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Terrestrial Trunked Radio (TETRA); Speech codec for full-rate traffic channel; Part 3: Specific operating features

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Foreword

This European Standard (Telecommunications series) has been produced by ETSI Project Terrestrial Trunked Radio (TETRA).

The present document is part 3 of a multi-part deliverable covering speech codec for full-rate traffic channel, as identified below:

Part 1: "General description of speech functions";

Part 2: "TETRA codec";

Part 3: "Specific operating features";

Part 4: "Codec conformance testing".

National transposition dates	
Date of adoption of this EN:	21 January 2005
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1 Scope

The present document describes all the functions associated with the TETRA speech codec, except the specification of the codec by itself which is entirely defined in EN 300 395-2 [1].

Clause 4 of the present document provides a description of the functions associated with the speech encoder, while clause 5 is its counterpart for the speech decoder.

Clause 6 describes the contents and the format of the signalling data block included in a stolen frame when used for transferring information relevant to the codec in a U-plane signalling message.

In addition, annex A provides indications and preferred solutions for the implementation of optional features.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication and/or edition number or version number) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.

Referenced documents which are not found to be publicly available in the expected location might be found at http://docbox.etsi.org/Reference.

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

[2] ETSI EN 300 392-7: "Terrestrial Trunked Radio (TETRA); Voice plus Data (V+D); Part 7: Security".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in EN 300 392-2, clause 3 apply.

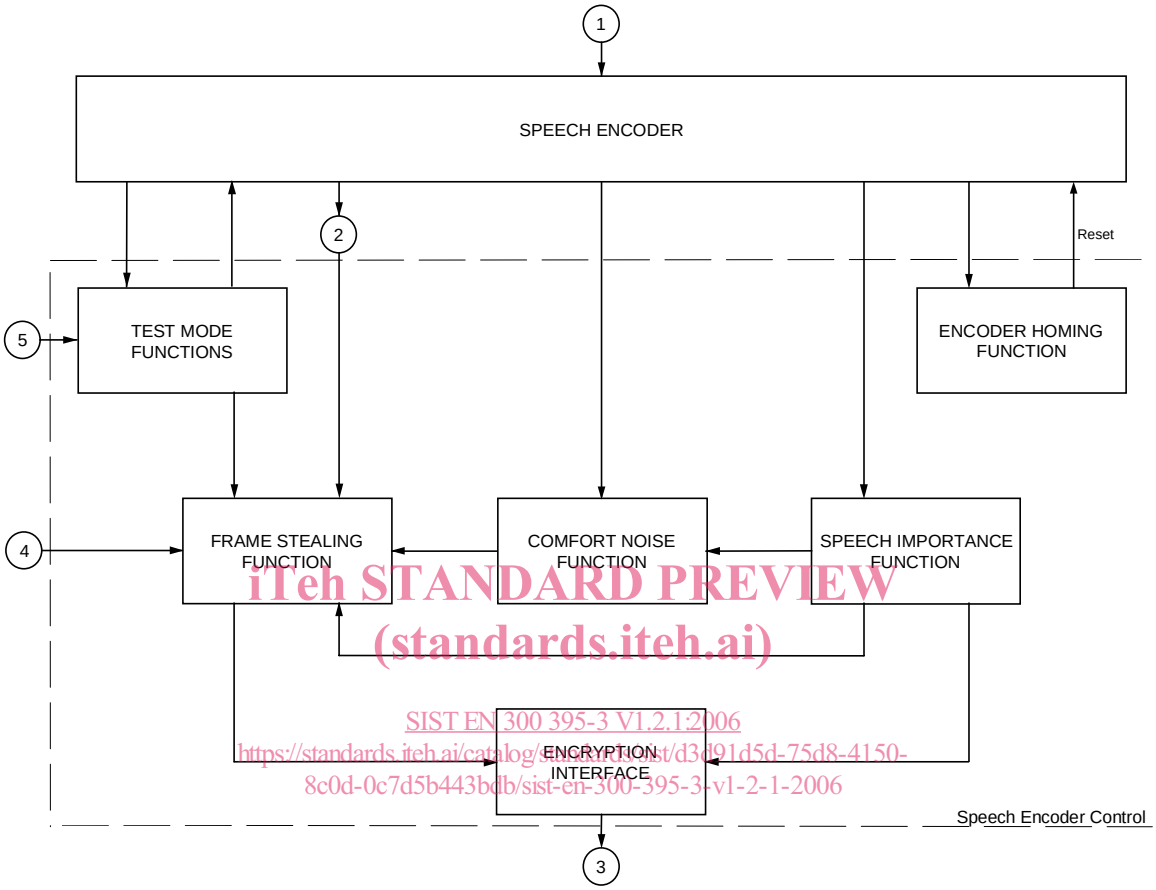
3.2 Abbreviations

For the purposes of the present document, the abbreviations given in EN 300 392-2, clause 3 and the following apply:

AMR	Adaptive Multi-Rate
BFI	Bad Frame Indicator
CNF	Comfort Noise Frame
DTX	Discontinuous Transmission
LTP	Long Term Predictor
MAC	Medium Access Control
MFG	Missing Frame Generation
PCM	Pulse Coded Modulation
RMS	Root Mean Square
VAD	Voice Activity Detector

4 TETRA Speech encoder

A diagram of the speech encoder and associated functions is given in figure 1. A more general overview is given in EN 300 395-1. The speech encoder is defined in EN 300 395-2 [1] and the other functions form the speech encoder control unit. The speech encoder control unit shall have access to all the internal data and functions of the speech encoder (including the input speech).



1) 16-bit uniform PCM, 8 000 samples/s.
2) Encoded speech frame 30 ms, 137 bits/frame.
3) Encoded speech frame in "TMD_UNITDATA_request" message.
4) Stolen indication in "TMD_REPORT_indication" message.
5) Test mode control.

Figure 1: Overview of speech encoder specific operating features

The speech encoder as defined in EN 300 395-2 [1] shall receive speech in the form of 16-bit uniform PCM at a rate of 8 000 samples per second.

The coded data corresponding to each 30 ms speech frame shall be output from the speech encoder control unit via the encryption interface to the encryption unit (or directly to the MAC if encryption is not used). The interfaces with the encryption unit, namely interface points 3 and 4 in figure 1, shall be as defined in EN 300 392-7 [2], clause 7. Message "TMD_UNITDATA_ request" is the means of conveying half-slots from the U-plane to the MAC, while "TMD_REPORT_indication" enables the MAC to pass control information to the U-plane.

Comfort noise parameters may be generated and their presence in the coded speech data shall be indicated by a U-plane signalling message conveyed using the frame stealing mechanism.

A speech importance indication shall be provided.

The presence of a homing sequence in the input speech shall be recognized and the encoder reset to a defined state.

All functions necessary to support conformance testing shall be implemented.

An appropriate U_device destination address shall be set for each half slot of coded speech data to allow correct routing at the receiver.

4.1 Encoder homing function

4.1.1 Definition of encoder homing frame

The encoder homing frame shall consist of 240 identical samples (corresponding to a 30 ms speech frame), each 16 bits long with the value 0x0008.

NOTE: 0x0008 is a number represented in hexadecimal notation.

4.1.2 Encoder homing

Whenever the speech encoder receives at its input an encoder homing frame exactly aligned with its internal speech frame segmentation, the following events shall take place:

Step 1: the speech encoder performs its normal operation and produces a speech parameter frame at its output which is in general unknown;

Step 2: the speech encoder shall be reset and placed in its home state by executing the reset functions "Init_Coder_Tetra( )" and "Init_Pre_Process( )" as defined in EN 300 395-2 [1];

Step 3: the speech encoder is now in its home state and any further consecutive encoder homing frames shall result in an output speech parameter frame identical to the decoder homing frame.

Applying a sequence of N encoder homing frames to the speech encoder input shall cause at least N-1 decoder homing frames at the output of the speech encoder control unit.

4.2 Speech importance function

This function shall compute an importance parameter for each speech frame. This may be done on the basis of the likely degradation in speech quality which would result from stealing that frame. The importance parameter shall take one of the values:

- NO_IMPORTANCE;
- LOW;
- MEDIUM; or
- HIGH.

Even in the case of speech frames marked "NO_IMPORTANCE" there may be some benefit in terms of speech quality from transmission to the end user.

4.3 Comfort noise function

This function may compute speech parameters which can be used for comfort noise generation at the receiver.

A Comfort Noise Frame (CNF) shall have the same format as a normal speech frame.

The comfort noise function may also determine when a CNF should be transmitted.

If Discontinuous Transmission (DTX) is employed on an uplink, then at least a CNF, or some other data, should be transmitted frequently enough that the receiving base station does not drop the connection.