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Digital cellular telecommunications system (Phase 2+) (GSM); Channel coding (GSM 05.03 version 8.5.1 Release 1999)

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Foreword

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

The present document specifies the data blocks given to the encryption unit. It includes the specification of encoding, reordering, interleaving and the stealing flag within the digital cellular telecommunications system (Phase 2+).

The contents of the present document may be subject to continuing work within SMG and may change following formal SMG approval. Should SMG modify the contents of the present document it will then be re-submitted for formal approval procedures by ETSI with an identifying change of release date and an increase in version number as follows:

Version 8.x.y

where:

8 GSM Phase 2+ Release 1999.

x the second digit is incremented for changes of substance, i.e. technical enhancements, corrections, updates, etc.

y the third digit is incremented when editorial only changes have been incorporated in the specification.

National transposition dates	
Date of adoption of this EN:	17 November 2000
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1 Scope

A reference configuration of the transmission chain is shown in GSM 05.01 [4]. According to this reference configuration, the present document specifies the data blocks given to the encryption unit.

It includes the specification of encoding, reordering, interleaving and the stealing flag. It does not specify the channel decoding method.

The definition is given for each kind of logical channel, starting from the data provided to the channel encoder by the speech coder, the data terminal equipment, or the controller of the Mobile Station (MS) or Base Transceiver Station (BTS). The definitions of the logical channel types used in this technical specification are given in GSM 05.02 [5], a summary is in annex A.

1.1 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.
- A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.
- For this Release 1999 document, references to GSM documents are for Release 1999 versions (version 8.x.y).

[1] GSM 01.04: "Digital cellular telecommunications system (Phase 2+); Abbreviations and acronyms".

[2] GSM 04.08: "Digital cellular telecommunications system (Phase 2+); Mobile radio interface layer 3 specification".

[3] GSM 04.21: "Digital cellular telecommunications system (Phase 2+); Rate adaption on the Mobile Station - Base Station System (MS - BSS) interface".

[4] GSM 05.01: "Digital cellular telecommunications system (Phase 2+); Physical layer on the radio path General description".

[5] GSM 05.02: "Digital cellular telecommunications system (Phase 2+); Multiplexing and multiple access on the radio path".

[6] GSM 05.05: "Digital cellular telecommunications system (Phase 2+); Radio Transmission and Reception".

[7] GSM 05.09: "Digital cellular telecommunications system (Phase 2+); Link adaptation".

[8] GSM 06.10: "Digital cellular telecommunications system; Full rate speech transcoding".

[9] GSM 06.20: "Digital cellular telecommunications system; Half rate speech transcoding".

[10] GSM 06.60: "Digital cellular telecommunications system; Enhanced Full Rate (EFR) speech transcoding".

[11] GSM 06.90: "Digital cellular telecommunications system; Adaptive Multi-Rate speech transcoding".

[12] GSM 06.93: "Digital cellular telecommunications system; Discontinous transmission (DTX) for Adaptive Multi-Rate speech traffic channels".

[13] GSM 03.64: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Overall description of the GPRS Radio Interface; Stage 2".

[14] GSM 03.52: "Digital cellular telecommunications system (Phase 2+); GSM Cordless Telephony System (CTS), Phase 1; Lower layers of the CTS Radio Interface; Stage 2".

1.2 Abbreviations

Abbreviations used in the present document are listed in GSM 01.04.

2 General

2.1 General organization

Each channel has its own coding and interleaving scheme. However, the channel coding and interleaving is organized in such a way as to allow, as much as possible, a unified decoder structure.

Each channel uses the following sequence and order of operations:

- the information bits are coded with a systematic block code, building words of information + parity bits;
- these information + parity bits are encoded with a convolutional code, building the coded bits;
- reordering and interleaving the coded bits, and adding a stealing flag, gives the interleaved bits.

All these operations are made block by block, the size of which depends on the channel. However, most of the channels use a block of 456 coded bits which is interleaved and mapped onto bursts in a very similar way for all of them. Figures 1a and 1b give a diagram showing the general structure of the channel coding.

This block of 456 coded bits is the basic structure of the channel coding scheme. In the case of full rate speech TCH, this block carries the information of one speech frame. In case of control channels, it carries one message.

In the case of half rate speech TCH, the information of one speech frame is carried in a block of 228 coded bits.

In the case of the Enhanced full rate speech the information bits coming out of the source codec first go through a preliminary channel coding. then the channel coding as described above takes place.

In the case of a packet switched channel the block of 456 or 1384 coded bits carries one radio block.

In the case of an enhanced circuit switched channel the block of 1368 coded bits (456 coded symbols) carries one radio block.

In the case of FACCH, a coded message block of 456 bits is divided into eight sub-blocks. The first four sub-blocks are sent by stealing the even numbered bits of four timeslots in consecutive frames used for the TCH. The other four sub-blocks are sent by stealing the odd numbered bits of the relevant timeslot in four consecutive used frames delayed 2 or 4 frames relative to the first frame. Along with each block of 456 coded bits there is, in addition, a stealing flag (8 bits), indicating whether the block belongs to the TCH or to the FACCH. In the case of SACCH, BCCH, CCCH or CTSCCH, this stealing flag is dummy. In the case of a packet switched channel, these bits are used to indicate the coding scheme used.

In the case of E-FACCH/F, a coded message block of 456 bits is divided into four sub-blocks. The four sub-blocks are sent by stealing all symbols of four timeslots in consecutive frames used for the E-TCH and using GMSK modulation. The indication of the E-FACCH/F is based on the identification of the modulation. Along with each block of 456 coded bits there is, in addition, a stealing flag (8 bits), indicating whether the block belongs to the E-FACCH, FACCH or TCH.

Some cases do not fit in the general organization, and use short blocks of coded bits which are sent completely in one timeslot. They are the random access messages of:

- the RACH;
- or PRACH and CPRACH;

on uplink and the synchronization information broadcast on the SCH or CSCH on the downlink. In CTS, they are the access request message of the CTSARCH on uplink and the information broadcast on the CTSBCH-SB on downlink.

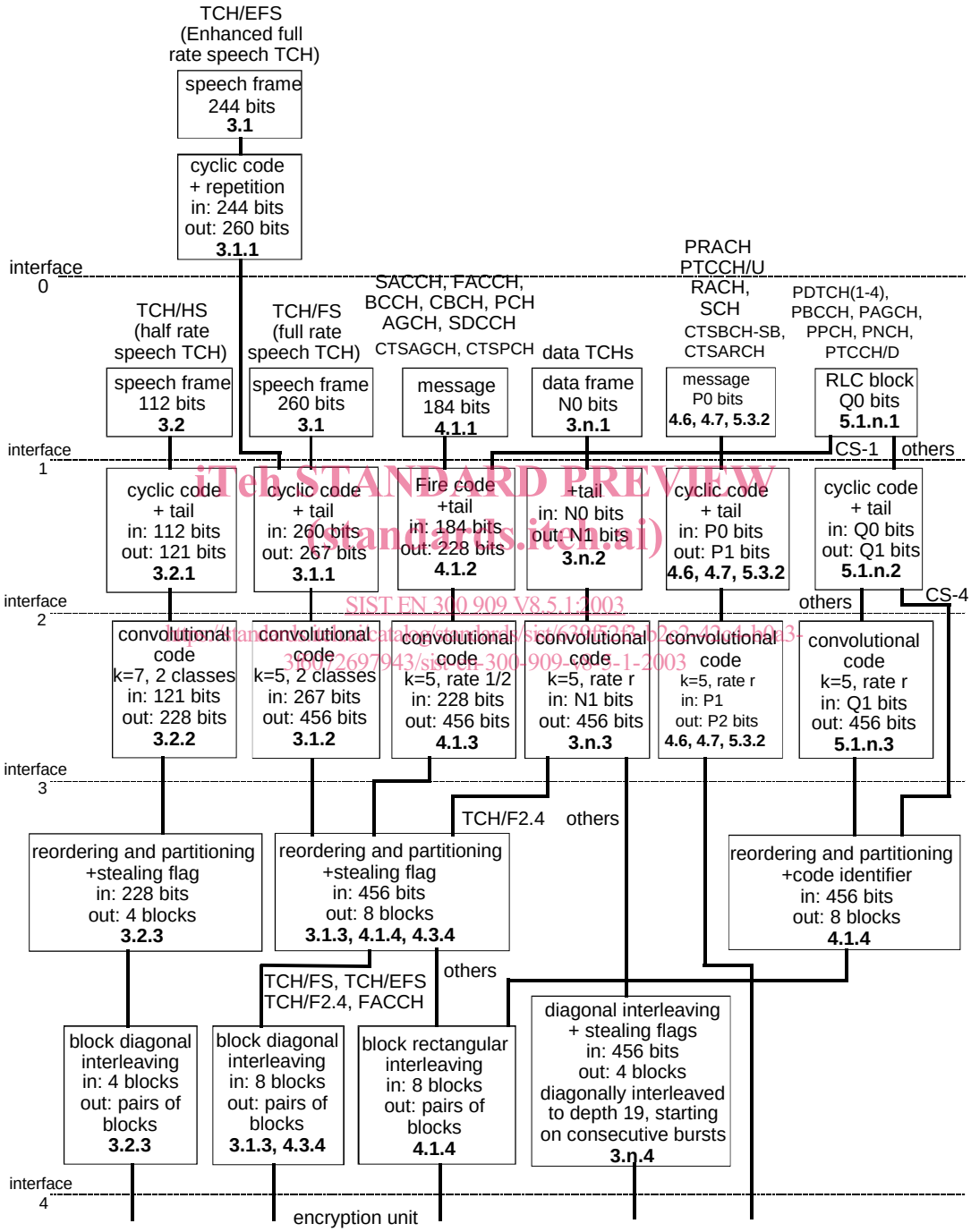

Figure 1a: Channel Coding and Interleaving Organization

In each box, the last line indicates the clause defining the function. In the case of RACH, P0 = 8 and P1 = 18; in the case of SCH, CSCH, CTSBCH-SB and CTSARCH, P0 = 25 and P1 = 39. In the case of data TCHs, N0, N1 and n depend on the type of data TCH.

Interfaces:

1) information bits (d);

2) information + parity + tail bits (u);

3) coded bits (c);

4) interleaved bits (e).

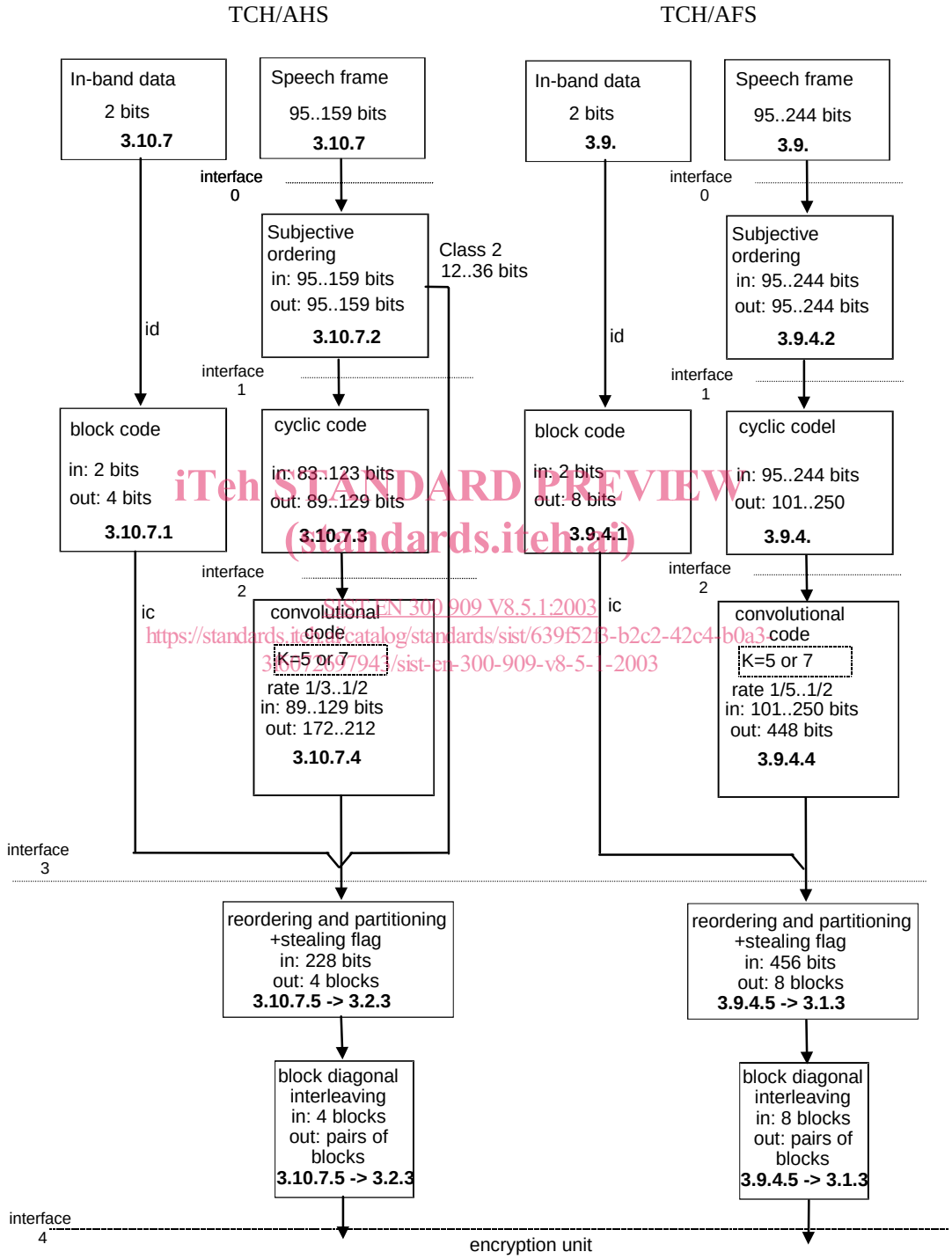

Figure 1b: Channel Coding and Interleaving Organization, adaptive multi-rate speech

In each box, the last line indicates the clause defining the function.