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**Digital cellular telecommunications system (Phase 2+);  
Enhanced Full Rate (EFR) speech transcoding  
(3GPP TS 46.060 version 13.0.0 Release 13)**



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## Foreword

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# Foreword

This Technical Specification has been produced by the 3<sup>rd</sup> Generation Partnership Project (3GPP).

The present document 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 within the digital cellular telecommunications system.

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

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# 1 Scope

The present document 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 Coder, hereafter referred to as ACELP.

The present document also specifies the conversion between A-law or  $\mu$ -law (PCS 1900) PCM and 13-bit uniform PCM. Performance requirements for the audio input and output parts are included only to the extent that they affect the transcoder performance. This part also describes the codec down to the bit level, thus enabling the verification of compliance to the part to a high degree of confidence by use of a set of digital test sequences. These test sequences are described in GSM 06.54 [7] and are available on disks.

In case of discrepancy between the requirements described in the present document and the fixed point computational description (ANSI-C code) of these requirements contained in GSM 06.53 [6], the description in GSM 06.53 [6] will prevail.

The transcoding procedure specified in the present document is applicable for the enhanced full rate speech traffic channel (TCH) in the GSM system.

In GSM 06.51 [5], a reference configuration for the speech transmission chain of the GSM enhanced full rate (EFR) system is shown. According to this reference configuration, the speech encoder takes its input as a 13-bit uniform PCM signal either from the audio part of the Mobile Station or on the network side, from the PSTN via an 8-bit/A-law or  $\mu$ -law (PCS 1900) to 13-bit uniform PCM conversion. The encoded speech at the output of the speech encoder is delivered to a channel encoder unit which is specified in GSM 05.03 [3]. In the receive direction, the inverse operations take place.

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# 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, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

- [1] GSM 01.04: "Digital cellular telecommunications system (Phase 2+); Abbreviations and acronyms".
- [2] GSM 03.50: "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: "Digital cellular telecommunications system (Phase 2+); Channel coding".
- [4] GSM 06.32: "Digital cellular telecommunications system (Phase 2+); Voice Activity Detection (VAD)".
- [5] GSM 06.51: "Digital cellular telecommunications system (Phase 2+); Enhanced Full Rate (EFR) speech processing functions General description".
- [6] GSM 06.53: "Digital cellular telecommunications system (Phase 2+); ANSI-C code for the GSM Enhanced Full Rate (EFR) speech codec".
- [7] GSM 06.54: "Digital cellular telecommunications system (Phase 2+); Test vectors for the GSM Enhanced Full Rate (EFR) speech codec".