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Terrestrial Trunked Radio (TETRA); Voice plus Data (V+D); Part 19: Interworking between TETRA and Broadband systems; Sub-part 2: Format for the transport of TETRA speech over mission critical broadband systems

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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 19, sub-part 2 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)":

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";

Part 19: "Interworking between TETRA and Broadband systems";

Sub-part 1: "Critical Communications Architecture for Interworking between TETRA and Broadband applications";

Sub-part 2: "Format for the transport of TETRA speech over mission critical broadband systems".

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

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).

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Introduction

The present document defines a TETRA speech transportation format that may be applied over IP networks using RTP and UDP encapsulation.

1 Scope

The present document defines a media format for the transport of TETRA air interface circuit mode speech over IP networks at the 20 ms packet delivery rate typically used by broadband networks.

The present document does not apply to the transportation of TETRA speech over the TETRA ISI. The transportation of TETRA speech over the TETRA ISI is defined by ETSI TS 100 392-3-8 [1].

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/.

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

[3] ETSI EN 300 395-2: "Terrestrial Trunked Radio (TETRA); Speech codec for full-rate traffic channel; Part 2: TETRA codec".

[4] ETSI EN 302 109: "Terrestrial Trunked Radio (TETRA); Security; Synchronization mechanism for end-to-end encryption".

[5] IETF RFC 3550: "RTP: A Transport Protocol for Real Time Applications".

[6] IETF RFC 4566: "SDP: Session Description Protocol".

[7] IETF RFC 3264: "An Offer/Answer Model with Session Description Protocol (SDP)".

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 TS 122 280: "LTE; Mission Critical Services Common Requirements (3GPP TS 22.280)".

[i.2] ETSI TS 123 379: "LTE; Functional architecture and information flows to support Mission Critical Push To Talk (MCPTT); Stage 2 (3GPP TS 23.379)".

[i.3] IETF RFC 3095: "RObust Header Compression (ROHC): Framework and four profiles: RTP, UDP, ESP, and uncompressed".

[i.4] IETF RFC 3261: "SIP: Session Initiation Protocol".

3 Definition of terms, symbols and abbreviations

3.1 Terms

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

C-plane signalling: TETRA control plane signalling messages [2]

NOTE: C-plane signalling can contain DTMF signalling

encryption synchronization information: sequence of symbols that is transmitted to the receiving terminal to synchronize an encryption key stream generator in the receiving terminal with an encryption key stream generator in the transmitting terminal

end-to-end encryption: encryption that is applied by an originating terminal or client and is decrypted only by chosen terminating terminals or clients

first half slot signalling packet: signalling packet that is associated with a first half slot speech frame

first half slot speech frame: TETRA ACELP speech frame that can be sent in the first half of a TETRA TDMA time slot [3]

NOTE: The TETRA ACELP codec generates first half slot speech frames and second half slot speech frames, and the decoder needs to be able to distinguish between these.

interworking function: function that enables interworking between land mobile radio systems and 3GPP defined mission critical systems

land mobile radio: Private Mobile Radio (PMR)

mission critical: quality or characteristic of a communication activity, application, service or device that requires low setup and transfer latency, high availability and reliability, ability to handle large numbers of users and devices, strong security and priority and pre-emption handling [i.1]

mission critical system: 3GPP system providing mission critical communication services [i.1]

payload block: information element that can contain a speech frame and/or a partial or full signalling packet

second half slot signalling packet: signalling packet that is associated with a second half slot speech frame

second half slot speech frame: TETRA ACELP speech frame that can be sent in the second half of a TETRA TDMA time slot [3]

NOTE: The TETRA ACELP codec generates first half slot speech frames and second half slot speech frames, and the decoder needs to be able to distinguish between these.

signalling packet: block of data comprising U-plane signalling or C-plane signalling

speech frame pair: pair of speech frames comprising a first half slot speech frame and a second half slot speech frame [3]

speech frame pair number: cyclical sequence number of a speech frame pair and any associated signalling packets

NOTE: The speech frame pair number is incremented at 60 ms intervals even if there are no speech frames or signalling packets to be transmitted for that speech frame pair number.

TDMA frame: repeating time unit comprising a set of timeslots and representing a time subdivision of a frequency channel [2]

TDMA frame number: cyclical sequence number of a TDMA frame [2]

timeslot: defined time interval within a TDMA frame [2]

U-plane signalling: TETRA encryption synchronization information and/or user-to-user signalling messages [2]

user-to-user signalling: signalling messages private to user applications

3.2 Symbols

Void.

3.3 Abbreviations

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

3GPP	Third Generation Partnership Project
ACELP	Algebraic Code-Excited Linear Predictive
BB	BroadBand
CSRC	Contributing SouRCe
DTMF	Dual Tone Multiple Frequency
E2EE	End-to-End Encryption
IANA™	Internet Assigned Numbers Authority
IE	Information Element
IETF	Internet Engineering Task Force
IP	Internet Protocol
ISI	Inter System Interface
IWF	InterWorking Function
MCPTT	Mission Critical Push To Talk
MS	Mobile Station
PDU	Protocol Data Unit
PSTN	Public Switched Telephone Network
RFC	Request For Comment
RoHC	Robust Header Compression
RTP	Real-time Transport Protocol
SDP	Session Description Protocol
SIP	Session Initiation Protocol
SSRC	Synchronization SouRCe
SwMI	Switching and Management Infrastructure
TDMA	Time Division Multiple Access
TETRA	Terrestrial Trunked Radio
UDP	User Datagram Protocol
V+D	Voice plus Data

4 Overview

Independently of SwMI or broadband network implementation, TETRA speech, U-plane signalling and C-plane signalling can be carried in packets over broadband networks.

The media format defined in the present document allows RTP packets [5] containing TETRA ACELP speech frames [3] and signalling to be transported through an IP network at 20 ms intervals.

A typical application is end-to-end encrypted voice calls between TETRA users and mission critical users [i.2]: end-to-end encrypted TETRA speech is carried between the TETRA interworking function (IWF) and mission critical users via the transport protocol defined in the present document.

The transmission defined in the present document is "packet mode" and packets may be subject to jitter. The maximum jitter is a system specific characteristic. The value of the allowable maximum jitter value is outside the scope of the present document.

5 Broadband Traffic PDU format and procedures

5.1 General on broadband traffic PDU contents

TETRA is a radio system where normally at least one end of the communication uses the TETRA air interface. Where there is a requirement for TETRA equipment to interwork with equipment on a broadband network, TETRA speech and traffic mode signalling can be transported over the broadband network in "broadband traffic" PDUs. The structure of the TETRA air interface sets some requirements on the broadband traffic PDU contents and format. The main structure of TETRA speech encoding and traffic mode signalling is retained. TETRA-compatible MSs, the TETRA SwMI and the TETRA traffic PDU support:

- 30 ms speech frame and/or traffic mode signalling generation period [3]; and
- ACELP speech coding and reservation for other codecs.

The TETRA speech and traffic mode signalling can originate from a TETRA MS, an MCPTT client [i.2] containing a TETRA speech codec or a TETRA or MCPTT despatcher or a PSTN gateway.

TETRA voice media comprises a sequence of speech frame pairs, each pair comprising a first half slot speech frame and a second half slot speech frame, although individual speech frames may be dropped or "stolen" (i.e. replaced by an associated signalling packet). The receiver needs to be able to distinguish between first half slot and second half slot speech frames, and the broadband traffic PDU provides this distinction. A stolen or otherwise unavailable speech frame is indicated in the broadband traffic PDU to facilitate re-use of the relevant TDMA timeslot for other signalling purposes within a terminating TETRA system. A second half slot speech frame cannot be stolen unless the first half slot speech frame has also been stolen.

TETRA traffic mode signalling needs to be associated with a specific speech frame, and the broadband traffic PDU provides this association. The traffic mode signalling can carry TETRA U-plane signalling [2]. U-plane signalling can be used to carry end-to-end encryption synchronization information as specified in ETSI EN 302 109 [4].

The traffic mode signalling is carried in a "signalling packet". A signalling packet can contain a TETRA MAC-U-SIGNAL PDU. The use of this PDU shall be as specified in ETSI EN 300 392-2 [2].

The broadband traffic PDU is transported as RTP payload [5], there being one broadband traffic PDU per RTP packet. RTP usage is defined in Annex A. Padding bits ensure that the broadband traffic PDUs end on octet boundaries. This causes the containing RTP packets to end on octet boundaries, as required when sent via UDP.

5.2 TETRA payload

5.2.1 TETRA payload encoding

The protocol has been designed to support the transport of TETRA voice media in the form of speech codec frames (single/dual) and TETRA U-plane and C-plane services. The present document describes in detail the broadband traffic PDU formats for TETRA speech codec frames and TETRA U-plane and C-plane services. The generic payload structure is presented in figure 5.1.

Payload Header	Payload Block

Figure 5.1: TETRA payload structure

The payload header (contents control information element) indicates the presence and contents of the payload block (e.g. speech frame and/or signalling packet or no traffic).

The TETRA speech and signalling are transmitted over the broadband network in RTP packets. The RTP packets are transmitted at 20 ms intervals in a three-phase cycle (phase-0, phase-1 and phase-2) that allows the 20 ms broadband delivery rate to be reconciled with the TETRA 60 ms speech frame pair generation rate.