading the standard*:

- 1) design and development of TETRA 2 network and equipment;
- 2) system and technical support activity in procurement phases of a TETRA 2 network;
- 3) upgrading of an existing TETRA network to a TEDS capable network;
- 4) applications development activity.

This list is not exhaustive. Although the emphasis is on a readership with a technical background a selective reading of the contents will also be of benefit to non-technical personnel engaged on other aspects of a TETRA 2 network. No market or user type information nor a competitive analysis with respect to other technologies or standards are included.

If any conflict is found between the present document and the clauses in the TETRA standard ETSI EN 300 392-2 [i.2] V3.7.1, or later versions, then the standard takes precedence. In addition to describing TEDS architecture, parameters and features, the present document provides detailed system simulation results and typical link budget calculations to assist readers in their outline radio coverage planning. The effect of using TETRA 2 terminals in high velocity environments such as trainborne, not included in the standard, is also evaluated in the present document.

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## 2 References

### 2.1 Normative references

Normative references are not applicable in the present document.

### 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] | ISO/IEC 8348: "Information technology -- Open Systems Interconnection -- Network service definition".  |
| [i.2] | ETSI EN 300 392-2: "Terrestrial Trunked Radio (TETRA); Voice plus Data (V+D); Part 2: Air Interface (AI)".   |
| [i.3] | ETSI EN 300 394-1: "Terrestrial Trunked Radio (TETRA); Conformance testing specification; Part 1: Radio".  |
| [i.4] | ETSI EN 301 344: "Digital cellular telecommunications system (Phase 2+) (GSM); General Packet Radio Service (GPRS); Service description; Stage 2 (GSM 03.60)".   |
| [i.5] | ETSI TS 122 060: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); General Packet Radio Service (GPRS); Service description; Stage 1 (3GPP TS 22.060)". |
| [i.6] | IETF RFC 1144: "Compressing TCP/IP headers for low-speed serial links".  |

- [i.7] IETF RFC 2507: "IP Header Compression".
- [i.8] IETF RFC 2508: "Compressing IP/UDP/RTP Headers for Low-Speed Serial Links".
- [i.9] IETF RFC 1977: "PPP BSD Compression Protocol".
- [i.10] IETF RFC 1978: "PPP Predictor Compression Protocol".
- [i.11] IETF RFC 3095: "RObust Header Compression (ROHC): Framework and four profiles: RTP, UDP, ESP and uncompressed".
- [i.12] ETSI EN 300 392-1: "Terrestrial Trunked Radio (TETRA); Voice plus Data (V+D); Part 1: General network design".
- [i.13] ETSI EN 300 396-3: "Terrestrial Trunked Radio (TETRA); Technical requirements for Direct Mode Operation (DMO); Part 3: Mobile Station to Mobile Station (MS-MS) Air Interface (AI) protocol".
- [i.14] ETSI ETR 300-1 (1997): "Terrestrial Trunked Radio (TETRA); Voice plus Data (V+D); Designers' guide; Part 1: Overview, technical description and radio aspects".
- [i.15] ETSI TR 102 491: "Electromagnetic compatibility and Radio spectrum Matters (ERM); TETRA Enhanced Data Service (TEDS); System reference document".
- [i.16] ETSI EN 300 113-1 (V1.6.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Land mobile service; Radio equipment intended for the transmission of data (and/or speech) using constant or non-constant envelope modulation and having an antenna connector; Part 1: Technical characteristics and methods of measurement".
- [i.17] CEPT ERC Report 68: "Monte-Carlo Simulation Methodology for the use in Sharing and Compatibility Studies between Different Radio Services or Systems", Naples, February 2000, revised in Regensburg, May 2001 and Baden, June 2002.
- [i.18] ERO: "SEAMCAT-3 User Manual", November 2005.
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## 3 Definitions and abbreviations

### 3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

**access code:** subdivision of mobiles for random access opportunities

**acknowledged data transfer:** service provided by the layer below which gives an acknowledgement back over the air interface from the lower layer peer entity

NOTE: This service is used by the layer 3 entities to get a secure transmission including retransmissions.

**adjacent-channel interference:** interference caused by coupling from a signal in an adjacent channel

**advanced link:** bidirectional connection-oriented path between an MS and a BS using the acknowledged service - or unidirectional connection-oriented path between a BS and one or several MSs using the unacknowledged service - with provision of windowing, segmentation, extended error protection and choice among several throughputs

NOTE: The advanced link requires a set-up phase.

**air-interface:** wireless interface between a base station and a mobile station (trunked mode) or between two mobile stations (direct mode)

**announced cell reselection:** cell reselection where the MS MLE informs the SwMI both in the old cell (leaving cell) and in the new cell (arriving cell) that cell change is performed

**assessment:** act of estimating the path loss parameter of the serving cell main carrier or of a channel class (on the serving cell or an adjacent cell), based on measurements made on another channel or carrier radiated from the same site and applying conversion factors to those measurements

**assigned channel:** channel allocated by the infrastructure to certain MSs using channel allocation command(s) addressed to those MSs

NOTE: An assigned channel may be allocated for secondary control purposes or for a circuit mode call.

**Associated Control Channel (ACCH):** dedicated signalling channel associated with a channel that has been assigned for circuit mode traffic

NOTE: It comprises the Fast Associated Control Channel (FACCH) which uses frames 1 to 18 when there is no traffic in a given direction or the Slow Associated Control Channel (SACCH) which is always available in frame 18 when there is traffic.

**background class data:** data that requires high delivery reliability but can tolerate delay

**background measurement:** measurements performed by the lower layers while maintaining the current service to the service users, i.e. the MS MLE

**basic link:** bidirectional connectionless path between one or several MSs and a BS, with provision of both unacknowledged and acknowledged services on a single message basis

**baud rate:** equivalent to signalling rate or symbol rate

**broadcast:** unidirectional point to multi-point mode of transmission

**burst header:** burst identifier (carrying a SICCH channel for all burst types, plus an AACH channel for the NDB)

**burst payload:** section of burst carrying traffic channel information

**C-plane:** plane for control and packet data signalling

**carrier specific signalling:** additional  $\pi/4$ -DQPSK common signalling channel allocated in conjunction with a traffic channel specific to the carrier

**cell reselection:** act of changing the serving cell from an old cell to a new cell

NOTE: Cell reselection is performed by procedures located in the MLE and in the MAC. When the reselection is made and possible registration is performed, the MS is said to be attached to the cell.

**channel class:** set of values indicating the general RF characteristics of a concentric channel or fully super-sectored channel

**channel estimation:** process of estimating the degradation of a digital radio channel by the propagation effect to apply correction

**cipher key:** value that is used to determine the transformation of plain text to cipher text in a cryptographic algorithm

**cipher text:** data produced through the use of encipherment

**co-channel interference:** interference between two different communication channels re-using the same frequency

**coherent detection:** conversion of the intermediate frequency (IF) signal to I and Q components so that the phase of the components is preserved

**Common Cipher Key (CCK):** cipher key that is generated by the infrastructure to protect group addressed signalling and traffic

NOTE: CCK is also used for protection of SSI identities (ESI) in layer 2.

**common control channels:** control channels transmitted by the infrastructure to control the MS population

NOTE: The common control channels comprise the  $\pi/4$ -DQPSK Main Control CHannel (MCCH) or QAM Main Control CHannel (MCCH-Q), and common Secondary Control CHannels (common SCCH).

**concentric channel:** channel that has essentially the same azimuthal radiation pattern as the main carrier and is radiated from the same site as the main carrier

**conforming channel:** channel that has essentially the same azimuthal radiation pattern as the main carrier, is radiated from the same site as the main carrier and has essentially the same range and coverage area as the main carrier

NOTE: A conforming channel is a special case of a concentric channel.

**Conventional Access (CA):** method of operation in which the main carrier uses phase modulation

**Conventional Access (CA) cell:** cell on which the main carrier uses phase modulation

**Conventional Access (CA) MS:** MS that is currently camped on a conventional access cell

**Cyclic Redundancy Check (CRC):** algorithm for detection and correction of accidental errors in a data stream

**D8PSK channel:** channel on which signalling and data messages are sent using either  $\pi/4$ -DQPSK bursts or  $\pi/8$ -D8PSK bursts

**delay spread:** measure of channel time dispersion due to multipath propagation

NOTE: The larger the delay spread (i.e. the relative propagation delays along the various paths), the more pronounced the channel frequency selectivity.

**Derived Cipher Key (DCK):** key generated during authentication for use in protection of individually addressed signalling and traffic

**Direct Access (DA):** method of operation in which the main carrier uses QAM

**Direct Access (DA) cell:** cell on which the main carrier uses QAM

**Direct Access (DA) MS:** MS that is currently camped on a direct access cell

**doppler bandwidth:** Same as doppler spread.