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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).

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

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

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.

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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.

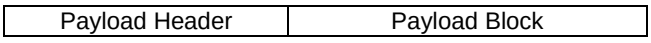

Figure 5.1: TETRA payload structure

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.

The payload format allows some or all signalling packets to be transmitted without stealing speech frames, facilitating fast end-to-end encryption synchronization without speech quality loss for TETRA speech that originates and terminates within the broadband network. The speech frames include a "stealing recommendation" indication that is used by the TETRA IWF to determine which speech frames to steal when delivering the speech and signalling to a TETRA SwMI. An originator in the broadband network should set the "stealing recommendation" indication at intervals suitable for a receiver using a TETRA SwMI as illustrated in ETSI EN 302 109, clause 4.4.3 [4].

When stealing is used, either the first half slot speech frame is stolen or both the first half slot and the second half slot speech frames are stolen. A second half slot shall not be stolen unless the preceding first half slot has been stolen.

RTP packets contain a timestamp [5]. Because the sample period for speech in the TETRA codec is 0,125 ms and there are 30 ms of coded speech in each speech frame, the timestamp is incremented by 240 units between RTP packets that can contain consecutive speech frames.

More specifically:

- the present document specifies which RTP packets can contain speech frames;
- the timestamp is incremented by 240 units between RTP packets that can contain consecutive speech frames (even if the speech frame or RTP packet is absent);
- an RTP packet that cannot contain a speech frame carries a timestamp equal to that in the immediately preceding RTP packet.

5.2.2 Broadband traffic PDU

The broadband traffic PDU carries TETRA voice media in the form of speech frames. The PDU may also carry signalling packets associated with the speech frames. The PDU is comprised of the following information elements, see table 5.1:

- Speech frame pair number: this information element indicates the sequence of speech frame pairs and the relationship of signalling packets to speech frame pairs in the payload block.
- Information element control: this information element indicates the presence or absence of the "additional information" information element.
- Additional information: this information element allows for future expansion of the broadband traffic PDU.
- Traffic type: this information element identifies the type of circuit mode speech.
- Payload type: this information element indicates type of payload that follows.
- Basic payload, reserved, reserved, reserved: one of these information elements is selected by the "payload type" information element. The basic payload carries the speech frames and signalling packets.

The basic payload shall be the default payload format if no other payload format is specified in the SDP negotiation (clause A.3).

NOTE: The length of this PDU is an exact number of octets.

Table 5.1: Broadband traffic PDU

Information element	Length	Type	C/O/M	Remarks
Speech frame pair number	5	1	M	
Information element control	2	1	M	Shall be set to a value "0".
Additional information	32		C	See notes 1 and 2.
Traffic type	4	1	M	
Payload type	2	1	M	
Basic payload	Variable		C	See note 3.
Reserved	Variable		C	See note 3.
Reserved	Variable		C	See note 3.
Reserved	Variable		C	See note 3.
NOTE 1: The "additional information" information element allows future expansion of the PDU. NOTE 2: Shall be present as defined in the "information element control" information element. NOTE 3: One of these shall be present as defined in the "payload type" information element.				

5.2.3 Basic Payload

When the basic payload format is used, signalling packets associated with first half slot speech frames can be transported without stealing, facilitating fast end-to-end encryption synchronization without speech quality loss for TETRA speech that originates and terminates within the broadband network. Signalling packets associated with second half slot speech frames can be sent only by stealing (i.e. by replacing the speech frame with the corresponding signalling packet). The basic payload shall be the default payload format if no other payload format is specified in the SDP negotiation (clause A.3).

The speech frames and signalling packets are sent a phase-0 basic block, a phase-1 basic block and a phase-2 basic block. The basic blocks are sent in the following three-phase 60 ms cycle:

Phase 0 (clause 5.3.9): 0 ms: s1; 137 bits (plus 3 control bits)

Phase 1 (clause 5.3.11): 20 ms: u1; 127 bits (plus 1 control bit)

Phase 2 (clause 5.3.13): 40 ms: s2 or u2; 137 or 127 bits (plus 3 or 2 control bits)

Where:

the phase timing indicates the elapsed time after a first half slot speech frame becomes available;

s1 and s2 represent first half slot and second half slot speech frames;

u1 and u2 represent first half slot and second half slot signalling packets;

maximum size of broadband traffic PDUs: 160 bits;

scheduled bit rate for broadband traffic PDUs: 8,00 kbps;

maximum actual bit rate of broadband traffic PDUs: 7,73 kbps;

minimum actual bit rate of broadband traffic PDUs (no signalling packets): 5,60 kbps;

delay from speech frame availability at transmitter to start of decoding; not using end-to-end encryption: 10 ms (excluding transmission delays);

delay from speech frame availability to start of decoding; using end-to-end encryption: 10 ms (excluding transmission delays).

NOTE 1: In speech originating from a TETRA MS, signalling packets are sent by stealing. If the phase-0 basic block originating from a TETRA MS contains a speech frame, the phase-1 basic block from the same cycle does not contain a signalling packet. If the phase-1 basic block originating from a TETRA MS contains a signalling packet, the phase-0 basic payload from the same cycle does not contain a speech frame.

NOTE 2: The above PDU sizes and bit rates assume the "additional information" information element is not included.

NOTE 3: The RTP packets are 96 bits greater than the broadband traffic PDUs. Uncompressed IP/UDP/RTP packets are 320 bits greater than the broadband traffic PDUs.

NOTE 4: To obtain the bit rates for RTP packets, add 4,8 kbps to the broadband traffic PDU bit rates. To obtain the bit rates for uncompressed IP/UDP/RTP packets, add 16 kbps to the broadband traffic PDU bit rates.

5.3 Broadband traffic PDU information elements

5.3.1 Additional information

The Additional information information element shall be encoded as defined in table 5.2.

Table 5.2: Contents of the Additional information information element

Information element	Length	Value	Remarks
Additional information	32	0	Reserved for additional information.
		etc.	etc.
		$2^{32} - 1$	Reserved for additional information.

5.3.2 Basic payload

The Basic payload information element shall be encoded as defined in table 5.3.

Table 5.3: Contents of the Basic payload information element

Information element	Length	Type	C/O/M	Remarks
Phase	2	1	M	
Phase-0 basic block	Variable		C	See note.
Phase-1 basic block	Variable		C	See note.
Phase-2 basic block	Variable		C	See note.
NOTE: One of these shall be present as indicated by the "phase" information element.				

5.3.3 E2EE

The E2EE information element shall be encoded as defined in table 5.4.

Table 5.4: Contents of the E2EE information element

Information element	Length	Value	Remarks
E2EE	1	0	Speech frame is not end-to-end encrypted.
		1	Speech frame is end-to-end encrypted, see note.
NOTE: This value shall not be used unless agreed during SDP negotiation.			

5.3.4 Information element control

The Information element control present information element shall be encoded as defined in table 5.5.

Table 5.5: Contents of the information element control information element

Information element	Length	Value	Remarks
Information element control	2	0	"Additional information" information element is not present, see note 1.
		1	"Additional information" information element is present, see notes 1 and 2.
		2	See notes 1 and 3.
		3	See notes 1 and 3.
NOTE 1: For the present document only the value "0" is applicable. NOTE 2: If this value is received the PDU should not be discarded. NOTE 3: If this value is received the PDU shall be discarded.			

5.3.5 Payload type

The payload type information element shall be encoded as defined in table 5.6.

Table 5.6: Contents of the payload type information element

Information element	Length	Value	Remarks
Payload type	2	0	Basic payload.
		1	Reserved, see notes 1 and 2.
		2	Reserved, see notes 1 and 2.
		3	Reserved, see notes 1 and 2.
NOTE 1: This value shall not be used in the present document. NOTE 2: The PDU shall be discarded if this value is received.			

5.3.6 Phase

The phase information element shall be encoded as defined in table 5.7.

Table 5.7: Contents of the Phase information element

Information element	Length	Value	Remarks
Phase	2	0	Phase-0.
		1	Phase-1.
		2	Phase-2.
		3	Reserved. See notes 1 and 2.
NOTE 1: This value shall not be used in the present document. NOTE 2: The PDU shall be discarded if this value is received.			

5.3.7 Phase-0 basic block

The phase-0 basic block information element shall be encoded as defined in table 5.8. When a PDU including this element is transmitted the timestamp in the containing RTP packet shall be incremented as described in clause 5.2.1.

Table 5.8: Contents of the Phase-0 basic block information element

Information element	Length	Type	C/O/M	Remarks
Speech frame status	2	1	M	
E2EE	1		C	See note 1.
Speech frame	137		C	See notes 1, 2 and 3.
Padding-a	7		C	Shall be set to "0". See note 4.
Padding-b	5		C	Shall be set to "0". See note 5.
NOTE 1: Shall be present if "speech frame status" = "speech frame present" or "speech frame present, recommended for stealing". NOTE 2: If present, shall contain the first half-slot speech frame of the present speech frame pair. NOTE 3: The speech frame is defined in ETSI EN 300 395-2 [3]. NOTE 4: Shall be present if the "speech frame" information element is not present. NOTE 5: Shall be present if the "speech frame" information element is present.				

5.3.8 Phase-1 basic block

The phase-1 basic block information element shall be encoded as defined in table 5.9. When a PDU including this element is transmitted the timestamp in the containing RTP packet shall not be incremented.

Table 5.9: Contents of the Phase-1 basic block information element

Information element	Length	Type	C/O/M	Remarks
Signalling packet status	1	1	M	
Signalling packet	127		C	See notes 1, 2 and 3.
Padding-d	1		C	Shall be set to "0". See note 1.
NOTE 1: Shall be present if signalling packet status = "present". NOTE 2: If present, shall contain a first half-slot signalling packet for the present speech frame pair number. NOTE 3: There are no padding bits if the signalling packet is not present.				

5.3.9 Phase-2 basic block

The phase-2 basic block information element shall be encoded as defined in table 5.10. When a PDU including this element is transmitted the timestamp in the containing RTP packet shall be incremented as described in clause 5.2.1.

Table 5.10: Contents of the Phase-2 basic block information element

Information element	Length	Type	C/O/M	Remarks
Speech frame status	2	1	M	
E2EE	1		C	See note 1.
Speech frame	137		C	See notes 1, 2 and 3.
Signalling packet	127		C	See notes 4, 5 and 8.
Padding-e	7		C	Shall be set to "0". See note 6.
Padding-f	5		C	Shall be set to "0". See note 7.
NOTE 1: Shall be present if "speech frame status" = "speech frame present" or "speech frame present, recommended for stealing". NOTE 2: If present, shall contain the second half-slot speech frame of the present speech frame pair number. NOTE 3: The speech frame is defined in ETSI EN 300 395-2 [3]. NOTE 4: Shall be present if "speech frame status" = "speech frame not present because stolen". NOTE 5: If present, shall contain a second half slot signalling packet for the present speech frame pair number. NOTE 6: Shall be present if "speech frame" is not present and "signalling packet" is not present. NOTE 7: Shall be present if "speech frame" is present. NOTE 8: There are no padding bits if the signalling packet is present.				

5.3.10 Signalling packet

The signalling packet information element shall be encoded as defined in table 5.11.

Table 5.11: Contents of the signalling packet information element

Information element	Length	Type	C/O/M	Remarks
Signalling packet type	2	1	M	Shall be set to "0" in the present document.
Supplementary signalling packet type	1		C	Shall be set to "0" in the present document. See note 1.
MAC-U-SIGNAL PDU	124		C	See notes 2 and 3.
Reserved	124		C	See note 4.
Reserved	125		C	See note 5.
NOTE 1: Shall be present if "signalling packet type" has value "0". NOTE 2: Shall be present if "supplementary signalling packet type" has value "0". NOTE 3: The MAC-U-SIGNAL PDU is defined in ETSI EN 300 392-2 [2]. NOTE 4: Shall be present if "supplementary signalling packet type" has value "1". NOTE 5: Shall be present if "signalling packet type" does not have value "0".				

5.3.11 Signalling packet type

The signalling packet type information element shall be encoded as defined in table 5.12.

Table 5.12: Contents of the signalling packet type information element

Information element	Length	Value	Remarks
Signalling packet type	2	0	MAC-U-SIGNAL PDU or reserved supplementary signalling packet type.
		1	Reserved.
		2	Reserved.
		3	Reserved.

5.3.12 Signalling packet status

The signalling packet status information element shall be encoded as defined in table 5.13.

Table 5.13: Contents of the signalling packet status information element

Information element	Length	Value	Remarks
Signalling packet status	1	0	Not present.
		1	Present.

5.3.13 Speech frame pair number

The speech frame pair number information element in the payload header shall be encoded as defined in table 5.14.

The speech frame pair number information element can be used by the destination codec in conjunction with the "phase" information element introducing the payload block to monitor the sequence of speech frames and associated signalling packets.

When the speech originates from a TETRA MS, the speech frame pair number in the payload header may represent the TETRA TDMA frame number associated with the material in the payload when the TETRA base station received it over the TETRA air interface.

Table 5.14: Contents of the speech frame pair number information element

Information element	Length	Value	Remarks
Speech frame pair number	5	0	Reserved.
		1	Speech frame pair 1.
		2	Speech frame pair 2.
		etc.	etc.
		17	Speech frame pair 17.
		18	Reserved.
		19	Reserved.
		20	Reserved.
		etc.	etc.
		31	Reserved.

5.3.14 Speech frame status

The speech frame status information element shall be encoded as defined in table 5.15.

Table 5.15: Contents of the Speech frame status information element

Information element	Length	Value	Remarks
Speech frame status	2	0	Speech frame present.
		1	Speech frame present; recommended for stealing.
		2	Speech frame not present because stolen.
		3	Speech frame not present for other reason.

5.3.15 Supplementary signalling packet type

The supplementary signalling packet type information element shall be encoded as defined in table 5.16.

Table 5.16: Contents of the supplementary signalling packet type information element

Information element	Length	Value	Remarks
Supplementary signalling packet type	1	0	MAC-U-SIGNAL PDU.
		1	Reserved.

5.3.16 Traffic type

The Traffic type information element shall be encoded as defined in table 5.17.

Table 5.17: Contents of the Traffic type information element

Information element	Length	Value	Remarks
Traffic type	4	0	ACELP, refer to ETSI EN 300 395-2 [3].
		1	Reserved for codec 2.
		2	Reserved for codec 3.
		3	Proprietary codec.
		Other	Reserved.

Annex A (normative): User information transport in RTP session

A.1 General

When SIP/IP [i.4] is used for the transport of signalling, the traffic user information (TETRA payload) related to a call shall be carried in one RTP session as defined in IETF RFC 3550 [5].

A.2 RTP usage

The traffic PDU is transported as an RTP payload in a generic RTP packet, to be carried over a standard UDP/IP envelope.

The format of the RTP packet to be used for the transmission of the traffic PDU is shown in table A.1. The table is re-arranged with respect to the IETF RFC 3550 [5] for coherence with the rest of the present document; however, the expected transmission order of the bits is still the same. Many fields shall assume the fixed values shown in table A.1.

Table A.1: RTP Packet for broadband traffic

Information element	Length	Value	Remarks
Version	2	2	RTP version 2.
Padding	1	0	padding not used (TETRA payload always octet-aligned).
Extension	1	0	Header extension not used.
CSRC count	4	0	Number of Contributing sources always 0.
Marker	1		Not used, could be any.
Payload Type	7		TETRA Speech Format for broadband. See note 4.
Sequence number	16		Incremented by one at each transmitted packet. See note 2.
Timestamp	32		Sequential time. See note 1.
SSRC	32		Synchronization source. See note 2.
Broadband traffic PDU	variable		See clause 5.2.2, see note 3.

NOTE 1: According to IETF RFC 3550 [5] "for fixed-rate audio the timestamp clock would likely increment by one for each sampling period", therefore, because the sample period for speech in the TETRA codec is 0,125 ms and there are 30 ms of coded speech in each speech frame:
- the present document specifies which RTP packets can contain speech frames;
- the timestamp is incremented by 240 units in RTP packets that can carry speech frames (even if the speech frame or RTP packet is absent);
- an RTP packet that cannot contain a speech frame carries a timestamp equal to that in the immediately preceding RTP packet.

NOTE 2: The SSRC is an initially random number sent by the transmitting entity generating the traffic. A restarted value in the sequence number may occur every time the talking party changes during a call. The SSRC changes every time the talking party changes. (The SSRC is used for encryption synchronization of the RTP packets). The IWF has to allocate speech items with changed SSRCs to the TETRA call defined by the speech items' IP + UDP addresses.

NOTE 3: The relationship between a call and RTP packets flow is defined during call establishment and is associated to the destination IP address and UDP port.

NOTE 4: Payload type value could be any dynamic payload type value (IETF RFC 4566 [6]) and it is negotiated by the gateways during call establishment.

RTP packets containing a TETRA traffic PDU are sent using UDP/IP protocol stacks. Although RTP/UDP/IP header compression (and especially RoHC defined in IETF RFC 3095 [i.3]) is somehow advisable because of the small packet dimensions, no header compression is specified in the present document.

A.3 Session Description Protocol

A.3.1 General

The Session Description Protocol (SDP) is used to negotiate the media on which the media shall flow between two endpoints, for example Individual Call and Group Call. The SDP is described in IETF RFC 4566 [6].

The TETRA ACELP codec can be offered in the Session Description Protocol (SDP) [6] offer/answer negotiation during call establishment.

The following clauses describe the usage of mandatory lines of an SDP offer and answer.

A.3.2 Protocol Version ("v=")

See IETF RFC 4566 [6].

A.3.3 Origin ("o=")

See IETF RFC 4566 [6].

A.3.4 Session Name ("s=")

See IETF RFC 4566 [6].

A.3.5 Connection Data ("c=")

See IETF RFC 4566 [6].

A.3.6 Timing ("t=")

See IETF RFC 3264 [7].

A.3.7 Media Type ("m=") and associated Attributes ("a=")

The Media Type field is defined as "m=<media> <port> <proto/number of ports> <fmt> where the:

- <media> shall be specified as 'audio'.
- <proto/number of ports> shall be a single port.
- <proto> shall be specified as 'RTP/AVP'.
- <fmt> shall contain at least one media format description.
  The <fmt> may contain more than one media format description, but at least one of them shall have the attributes equal to TETRA_ACELP_BB.

The following media attributes shall be supported:

a=rtpmap	(for each fmt in the m-line).
a=sendrecv	(the attribute may be omitted, but shall be handled as the only supported value).
a=ptime:30	(the attribute may be omitted, but shall be handled as the only supported value).
a=maxptime:30	(the attribute may be omitted, but shall be handled as the only supported value).

a=payload-type This attribute identifies the active payload types as a subset of all payload types, for example to be able to support advanced payload type as well as the basic payload type. Possible values are a comma separated list of payload types from the set: 0,..., 3 (see clause 5.3.5). If payload-type is specified, any restriction shall be observed and payloads encoded with types outside of the subset shall not be sent in any RTP payload or used in payload-type requests. If not present, payload type 0 shall be inferred by default.

a=encryption-mode If specified, this attribute identifies the end-to-end encryption modes that can be used. Possible values are a comma separated list of encryption modes from the set: 0, 1. The value 0 indicates no end-to-end encryption, whilst the value 1 indicates end-to-end encryption. If encryption-mode is specified, any restriction shall be observed and frames encoded with modes outside of the subset shall not be sent in any RTP payload or used in encryption-mode requests. If not present, encryption mode 0 shall be inferred by default.

A.3.8 Example of SDP Content

The following headers fields are used for negotiating the streaming between two endpoints using the TETRA ACELP BB codec. This example does not preclude use of any other additional header fields that may be required by other standards e.g. 3GPP.

Table A.2: SDP content

```
[offer conveyed in SIP INVITE]
Content-Type: application/sdp
v=0
o=- 234567890 234567890 IN IP4 151.3.7.100
s=549755813888
c=IN IP4 151.3.7.200
t=0 0
m=audio 45678 RTP/AVP 119 120
a=rtpmap:119 TETRA_ACELP_BB/8000
a=fmtp:119 payload-type=0; encryption-mode=0,1
a=rtpmap:120 AMR-WB/16000
a=ptime:30
a=maxptime:30
a=sendrecv


[answer conveyed in SIP 200 OK]
Content-Type: application/sdp
v=0
o=- 234568901 234568901 IN IP4 87.34.5.300
s=549755813888
c=IN IP4 87.35.5.41
t=0 0
m=audio 56789 RTP/AVP 119
a=rtpmap:119 TETRA_ACELP_BB/8000
A=fmtp:119 payload-type=0; encryption-modes=0,1
a=ptime:30
a=maxptime:30
a=sendrecv
```

A.4 IANA considerations

A.4.1 General

This clause contains information to assist in the mapping between IANA media format attributes associated with the TETRA_ACELP_BB audio format definition and the present document.

A.4.2 Details

Table A.3 indicates the identified parameter mappings.

Table A.3: Audio format attribute mappings

TETRA_ACELP_BB audio format attribute	Attribute relation to the present document
payload-type	Indices into payload type IE for the Broadband Traffic PDU described in clause 5.2.2. The index 0 corresponds to the basic payload. Any other index values follow sequentially.
encryption-mode	Indicates whether end-to-end encryption is offered, as used in clause 5.3.3. Encryption-mode = 0 indicates that no end-to-end encryption is to be applied whilst encryption-mode = 1 indicates that end-to-end encryption is to be applied.

Annex B (informative): Change requests

The present document includes change requests as presented in table B.1.

Table B.1: Change requests

No	CR vers.	Standard Version	Clauses affected	Title	CR Status

History

Document history		
V1.1.1	March 2019	Publication