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Digital cellular telecommunications system (Phase 2) (GSM); Enhanced Full Rate (EFR) speech processing functions; General description (GSM 06.51 version 4.0.1)

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Digital cellular telecommunications system (Phase 2); Enhanced Full Rate (EFR) speech processing functions; General description (GSM 06.51 version 4.0.1)

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Foreword

This European Standard (Telecommunications series) has been produced by the Special Mobile Group (SMG) Technical Committee of the European Telecommunications Standards Institute (ETSI).

This EN introduces the Enhanced Full Rate (EFR) speech traffic channels within the digital cellular telecommunications system.

This EN corresponds to GSM technical specification, GSM 06.51, version 4.0.1

National transposition dates	
Date of adoption of this EN:	19 December 1997
Date of latest announcement of this EN (doa):	31 March 1998
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	30 September 1998
Date of withdrawal of any conflicting National Standard (dow):	30 September 1998

1 Scope

This EN is an introduction to GSM 06.60 (EN 301 245) [6], GSM 06.61 (EN 301 246) [7], GSM 06.62 (EN 301 247) [8], GSM 06.81 (EN 301 248) [9] and GSM 06.82 (EN 301 249) [10] ENs dealing with the speech processing functions in the Enhanced Full Rate channel of the GSM system. A general overview of the speech processing functions is given, with reference to the ENs where each function is specified in detail.

2 Normative references

This EN incorporates by dated and undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this EN only when incorporated in it by amendment or revision. For undated references, the latest edition of the publication referred to applies.

- [1] GSM 01.04 (ETR 100): "Digital cellular telecommunications system (Phase 2); Abbreviations and acronyms".
- [2] GSM 03.50 (ETS 300 540): "Digital cellular telecommunications system (Phase 2); Transmission planning aspects of the speech service in the GSM Public Land Mobile Network (PLMN) system".
- [3] GSM 05.03 (ETS 300 575): "Digital cellular telecommunications system (Phase 2); Channel coding".
- [4] GSM 06.53 (EN 301 244): "Digital cellular telecommunications system (Phase 2); ANSI-C code for the GSM Enhanced Full Rate (EFR) speech codec".
- [5] GSM 06.54 (EN 301 250): "Digital cellular telecommunications system (Phase 2); Test vectors for the GSM Enhanced Full Rate (EFR) speech codec".
- [6] GSM 06.60 (EN 301 245): "Digital cellular telecommunications system (Phase 2); Enhanced Full Rate (EFR) speech transcoding".
- [7] GSM 06.61 (EN 301 246): "Digital cellular telecommunications system (Phase 2); Substitution and muting of lost frame for Enhanced Full Rate (EFR) speech traffic channels".
- [8] GSM 06.62 (EN 301 247): "Digital cellular telecommunications system (Phase 2); Comfort noise aspects for Enhanced Full Rate (EFR) speech traffic channels".
- [9] GSM 06.81 (EN 301 248): "Digital cellular telecommunications system (Phase 2); Discontinuous transmission (DTX) for Enhanced Full Rate (EFR) speech traffic channels".
- [10] GSM 06.82 (EN 301 249): "Digital cellular telecommunications system (Phase 2); Voice Activity Detector (VAD) for Enhanced Full Rate (EFR) speech traffic channels".

3 Definitions and abbreviations

3.1 Definitions

Definition of terms used in this EN can be found in GSM 06.60 (EN 301 245) [6], GSM 06.61 (EN 301 246) [7], GSM 06.62 (EN 301 247) [8], GSM 06.81 (EN 301 248) [9] and GSM 06.82 (EN 301 249) [10].

3.2 Abbreviations

For the purposes of this EN, the following abbreviations apply:

ACELP	Algebraic Code Excited Linear Prediction
BFI	Bad Frame Indication

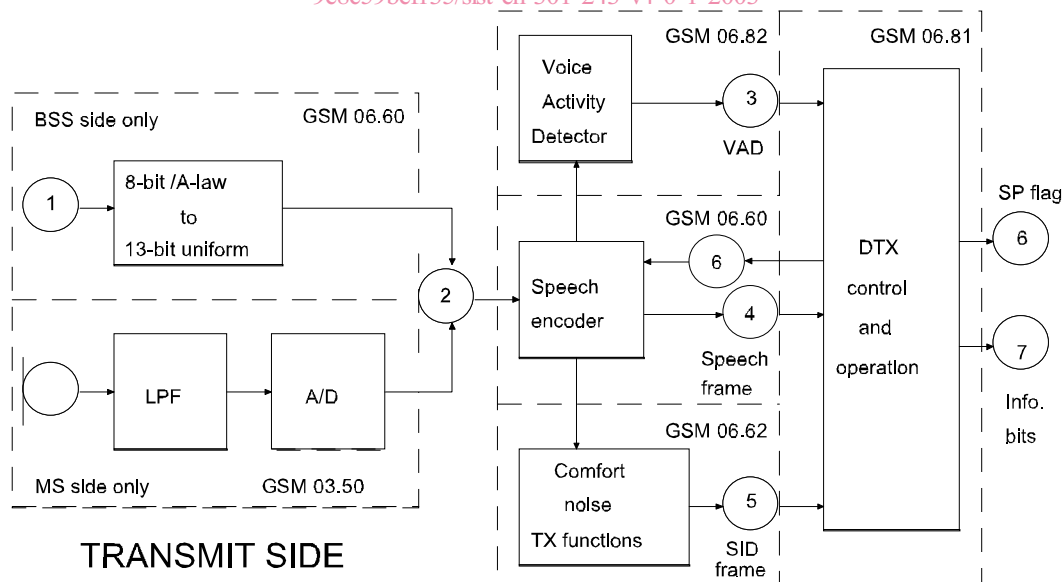
BSS	Base Station System
CCITT	Comité Consultatif International Télégraphique et Téléphonique
DTX	Discontinuous Transmission
ETS	European Telecommunication Standard
GSM	Global System for Mobile communications
MS	Mobile Station
PCM	Pulse Code Modulated
PLMN	Public Land Mobile Network
PSTN	Public Switched Telephone Network
RF	Radio Frequency
RSS	Radio SubSystem
RX	Receive
SACCH	Slow Associated Control CHannel
SID	SIlence Descriptor
SP flag	SPeech flag
TAF	Time Alignment Flag
TX	Transmit

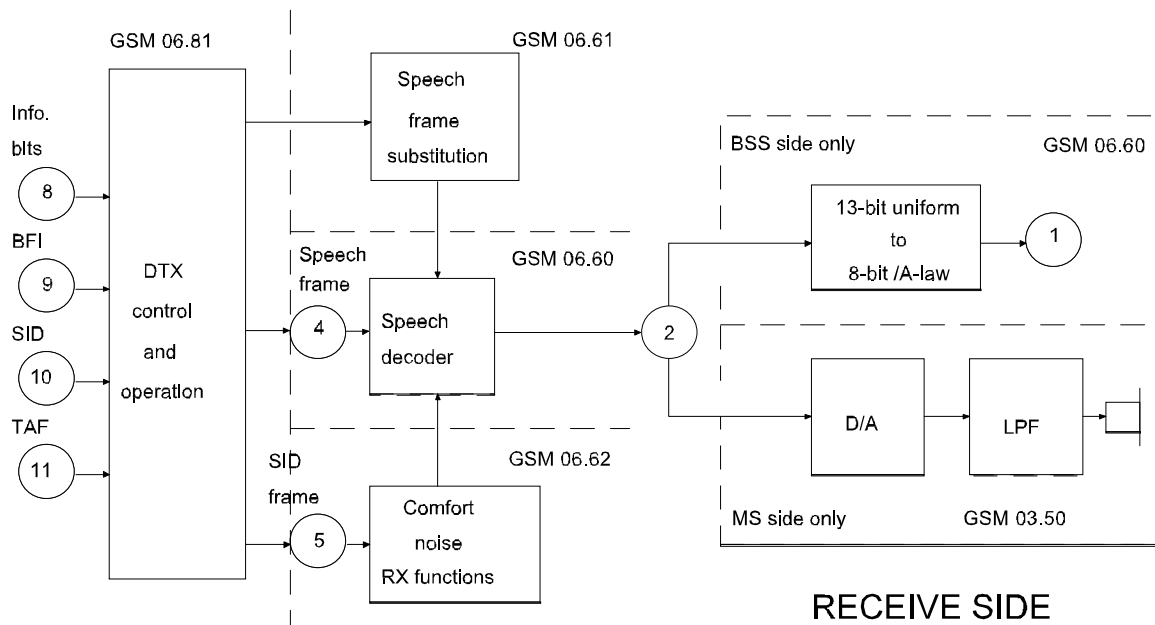
For abbreviations not given in this subclause, see GSM 01.04 (ETR 100) [1].

4 General

Figure 1 presents a reference configuration where the various speech processing functions are identified. In this figure, the relevant Standards for each function are also indicated.

In figure 1, the audio parts including analogue to digital and digital to analogue conversion are included, to show the complete speech path between the audio input/output in the Mobile Station (MS) and the digital interface of the PSTN. The detailed specification of the audio parts are contained in GSM 03.50 (ETS 300 540) [2]. These aspects are only considered to the extent that the performance of the audio parts affect the performance of the speech transcoder.





- 1) 8-bit /A-law PCM (CCITT recommendation G.711), 8 000 samples/s
- 2) 13-bit uniform PCM, 8 000 samples/s
- 3) Voice Activity Detector (VAD) flag
- 4) Encoded speech frame, 50 frames/s, 244 bits/frame
- 5) Silence Descriptor (SID) frame, 244 bits/frame
- 6) SPeech (SP) flag, indicates whether information bits are speech or SID information
- 7) Information bits delivered to the radio subsystem
- 8) Information bits received from the radio subsystem
- 9) Bad Frame Indication
- 10) Silence Descriptor (SID) flag
- 11) Time Alignment Flag (TAF), marks the position of the SID frame within the Slow Associated Control CHannel (SACCH) multiframe

Figure 1: Overview of audio processing functions

5 Enhanced Full Rate speech channel transcoding

As shown in figure 1, the speech encoder takes its input as a 13-bit uniform Pulse Code Modulated (PCM) signal either from the audio part of the Mobile Station or on the network side, from the Public Switched Telephone Network (PSTN) via an 8-bit/A-law to 13-bit uniform PCM conversion. The encoded speech at the output of the speech encoder is delivered to the channel coding function defined in GSM 05.03 (ETS 300 575) [3] to produce an encoded block consisting of 456 bits leading to a gross bit rate of 22,8 kbit/s.

In the receive direction, the inverse operations take place. GSM 06.60 (EN 301 245) [6] describes the detailed mapping between input blocks of 160 speech samples in 13-bit uniform PCM format to encoded blocks of 244 bits and from encoded blocks of 244 bits to output blocks of 160 reconstructed speech samples. The sampling rate is 8 000 sample/s leading to a bit rate for the encoded bit stream of 12,2 kbit/s. The coding scheme is the so-called Algebraic Code Excited Linear Prediction, hereafter referred to as ACELP.