# EUROPEAN TELECOMMUNICATION STANDARD

**ETS 300 909**

**August 1997**

**Second Edition**

Source: ETSI SMG

Reference: RE/SMG-020503QR2

ICS: 33.020

**Key words:** Digital cellular telecommunications system, Global System for Mobile communications (GSM)

GLOBAL SYSTEM FOR
MOBILE COMMUNICATIONS

# Digital cellular telecommunications system (Phase 2+); Channel coding (GSM 05.03 version 5.3.1)

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# Contents

## Foreword

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

This ETS 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+).

This ETS is a GSM technical specification version 5, which contains GSM Phase 2+ enhancements/features to the version 4 GSM technical specification.

The contents of this ETS is subject to continuing work within SMG and may change following formal SMG approval. Should SMG modify the contents of this ETS, it will be resubmitted for OAP by ETSI with an identifying change of release date and an increase in version number as follows:

Version 5.x.y

where:

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

- x the second digit is incremented for all other types of changes, i.e. technical enhancements, corrections, updates, etc.

The specification from which this ETS has been derived was originally based on CEPT documentation, hence the presentation of this ETS may not be entirely in accordance with the ETSI drafting rules.

| **Transposition dates** | |
|---|---|
| Date of adoption: | 25 July 1997 |
| Date of latest announcement of this ETS (doa): | 30 November 1997 |
| Date of latest publication of new National Standard or endorsement of this ETS (dop/e): | 31 May 1998 |
| Date of withdrawal of any conflicting National Standard (dow): | 31 May 1998 |

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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, this technical ETS 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 Normative references

This ETS 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 ETS 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 350): "Digital cellular telecommunications system (Phase 2+); Abbreviations and acronyms".

[2] GSM 04.08 (ETS 300 940): "Digital cellular telecommunications system (Phase 2+); Mobile radio interface layer 3 specification".

[3] GSM 04.21 (ETS 300 945): "Digital cellular telecommunications system; 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 (ETS 300 908): "Digital cellular telecommunications system (Phase 2+); Multiplexing and multiple access on the radio path".

[6] GSM 05.05: (ETS 300 910): "Digital cellular telecommunications system (Phase 2+); Radio Transmission and Reception".

[7] GSM 06.10 (ETS 300 961): "Digital cellular telecommunications system; Full rate speech transcoding".

[8] GSM 06.20 (ETS 300 969): "Digital cellular telecommunications system; Half rate speech transcoding".

[9] GSM 06.60 (ETS 300 726): "Digital cellular telecommunications system ; Enhanced Full Rate (EFR) speech transcoding".

## 1.2 Abbreviations

Abbreviations used in this ETS 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. Figure 1 gives 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 though a preliminary channel coding. then the channel coding as described above takes place.

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 or CCCH, this stealing flag is dummy.

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 on uplink and the synchronization information broadcast of the SCH on downlink.

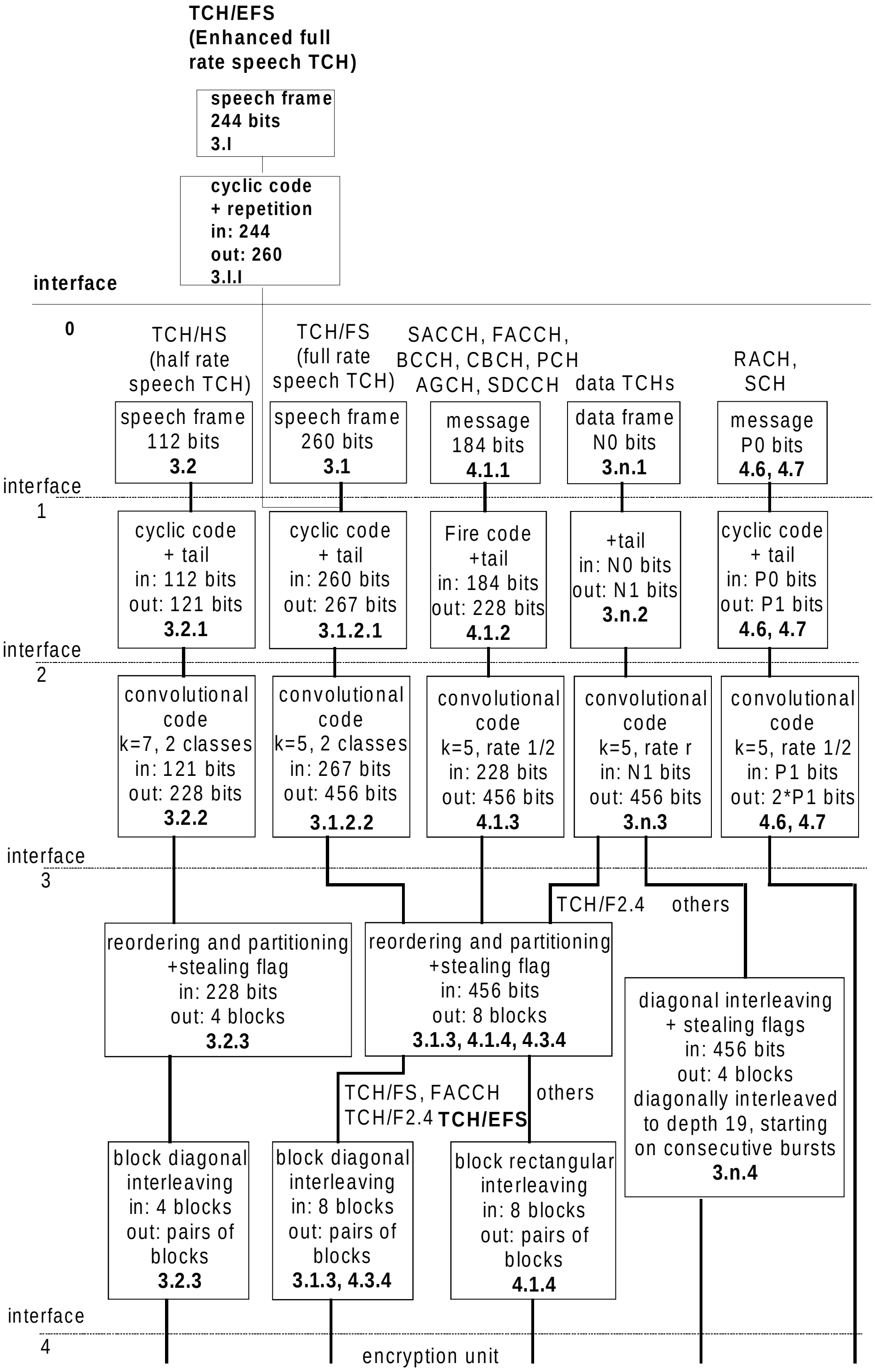


**Figure 1: Channel Coding and Interleaving Organization**

In each box, the last line indicates the chapter defining the function. In the case of RACH, P0 = 8 and P1 = 18; in the case of SCH, 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).

## 2.2 Naming Convention

For ease of understanding a naming convention for bits is given for use throughout the technical specification:

- General naming:

  "k" and "j" for numbering of bits in data blocks and bursts;

  "$K_x$" gives the amount of bits in one block, where "x" refers to the data type;

  "n" is used for numbering of delivered data blocks where;

  "N" marks a certain data block;

  "B" is used for numbering of bursts or blocks where;

  "$B_0$" marks the first burst or block carrying bits from the data block with n = 0 (first data block in the transmission).

- Data delivered to the preliminary channel encoding unit (for EFR only):

  s(k) for $k = 1..., K_s$

- Data delivered by the preliminary channel encoding unit (for EFR only) before bits rearrangement

  w(k) for $k = 1..., K_w$

- Data delivered to the encoding unit (interface 1 in figure 1):

  d(k) for $k = 0,1,...,K_d-1$

- Data after the first encoding step (block code, cyclic code; interface 2 in figure 1):

  u(k) for $k = 0,1,...,K_u-1$

- Data after the second encoding step (convolutional code ; interface 3 in figure 1):

  c(n,k) or c(k) for $k = 0,1,...,K_c-1$
  $n = 0,1,...,N,N+1,...$

- Interleaved data:

  i(B,k) for $k = 0,1,...,K_i-1$
  $B = B_0, B_0+1,....$

- Bits in one burst (interface 4 in figure 1):
  e(B,k) for $k = 0,1,114,115$
  $B = B_0,B_0+1,...$

# 3 Traffic Channels (TCH)

Two kinds of traffic channel are considered: speech and data. Both of them use the same general structure (see figure 1), and in both cases, a piece of information can be stolen by the FACCH.

## 3.1 Speech channel at full rate (TCH/FS and TCH/EFS)

The speech coder (whether Full rate or Enhanced full rate) delivers to the channel encoder a sequence of blocks of data. In case of a full rate and enhanced full rate speech TCH, one block of data corresponds to one speech frame.

For the full rate coder each block contains 260 information bits, including 182 bits of class 1 (protected bits), and 78 bits of class 2 (no protection), (see table 2).

The bits delivered by the speech coder are received in the order indicated in GSM 06.10 and have to be rearranged according to table 2 before channel coding as defined in subclauses 3.1.1 to 3.1.4. The rearranged bits are labelled {d(0),d(1),...,d(259)}, defined in the order of decreasing importance.

For the EFR coder each block contains 244 information bits. The block of 244 information bits, labelled s(1).., s(244), passes through a preliminary stage, applied only to EFR (see figure 1) which produces 260 bits corresponding to the 244 input bits and 16 redundancy bits. Those 16 redundancy bits correspond to 8 CRC bits and 8 repetition bits, as described in subclause 3.1.1. The 260 bits, labelled w(1)..w(260), have to be rearranged according to table 7 before they are delivered to the channel encoding unit which is identical to that of the TCH/FS. The 260 bits block includes 182 bits of class 1(protected bits) and 78 bits of class 2 (no protection). The class 1 bits are further divided into the class 1a and class 1b, class 1a bits being protected by a cyclic code and the convolutional code whereas the class 1b are protected by the convolutional code only.

### 3.1.1 Preliminary channel coding for EFR only

#### 3.1.1.1 CRC calculation

An 8-bit CRC is used for error-detection. These 8 parity bits (bits w253-w260) are generated by the cyclic generator polynomial: $g(D) = D^8 + D^4 + D^3 + D^2 + 1$ from the 65 most important bits (50 bits of class 1a and 15 bits of class 1b). These 65 bits *(b(1)-b(65))* are taken from the table 5 in the following order (read row by row, left to right):

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| s39 | s40 | s41 | s42 | s43 | s44 | s48 | s87 | s45 | s2 |
| s3 | s8 | s10 | s18 | s19 | s24 | s46 | s47 | s142 | s143 |
| s144 | s145 | s146 | s147 | s92 | s93 | s195 | s196 | s98 | s137 |
| s148 | s94 | s197 | s149 | s150 | s95 | s198 | s4 | s5 | s11 |
| s12 | s16 | s9 | s6 | s7 | s13 | s17 | s20 | s96 | s199 |
| s1 | s14 | s15 | s21 | s25 | s26 | s28 | s151 | s201 | s190 |
| s240 | s88 | s138 | s191 | s241 | | | | | |

The encoding is performed in a systematic form, which means that, in GF(2), the polynomial:

$$b(1)D^{72} + b(2)D^{71} + ... + b(65)D^8 + p(1)D^7 + p(2)D^6 + ... + p(7)D^1 + p(8)$$

p(1) - p(8): the parity bits (w253-w260)

b(1) - b(65) = the data bits from the table above

when divided by *g(D),* yields a remainder equal to 0.

#### 3.1.1.2 Repetition bits

The repeated bits are s70, s120, s173 and s223. They correspond to one of the bits in each of the PULSE_5, the most significant one not protected by the channel coding stage.

#### 3.1.1.3 Correspondence between input and output of preliminary channel coding

The preliminary coded bits w(k) for k = 1 to 260 are hence defined by:

w(k) = s(k) for k = 1 to 71
w(k) = s(k-2) for k = 74 to 123
w(k) = s(k-4) for k = 126 to 178
w(k) = s(k-6) for k = 181 to s230
w(k) = s(k-8) for k = 233 to s252

Repetition bits:

w(k) = s(70) for k = 72 and 73
w(k) = s(120) for k = 124 and 125
w(k) = s(173) for k = 179 and 180
w(k) = s(223) for k = 231 and 232

Parity bits:

w(k = p(k-252) for k = 253 to 260

### 3.1.2 Channel coding for FR and EFR

#### 3.1.2.1 Parity and tailing for a speech frame

a) Parity bits:

The first 50 bits of class 1 (**known as class 1a for the EFR)** are protected by three parity bits used for error detection. These parity bits are added to the 50 bits, according to a degenerate (shortened) cyclic code (53,50,2), using the generator polynomial:

$$g(D) = D^3 + D + 1$$

The encoding of the cyclic code is performed in a systematic form, which means that, in GF(2), the polynomial:

$$d(0)D^{52} + d(1)D^{51} + \ldots + d(49)D^3 + p(0)D^2 + p(1)D + p(2)$$

where p(0), p(1), p(2) are the parity bits, when divided by g(D), yields a remainder equal to:

$$1 + D + D^2$$

b) Tailing bits and reordering:

The information and parity bits of class 1 are reordered, defining 189 information + parity + tail bits of class 1, {u(0),u(1),...,u(188)} defined by:

u(k) = d(2k) and u(184-k) = d(2k+1) for k = 0,1,...,90
u(91+k) = p(k) for k = 0,1,2
u(k) = 0 for k = 185,186,187,188 (tail bits)

#### 3.1.2.2 Convolutional encoder

The class 1 bits are encoded with the 1/2 rate convolutional code defined by the polynomials:

$G0 = 1 + D^3 + D^4$
$G1 = 1 + D + D^3 + D^4$

The coded bits {c(0), c(1),..., c(455)} are then defined by:

- class 1: c(2k) = u(k) + u(k-3) + u(k-4)
  c(2k+1) = u(k) + u(k-1) + u(k-3) + u(k-4) for k = 0,1,...,188
  u(k) = 0 for k < 0

- class 2: c(378+k) = d(182+k) for k = 0,1,....,77

### 3.1.3 Interleaving

The coded bits are reordered and interleaved according to the following rule:

i(B,j) = c(n,k), for k = 0,1,...,455
n = 0,1,...,N,N+1,...
$B = B_0 + 4n + (k \bmod 8)$
j = 2((49k) mod 57) + ((k mod 8) div 4)

See table 1. The result of the interleaving is a distribution of the reordered 456 bits of a given data block, n = N, over 8 blocks using the even numbered bits of the first 4 blocks ($B = B_0 + 4N + 0, 1, 2, 3$) and odd numbered bits of the last 4 blocks ($B = B_0 + 4N + 4, 5, 6, 7$). The reordered bits of the following data block, n = N+1, use the even numbered bits of the blocks $B = B_0 + 4N + 4, 5, 6, 7$ ($B = B_0 + 4(N+1) + 0, 1, 2, 3$) and the odd numbered bits of the blocks $B = B_0 + 4(N+1) + 4, 5, 6, 7$. Continuing with the next data blocks shows that one block always carries 57 bits of data from one data block (n = N) and 57 bits of data from the next block (n = N+1), where the bits from the data block with the higher number always are the even numbered data bits, and those of the data block with the lower number are the odd numbered bits.

The block of coded data is interleaved "block diagonal", where a new data block starts every 4th block and is distributed over 8 blocks.

### 3.1.4 Mapping on a Burst

The mapping is given by the rule:

e(B,j) = i(B,j) and e(B,59+j) = i(B,57+j) for j = 0,1,...,56

and

e(B,57) = hl(B) and e(B,58) = hu(B)

The two bits, labelled hl(B) and hu(B) on burst number B are flags used for indication of control channel signalling. For each TCH/FS block not stolen for signalling purposes:

hu(B) = 0 for the first 4 bursts (indicating status of even numbered bits)
hl(B) = 0 for the last 4 bursts (indicating status of odd numbered bits)

For the use of hl(B) and hu(B) when a speech frame is stolen for signalling purposes see subclause 4.2.5.

## 3.2 Speech channel at half rate (TCH/HS)

The speech coder delivers to the channel encoder a sequence of blocks of data. In case of a half rate speech TCH, one block of data corresponds to one speech frame. Each block contains 112 bits, including 95 bits of class 1 (protected bits), and 17 bits of class 2 (no protection), see tables 3a and 3b.

The bits delivered by the speech coder are received in the order indicated in GSM 06.20 and have to be arranged according to either table 3a or table 3b before channel encoding as defined in subclauses 3.2.1 to 3.2.4. The rearranged bits are labelled {d(0),d(1),...,d(111)}. Table 3a has to be taken if parameter Mode = 0 (which means that the speech encoder is in unvoiced mode), while table 3b has to be taken if parameter Mode = 1, 2 or 3 (which means that the speech encoder is in voiced mode).

### 3.2.1 Parity and tailing for a speech frame

a) Parity bits:

The most significant 22 class 1 bits d(73),d(74),...,d(94) are protected by three parity bits used for error detection. These bits are added to the 22 bits, according to a cyclic code using the generator polynomial:

$$g(D) = D^3 + D + 1$$

The encoding of the cyclic code is performed in a systematic form, which means that, in GF(2), the polynomial:

$$d(73)D^{24} + d(74)D^{23} + ... + d(94)D^3 + p(0)D^2 + p(1)D + p(2)$$

where p(0), p(1), p(2) are the parity bits, when divided by g(D), yields a remainder equal to:

$$1 + D + D^2.$$

b) Tail bits and reordering:

The information and parity bits of class 1 are reordered, defining 104 information + parity + tail bits of class 1, {u(0),u(1),...,u(103)} defined by:

| | |
|---|---|
| u(k) = d(k) | for k = 0,1,...,94 |
| u(k) = p(k-95) | for k = 95,96,97 |
| u(k) = 0 | for k = 98,99,...,103 (tail bits) |

### 3.2.2 Convolutional encoder

The class 1 bits are encoded with the punctured convolutional code defined by the mother polynomials:

$$G4 = 1 + D^2 + D^3 + D^5 + D^6$$

$$G5 = 1 + D + D^4 + D^6$$

$$G6 = 1 + D + D^2 + D^3 + D^4 + D^6$$

and the puncturing matrices:

| | |
|---|---|
| (1,0,1) | for {u(0),u(1),...,u(94)} (class 1 information bits);<br>and {u(98),u(99),...,u(103)} (tail bits). |
| (1,1,1) | for {u(95),u(96),u(97)} (parity bits) |

In the puncturing matrices, a 1 indicates no puncture and a 0 indicates a puncture.

The coded bits {c(0),c(1),...,c(227)} are then defined by:

class 1 information bits:

| | | |
|---|---|---|
| c(2k) | = u(k)+u(k-2)+u(k-3)+ (k-5)+u(k-6) | |
| c(2k+1) | = u(k)+u(k-1)+u(k-2)+u(k-3)+u(k-4)+u(k-6) | for k = 0,1,...,94;u(k) = 0 for k<0 |

parity bits:

| | | |
|---|---|---|
| c(3k-95) | = u(k)+u(k-2)+u(k-3)+u(k-5)+u(k-6) | |
| c(3k-94) | = u(k)+u(k-1)+u(k-4)+u(k-6) | |
| c(3k-93) | = u(k)+u(k-1)+u(k-2)+u(k-3)+u(k-4)+u(k-6) | for k = 95,96,97 |

tail bits:

$c(2k+3) = u(k)+u(k-2)+u(k-3)+u(k-5)+u(k-6)$
$c(2k+4) = u(k)+u(k-1)+u(k-2)+u(k-3)+u(k-4)+u(k-6)$ for k = 98,99,...,103

class 2 information bits:

$c(k+211) = d(k+95)$ for k = 0,1,...,16

### 3.2.3 Interleaving

The coded bits are reordered and interleaved according to the following rule:

$i(B,j) = c(n,k)$ for $k = 0,1,...,227$
$n = 0,1,...,N,N+1,...$
$B = B0 + 2n + b$

The values of b and j in dependence of k are given by table 4.

The result of the interleaving is a distribution of the reordered 228 bits of a given data block, n = N, over 4 blocks using the even numbered bits of the first 2 blocks (B = B0+2N+0,1) and the odd numbered bits of the last 2 blocks (B = B0+2N+2,3). The reordered bits of the following data block, n = N + 1, use the even numbered bits of the blocks B = B0 + 2N + 2,3 (B = B0+2(N+1)+0,1) and the odd numbered bits of the blocks B = B0 + 2(N+1) + 2,3. Continuing with the next data blocks shows that one block always carries 57 bits of data from one data block (n = N) and 57 bits from the next block (n = N+1), where the bits from the data block with the higher number always are the even numbered data bits, and those of the data block with the lower number are the odd numbered bits. The block of coded data is interleaved "block diagonal", where a new data block starts every 2nd block and is distributed over 4 blocks.

### 3.2.4 Mapping on a burst

The mapping is given by the rule:

$e(B,j) = i(B,j)$ and $e(B,59+j) = i(B,57+j)$ for $j = 0,1,...,56$

and

$e(B,57) = hl(B)$ and $e(B,58) = hu(B)$

The two bits, labelled hl(B) and hu(B) on burst number B are flags used for indication of control channel signalling. For each TCH/HS block not stolen for signalling purposes:

hu(B) = 0 for the first 2 bursts (indicating status of the even numbered bits)
hl(B) = 0 for the last 2 bursts (indicating status of the odd numbered bits)

For the use of hl(B) and hu(B) when a speech frame is stolen for signalling purposes, see subclause 4.3.5.

## 3.3 Data channel at full rate, 12.0 kbit/s radio interface rate (9.6 kbit/s services (TCH/F9.6))

The definition of a 12.0 kbit/s radio interface rate data flow for data services is given in GSM 04.21.

### 3.3.1 Interface with user unit

The user unit delivers to the encoder a bit stream organized in blocks of 60 information bits (data frames) every 5 ms. Four such blocks are dealt with together in the coding process {d(0),...,d(239)}. For non-transparent services those four blocks shall align with one 240-bit RLP frame.

### 3.3.2 Block code

The block of 4 * 60 information bits is not encoded, but only increased with 4 tail bits equal to 0 at the end of the block.

$u(k) = d(k)$ for $k = 0,1,...,239$
$u(k) = 0$ for $k = 240,241,242,243$ (tail bits)

### 3.3.3 Convolutional encoder

This block of 244 bits {u(0),...,u(243)} is encoded with the 1/2 rate convolutional code defined by the following polynomials:

$G0 = 1 + D^3 + D^4$
$G1 = 1 + D + D^3 + D^4$

resulting in 488 coded bits {C(0), C(1),..., C(487)} with

$C(2k) = u(k) + u(k-3) + u(k-4)$
$C(2k+1) = u(k) + u(k-1) + u(k-3) + u(k-4)$ for $k = 0,1,...,243$ ; $u(k) = 0$ for $k < 0$

The code is punctured in such a way that the following 32 coded bits:

{C(11+15j) for j = 0,1,...,31} are not transmitted.

The result is a block of 456 coded bits, {c(0),c(1),..., c(455)}

### 3.3.4 Interleaving

The coded bits are reordered and interleaved according to the following rule:

$i(B,j) = c(n,k)$ for
$k = 0,1,...,455$
$n = 0,1,...,N,N + 1,...$
$B = B_0 + 4n + (k \bmod 19) + (k \operatorname{div} 114)$
$j = (k \bmod 19) + 19 (k \bmod 6)$

The result of the interleaving is a distribution of the reordered 114 bit of a given data block, n = N, over 19 blocks, 6 bits equally distributed in each block, in a diagonal way over consecutive blocks.

Or in other words the interleaving is a distribution of the encoded, reordered 456 bits from four given input data blocks, which taken together give n = N, over 22 bursts, 6 bits equally distributed in the first and 22nd bursts, 12 bits distributed in the second and 21st bursts, 18 bits distributed in the third and 20th bursts and 24 bits distributed in the other 16 bursts.

The block of coded data is interleaved "diagonal", where a new block of coded data starts with every fourth burst and is distributed over 22 bursts.

### 3.3.5 Mapping on a Burst

The mapping is done as specified for TCH/FS in subclause 3.1.4. On bitstealing by a FACCH, see subclause 4.2.5.

## 3.4 Data channel at full rate, 6.0 kbit/s radio interface rate (4.8 kbit/s services (TCH/F4.8))

The definition of a 6.0 kbit/s radio interface rate data flow for data services is given in GSM 04.21.

### 3.4.1 Interface with user unit

The user unit delivers to the encoder a bit stream organized in blocks of 60 information bits (data frames) every 10 ms, {d(0),d(1),...,d(59)}.

In the case where the user unit delivers to the encoder a bit stream organized in blocks of 240 information bits every 40 ms (e.g. RLP frames), the bits {d(0),d(1),...,d(59),d(60),...,d(60+59), d(2*60),...,d(2*60+59), d(3*60),...,d(3*60+59)} shall be treated as four blocks of 60 bits each as described in the remainder of this clause. To ensure end-to-end synchronization of the 240 bit blocks, the resulting block after coding of the first 120 bits {d(0),d(1),...,d(60+59)} shall be transmitted in one of the transmission blocks B0, B2, B4 of the channel mapping defined in GSM 05.02.

### 3.4.2 Block code

Sixteen bits equal to 0 are added to the 60 information bits, the result being a block of 76 bits, {u(0),u(1),...,u(75)}, with:

u(19k+p) = d(15k+p) for k = 0,1,2,3 and p = 0,1,...,14;
u(19k+p) = 0 for k = 0,1,2,3 and p = 15,16,17,18.

Two such blocks forming a block of 152 bits {u'(0),u'(1),...,u'(151)} are dealt with together in the rest of the coding process:

u'(k) = u1(k), k = 0,1,...,75 (u1 = 1st block)
u'(k+76) = u2(k), k = 0,1,...,75 (u2 = 2nd block)

### 3.4.3 Convolutional encoder

This block of 152 bits is encoded with the convolutional code of rate 1/3 defined by the following polynomials:

$G1 = 1 + D + D^3 + D^4$
$G2 = 1 + D^2 + D^4$
$G3 = 1 + D + D^2 + D^3 + D^4$

The result is a block of 3 * 152 = 456 coded bits, {c(0),c(1),...,c(455)}:

c(3k) = u'(k) + u'(k-1) + u'(k-3) + u'(k-4)
c(3k+1) = u'(k) + u'(k-2) + u'(k-4)
c(3k+2) = u'(k) + u'(k-1) + u'(k-2) + u'(k-3) + u'(k-4) for k = 0,1,...,151;
u'(k) = 0 for k < 0

### 3.4.4 Interleaving

The interleaving is done as specified for the TCH/F9.6 in subclause 3.3.4.

### 3.4.5 Mapping on a Burst

The mapping is done as specified for the TCH/FS in subclause 3.1.4. On bitstealing for signalling purposes by a FACCH, see subclause 4.2.5.

## 3.5 Data channel at half rate, 6.0 kbit/s radio interface rate (4.8 kbit/s services (TCH/H4.8))

The definition of a 6.0 kbit/s radio interface rate data flow for data services is given in GSM 04.21.

### 3.5.1 Interface with user unit

The user unit delivers to the encoder a bit stream organized in blocks of 60 information bits (data frames) every 10 ms. Four such blocks are dealt with together in the coding process, {d(0),d(1),...,d(239)}.

For non-transparent services those four blocks shall align with one complete 240-bit RLP frame.

### 3.5.2 Block code

The block encoding is done as specified for the TCH/F9.6 in subclause 3.3.2.

### 3.5.3 Convolutional encoder

The convolutional encoding is done as specified for the TCH/F9.6 in subclause 3.3.3.

### 3.5.4 Interleaving

The interleaving is done as specified for the TCH/F9.6 in subclause 3.3.4.

### 3.5.5 Mapping on a Burst

The mapping is done as specified for the TCH/FS in subclause 3.1.4. On bitstealing for signalling purposes by a FACCH, see subclause 4.3.5.

## 3.6 Data channel at full rate, 3.6 kbit/s radio interface rate (2.4 kbit/s and less services (TCH/F2.4))

The definition of a 3.6 kbit/s radio interface rate data flow for data services is given in GSM 04.21.

### 3.6.1 Interface with user unit

The user unit delivers to the encoder a bit stream organized in blocks of 36 information bits (data frames) every 10 ms. Two such blocks are dealt with together in the coding process, {d(0),d(1),...,d(71)}.

### 3.6.2 Block code

This block of 72 information bits is not encoded, but only increased with four tail bits equal to 0 at the end of the block.

$u(k) = d(k), \quad k = 0,1,...,71$
$u(k) = 0 \quad , \quad k = 72,73,74,75$ (tail bits);

### 3.6.3 Convolutional encoder

This block of 76 bits {u(0),u(1),...,u(75)} is encoded with the convolutional code of rate 1/6 defined by the following polynomials:

$G1 = 1 + D + D^3 + D^4$
$G2 = 1 + D^2 + D^4$
$G3 = 1 + D + D^2 + D^3 + D^4$
$G1 = 1 + D + D^3 + D^4$
$G2 = 1 + D^2 + D^4$
$G3 = 1 + D + D^2 + D^3 + D^4$

The result is a block of 456 coded bits:

{c(0), c(1),...,c(455)}, defined by

$c(6k) = c(6k+3) = u(k) + u(k-1) + u(k-3) + u(k-4)$
$c(6k+1) = c(6k+4) = u(k) + u(k-2) + u(k-4)$
$c(6k+2) = c(6k+5) = u(k) + u(k-1) + u(k-2) + u(k-3) + u(k-4)$, for $k = 0,1,...,75$;
$u(k) = 0$ for $k < 0$

### 3.6.4 Interleaving

The interleaving is done as specified for the TCH/FS in subclause 3.1.3.

### 3.6.5 Mapping on a Burst

The mapping is done as specified for the TCH/FS in subclause 3.1.4.

### 3.7 Data channel at half rate, 3.6 kbit/s radio interface rate (2.4 kbit/s and less services (TCH/H2.4))

The definition of a 3.6 kbit/s radio interface rate data flow for data services is given in GSM 04.21.

#### 3.7.1 Interface with user unit

The user unit delivers to the encoder a bit stream organized in blocks of 36 information bits (data frames) every 10 ms. Two such blocks are dealt with together in the coding process, {d(0),d(1),...,d(71)}.

#### 3.7.2 Block code

The block of 72 information bits is not encoded, but only increased with 4 tail bits equal to 0, at the end of the block.

Two such blocks forming a block of 152 bits {u(0),u(1),...,u(151)} are dealt with together in the rest of the coding process.

| | | |
|---|---|---|
| u(k) | = d1(k), | k = 0,1,...,75 (d1 = 1st information block) |
| u(k+76) | = d2(k), | k = 0,1,...,75 (d2 = 2nd information block) |
| u(k) | = 0, | k = 72,73,74,75,148,149,150,151 (tail bits) |

#### 3.7.3 Convolutional encoder

The convolutional encoding is done as specified for the TCH/F4.8 in subclause 3.4.3.

#### 3.7.4 Interleaving

The interleaving is done as specified for the TCH/F9.6 in subclause 3.3.4.

#### 3.7.5 Mapping on a Burst

The mapping is done as specified for the TCH/FS in subclause 3.1.4. On bit stealing for signalling purposes by a FACCH, see subclause 4.3.5.

## 4 Control Channels

### 4.1 Slow associated control channel (SACCH)

#### 4.1.1 Block constitution

The message delivered to the encoder has a fixed size of 184 information bits {d(0),d(1),...,d(183)}. It is delivered on a burst mode.

#### 4.1.2 Block code

a) Parity bits:

The block of 184 information bits is protected by 40 extra bits used for error correction and detection. These bits are added to the 184 bits according to a shortened binary cyclic code (FIRE code) using the generator polynomial:

$$g(D) = (D^{23} + 1)*(D^{17} + D^3 + 1)$$

The encoding of the cyclic code is performed in a systematic form, which means that, in GF(2), the polynomial:

$$d(0)D^{223} + d(1)D^{222} +...+d(183)D^{40} + p(1)D^{38} +...+p(38)D + p(39)$$

where {p(0),p(1),...,p(39)} are the parity bits , when divided by g(D) yields a remainder equal to:

$$1 + D + D^2 +...+ D^{39}.$$

b) Tail bits

Four tail bits equal to 0 are added to the information and parity bits, the result being a block of 228 bits.

$u(k) = d(k)$ for k= 0,1,...,183
$u(k) = p(k-184)$ for k = 184,185,...,223
$u(k) = 0$ for k = 224,225,226,227 (tail bits)

### 4.1.3 Convolutional encoder

This block of 228 bits is encoded with the 1/2 rate convolutional code (identical to the one used for TCH/FS) defined by the polynomials:

$G0 = 1 + D^3 + D^4$
$G1 = 1 + D + D^3 + D^4$

This results in a block of 456 coded bits: {c(0),c(1),...,c(455)} defined by:

$c(2k) = u(k) + u(k-3) + u(k-4)$
$c(2k+1) = u(k) + u(k-1) + u(k-3) + u(k-4)$ for k = 0,1,...,227 ; u(k) = 0 for k < 0

### 4.1.4 Interleaving

The coded bits are reordered and interleaved according to the following rule:

$i(B,j) = c(n,k)$ for
k = 0,1,...,455
n = 0,1,...,N,N+1,...
$B = B_0 + 4n + (k \bmod 4)$
$j = 2((49k) \bmod 57) + ((k \bmod 8) \operatorname{div} 4)$

See table 1. The result of the reordering of bits is the same as given for a TCH/FS (subclause 3.1.3) as can be seen from the evaluation of the bit number-index j, distributing the 456 bits over 4 blocks on even numbered bits and 4 blocks on odd numbered bits. The resulting 4 blocks are built by putting blocks with even numbered bits and blocks with odd numbered bits together into one block.

The block of coded data is interleaved "block rectangular" where a new data block starts every 4th block and is distributed over 4 blocks.

### 4.1.5 Mapping on a Burst

The mapping is given by the rule:

$e(B,j) = i(B,j)$ and $e(B,59+j) = i(B,57+j)$ for j = 0,1,...,56
and
$e(B,57) = hl(B)$ and $e(B,58) = hu(B)$

The two bits labelled hl(B) and hu(B) on burst number B are flags used for indication of control channel signalling. They are set to "1" for a SACCH.

## 4.2 Fast associated control channel at full rate (FACCH/F)

### 4.2.1 Block constitution

The message delivered to the encoder has a fixed size of 184 information bits. It is delivered on a burst mode.

### 4.2.2 Block code

The block encoding is done as specified for the SACCH in subclause 4.1.2.

### 4.2.3 Convolutional encoder

The convolutional encoding is done as specified for the SACCH in subclause 4.1.3.

### 4.2.4 Interleaving

The interleaving is done as specified for the TCH/FS in subclause 3.1.3.

### 4.2.5 Mapping on a Burst

A FACCH/F frame of 456 coded bits is mapped on 8 consecutive bursts as specified for the TCH/FS in subclause 3.1.4. As a FACCH is transmitted on bits which are stolen in a burst from the traffic channel, the even numbered bits in the first 4 bursts and the odd numbered bits of the last 4 bursts are stolen.

To indicate this to the receiving device the flags hl(B) and hu(B) have to be set according to the following rule:

hu(B) = 1 for the first 4 bursts (even numbered bits are stolen);
hl(B) = 1 for the last 4 bursts (odd numbered bits are stolen).

The consequences of this bitstealing by a FACCH/F is for a:

- speech channel (TCH/FS) and data channel (TCH/F2.4):
  One full frame of data is stolen by the FACCH.

- Data channel (TCH/F9.6):
  The bitstealing by a FACCH/F disturbs a maximum of 96 coded bits generated from an input frame of four data blocks. A maximum of 24 of the 114 coded bits resulting from one input data block of 60 bits may be disturbed.

- Data channel (TCH/F4.8):
  The bit stealing by FACCH/F disturbs a maximum of 96 coded bits generated from an input frame of two data blocks. A maximum of 48 of the 228 coded bits resulting from one input data block of 60 bits may be disturbed.

NOTE: In the case of consecutive stolen frames, a number of bursts will have both the even and the odd bits stolen and both flags hu(B) and hl(B) must be set to 1.

## 4.3 Fast associated control channel at half rate (FACCH/H)

### 4.3.1 Block constitution

The message delivered to the encoder has a fixed size of 184 information bits. It is delivered on a burst mode.

### 4.3.2 Block code

The block encoding is done as specified for the SACCH in subclause 4.1.2.

### 4.3.3 Convolutional encoder

The convolutional encoding is done as specified for the SACCH in subclause 4.1.3.

### 4.3.4 Interleaving

The coded bits are reordered and interleaved according to the following rule:

$i(B,j) = c(n,k)$ for $k = 0,1,...,455$
$n = 0,1,...,N,N+1,...$
$B = B_0 + 4n + (k \bmod 8) - 4((k \bmod 8) \text{ div } 6)$
$j = 2((49k) \bmod 57) + ((k \bmod 8) \text{ div } 4)$

See table 1. The result of the reordering of bits is the same as given for a TCH/FS (subclause 3.1.3) as can be seen from the evaluation of the bit number-index j, distributing the 456 bits over 4 blocks on even numbered bits and 4 blocks on odd numbered bits. The 2 last blocks with even numbered bits and the 2 last blocks with odd numbered bits are put together into 2 full middle blocks.

The block of coded data is interleaved "block diagonal" where a new data block starts every 4th block and is distributed over 6 blocks.

### 4.3.5 Mapping on a Burst

A FACCH/H frame of 456 coded bits is mapped on 6 consecutive bursts by the rule:

$e(B,j) = i(B,j)$ and $e(B,59+j) = i(B,57+j)$ for $j = 0,1,...,56$
and
$e(B,57) = hl(B)$ and $e(B,58) = hu(B)$

As a FACCH/H is transmitted on bits which are stolen from the traffic channel, the even numbered bits of the first 2 bursts, all bits of the middle 2 bursts and the odd numbered bits of the last 2 bursts are stolen.

To indicate this to the receiving device the flags hl(B) and hu(B) have to be set according to the following rule:

hu(B) = 1 for the first 2 bursts (even numbered bits are stolen)

hu(B) = 1 and hl(B) = 1 for the middle 2 bursts (all bits are stolen)

hl(B) = 1 for the last 2 bursts (odd numbered bits are stolen)

The consequences of this bitstealing by a FACCH/H is for a:

- speech channel (TCH/HS):
  two full consecutive speech frames are stolen by a FACCH/H.

- data channel (TCH/H4.8):
  The bitstealing by FACCH/H disturbs a maximum of 96 coded bits generated from an input frame of four data blocks. A maximum of 24 out of the 114 coded bits resulting from one input data block of 60 bits may be disturbed.

- data channel (TCH/H2.4):
  The bitstealing by FACCH/H disturbs a maximum of 96 coded bits generated from an input frame of four data blocks. A maximum of 24 out of the 114 coded bits resulting from one input data block of 36 bits may be disturbed.

NOTE: In the case of consecutive stolen frames, two overlapping bursts will have both the even and the odd numbered bits stolen and both flags hu(B) and hl(B) must be set to 1.

## 4.4 Broadcast control, Paging, Access grant, Notification and Cell broadcast channels (BCCH, PCH, AGCH, NCH, CBCH)

The coding scheme used for the broadcast control , paging, access grant, notification and cell broadcast messages is the same as for the SACCH messages, specified in subclause 4.1.

### 4.5 Stand-alone dedicated control channel (SDCCH)

The coding scheme used for the dedicated control channel messages is the same as for SACCH messages, specified in subclause 4.1.

### 4.6 Random access channel (RACH)

The burst carrying the random access uplink message has a different structure. It contains 8 information bits d(0),d(1),...,d(7).

Six parity bits p(0),p(1),...,p(5) are defined in such a way that in GF(2) the binary polynomial:

> $d(0)D^{13} + ... + d(7)D^{6} + p(0)D^{5} + ... + p(5)$, when divided by $D^{6} + D^{5} + D^{3} + D^{2} + D + 1$ yields a remainder equal to $D^{5} + D^{4} + D^{3} + D^{2} + D + 1$.

The six bits of the BSIC, {B(0),B(1),...,B(5)}, of the BS to which the Random Access is intended, are added bitwise modulo 2 to the six parity bits, {p(0),p(1),...,p(5)}. This results in six colour bits, C(0) to C(5) defined as C(k) = b(k) + p(k) (k = 0 to 5) where:

> b(0) = MSB of PLMN colour code
> b(5) = LSB of BS colour code.

This defines {u(0),u(1),..., u(17)} by:

| | | |
|---|---|---|
| u(k) | = d(k) | for k = 0,1,...,7 |
| u(k) | = C(k-8) | for k = 8,9,...,13 |
| u(k) | = 0 | for k = 14,15,16,17 (tail bits) |

The bits {e(0),e(1),..., e(35)} are obtained by the same convolutional code of rate 1/2 as for TCH/FS, defined by the polynomials:

> $G0 = 1 + D^{3} + D^{4}$
> $G1 = 1 + D + D^{3} + D^{4}$

and with:

| | |
|---|---|
| e(2k) | = u(k) + u(k-3) + u(k-4) |
| e(2k+1) | = u(k) + u(k-1) + u(k-3) + u(k-4) for k = 0,1,...,17 ; u(k) = 0 for k < 0 |

### 4.7 Synchronization channel (SCH)

The burst carrying the synchronization information on the downlink BCCH has a different structure. It contains 25 information bits {d(0),d(1),..., d(24)}, 10 parity bits {p(0),p(1),..., p(9)} and 4 tail bits. The precise ordering of the information bits is given in GSM 04.08.

The ten parity bits {p(0),p(1),,...,p(9)} are defined in such a way that in GF(2) the binary polynomial:

> $d(0)D^{34} + ... + d(24)D^{10} + p(0)D^{9} + ... + p(9)$, when divided by:
> $D^{10} + D^{8} + D^{6} + D^{5} + D^{4} + D^{2} + 1$, yields a remainder equal to:
> $D^{9} + D^{8} + D^{7} + D^{6} + D^{5} + D^{4} + D^{3} + D^{2} + D + 1$.

Thus the encoded bits {u(0),u(1),...,u(38)} are:

| | | |
|---|---|---|
| u(k) | = d(k) | for k = 0,1,...,24 |
| u(k) | = p(k-25) | for k = 25,26,...,34 |
| u(k) | = 0 | for k = 35,36,37,38 (tail bits) |

The bits {e(0),e(1),..., e(77)} are obtained by the same convolutional code of rate 1/2 as for TCH/FS, defined by the polynomials:

$G0 = 1 + D^3 + D^4$
$G1 = 1 + D + D^3 + D^4$

and with:

e(2k) = u(k) + u(k-3) + u(k-4)
e(2k+1) = u(k) + u(k-1) + u(k-3) + u(k-4) for k = 0,1,....,77 ; u(k) = 0 for k < 0

## 4.8 Access Burst on channels other than RACH

The encoding of this burst is as defined in subclause 4.6 for the random access channel (RACH). The BSIC used shall be the BSIC of the BTS to which the burst is intended.

## 4.9 Access Bursts for uplink access on a channel used for VGCS

The encoding of this burst is as defined in subclause 4.5 for the RACH. The BSIC used by the Mobile Station shall be the BSIC indicated by network signalling, or if not thus provided, the last received BSIC on the SCH of the current cell.

**Table 1: Reordering and partitioning of a coded block of 456 bits into 8 sub-blocks**

| k mod 8= | 0 | 1 | 2 | 3 |
|---|---|---|---|---|
| j=0 | k=0 | 57 | 114 | 171 |
| 2 | 64 | 121 | 178 | 235 |
| 4 | 128 | 185 | 242 | 299 |
| 6 | 192 | 249 | 306 | 363 |
| 8 | 256 | 313 | 370 | 427 |
| 10 | 320 | 377 | 434 | 35 |
| | 384 | 441 | 42 | 99 |
| | 448 | 49 | 106 | 163 |
| | 56 | 113 | 170 | 227 |
| | 120 | 177 | 234 | 291 |
| 20 | 184 | 241 | 298 | 355 |
| | 248 | 305 | 362 | 419 |
| | 312 | 369 | 426 | 27 |
| | 376 | 433 | 34 | 91 |
| | 440 | 41 | 98 | 155 |
| 30 | 48 | 105 | 162 | 219 |
| | 112 | 169 | 226 | 283 |
| | 176 | 233 | 290 | 347 |
| | 240 | 297 | 354 | 411 |
| | 304 | 361 | 418 | 19 |
| 40 | 368 | 425 | 26 | 83 |
| | 432 | 33 | 90 | 147 |
| | 40 | 97 | 154 | 211 |
| | 104 | 161 | 218 | 275 |
| | 168 | 225 | 282 | 339 |
| 50 | 232 | 289 | 346 | 403 |
| | 296 | 353 | 410 | 11 |
| | 360 | 417 | 18 | 75 |
| | 424 | 25 | 82 | 139 |
| | 32 | 89 | 146 | 203 |
| 60 | 96 | 153 | 210 | 267 |
| | 160 | 217 | 274 | 331 |
| | 224 | 281 | 338 | 395 |
| | 288 | 345 | 402 | 3 |
| | 352 | 409 | 10 | 67 |
| 70 | 416 | 17 | 74 | 131 |
| | 24 | 81 | 138 | 195 |
| | 88 | 145 | 202 | 259 |
| | 152 | 209 | 266 | 323 |
| | 216 | 273 | 330 | 387 |
| 80 | 280 | 337 | 394 | 451 |
| | 344 | 401 | 2 | 59 |
| | 408 | 9 | 66 | 123 |
| | 16 | 73 | 130 | 187 |
| | 80 | 137 | 194 | 251 |
| 90 | 144 | 201 | 258 | 315 |
| | 208 | 265 | 322 | 379 |
| | 272 | 329 | 386 | 443 |
| | 336 | 393 | 450 | 51 |
| | 400 | 1 | 58 | 115 |
| 100 | 8 | 65 | 122 | 179 |
| | 72 | 129 | 186 | 243 |
| | 136 | 193 | 250 | 307 |
| | 200 | 257 | 314 | 371 |
| | 264 | 321 | 378 | 435 |
| 110 | 328 | 385 | 442 | 43 |
| 112 | 392 | 449 | 50 | 107 |

| k mod 8= | 4 | 5 | 6 | 7 |
|---|---|---|---|---|
| j=1 | 228 | 285 | 342 | 399 |
| 3 | 292 | 349 | 406 | 7 |
| 5 | 356 | 413 | 14 | 71 |
| 7 | 420 | 21 | 78 | 135 |
| 9 | 28 | 85 | 142 | 199 |
| 11 | 92 | 149 | 206 | 263 |
| | 156 | 213 | 270 | 327 |
| | 220 | 277 | 334 | 391 |
| | 284 | 341 | 398 | 455 |
| | 348 | 405 | 6 | 63 |
| 21 | 412 | 13 | 70 | 127 |
| | 20 | 77 | 134 | 191 |
| | 84 | 141 | 198 | 255 |
| | 148 | 205 | 262 | 319 |
| | 212 | 269 | 326 | 383 |
| 31 | 276 | 333 | 390 | 447 |
| | 340 | 397 | 454 | 55 |
| | 404 | 5 | 62 | 119 |
| | 12 | 69 | 126 | 183 |
| | 76 | 133 | 190 | 247 |
| 41 | 140 | 197 | 254 | 311 |
| | 204 | 261 | 318 | 375 |
| | 268 | 325 | 382 | 439 |
| | 332 | 389 | 446 | 47 |
| | 396 | 453 | 54 | 111 |
| 51 | 4 | 61 | 118 | 175 |
| | 68 | 125 | 182 | 239 |
| | 132 | 189 | 246 | 303 |
| | 196 | 253 | 310 | 367 |
| | 260 | 317 | 374 | 431 |
| 61 | 324 | 381 | 438 | 39 |
| | 388 | 445 | 46 | 103 |
| | 452 | 53 | 110 | 167 |
| | 60 | 117 | 174 | 231 |
| | 124 | 181 | 238 | 295 |
| 71 | 188 | 245 | 302 | 359 |
| | 252 | 309 | 366 | 423 |
| | 316 | 373 | 430 | 31 |
| | 380 | 437 | 38 | 95 |
| | 444 | 45 | 102 | 159 |
| 81 | 52 | 109 | 166 | 223 |
| | 116 | 173 | 230 | 287 |
| | 180 | 237 | 294 | 351 |
| | 244 | 301 | 358 | 415 |
| | 308 | 365 | 422 | 23 |
| 91 | 372 | 429 | 30 | 87 |
| | 436 | 37 | 94 | 151 |
| | 44 | 101 | 158 | 215 |
| | 108 | 165 | 222 | 279 |
| | 172 | 229 | 286 | 343 |
| 101 | 236 | 293 | 350 | 407 |
| | 300 | 357 | 414 | 15 |
| | 364 | 421 | 22 | 79 |
| | 428 | 29 | 86 | 143 |
| | 36 | 93 | 150 | 207 |
| 111 | 100 | 157 | 214 | 271 |
| 113 | 164 | 221 | 278 | 335 |

**Table 2: Subjective importance of encoded bits for the full rate speech TCH (Parameter names and bit indices refer to GSM 06.10)**

| Importance class | Parameter name | Parameter number | Bit index | Label | Class |
|---|---|---|---|---|---|
| 1 | Log area ratio 1 | 1 | 5 | d0 | 1 with parity check |
| | block amplitude | 12,29,46,63 | 5 | d1, d2, d3, d4 | |
| 2 | Log area ratio 1 | 1 | 4 | | |
| | Log area ratio 2 | 2 | 5 | | |
| | Log area ratio 3 | 3 | 4 | | |
| 3 | Log area ratio 1 | 1 | 3 | | |
| | Log area ratio 2 | 2 | 4 | | |
| | Log area ratio 3 | 3 | 3 | | |
| | Log area ratio 4 | 4 | 4 | | |
| | LPT lag | 9,26,43,60 | 6 | | |
| | block amplitude | 12,29,43,63 | 4 | | |
| | Log area ratio 2,5,6 | 2,5,6 | 3 | | |
| | LPT lag | 9,26,43,60 | 5 | | |
| | LPT lag | 9,26,43,60 | 4 | | |
| | LPT lag | 9,26,43,60 | 3 | | |
| | LPT lag | 9,26,43,60 | 2 | | |
| 4 | block amplitude | 12,29,43,63 | 3 | | |
| | Log area ratio 1 | 1 | 2 | | |
| | Log area ratio 4 | 4 | 3 | | |
| | Log area ratio 7 | 7 | 2 | | |
| | LPT lag | 9,26,43,60 | 1 | ...d48, d49 | |
| | Log area ratio 5,6 | 5,6 | 2 | d50 | 1 with parity check |
| | LPT gain | 10,27,44,61 | 1 | | |
| | LPT lag | 9,26,43,60 | 0 | | |
| | Grid position | 11,28,45,62 | 1 | | |
| 5 | Log area ratio 1 | 1 | 1 | | |
| | Log area ratio 2,3,8,4 | 2,3,8,4 | 2 | | |
| | Log area ratio 5,7 | 5,7 | 1 | | |
| | LPT gain | 10,27,44,61 | 0 | | |
| | block amplitude | 12,29,43,63 | 2 | | |
| | RPE pulses | 13..25 | 2 | | |
| | RPE pulses | 30..42 | 2 | | |
| | RPE pulses | 47..59 | 2 | | |
| | RPE pulses | 64..76 | 2 | | |
| | Grid position | 11,28,45,62 | 0 | | |
| | block amplitude | 12,29,43,63 | 1 | | |
| | RPE pulses | 13..25 | 1 | | |
| | RPE pulses | 30..42 | 1 | | |
| | RPE pulses | 47..59 | 1 | | |
| | RPE pulses | 64..67 | 1 | ...d181 | |
| | RPE pulses | 68..76 | 1 | d182 | 2 |
| 6 | Log area ratio 1 | 1 | 0 | | |
| | Log area ratio 2,3,6 | 2,3,6 | 1 | | |
| | Log area ratio 7 | 7 | 0 | | |
| | Log area ratio 8 | 8 | 1 | | |
| | Log area ratio 8,3 | 8,3 | 0 | | |
| | Log area ratio 4 | 4 | 1 | | |
| | Log area ratio 4,5 | 4,5 | 0 | | |
| | block amplitude | 12,29,43,63 | 0 | | |
| | RPE pulses | 13..25 | 0 | | |
| | RPE pulses | 30..42 | 0 | | |
| | RPE pulses | 47..59 | 0 | | |
| | RPE pulses | 64..67 | 0 | | |
| | Log area ratio 2,6 | 2,6 | 0 | ...d259 | |

**Table 3a: Subjective importance of encoded bits for the half rate speech TCH for unvoiced speech frames (Parameter names and bit indices refer to GSM 06.20)**

| Parameter name | Bit index | Label | Class |
|---|---|---|---|
| R0 | 1 | d0 | |
| LPC 3 | 7 | d1 | |
| GSP 0-1 | 2 | d2 | |
| GSP 0-2 | 2 | d3 | |
| GSP 0-3 | 2 | d4 | |
| GSP 0-4 | 2 | d5 | |
| LPC 1 | 0 | d6 | |
| LPC 2 | 5...1 | d7...d11 | |
| LPC 3 | 6...1 | d12... | |
| Code 1-2 | 0 | | |
| Code 2-2 | 6...0 | | |
| Code 1-3 | 6...0 | | 1 |
| Code 2-3 | 6...3 | | |
| LPC3 | 0 | | without |
| R0 | 0 | | parity |
| INT-LPC | 0 | | check |
| Code 1-2 | 1...6 | | |
| Code 2-1 | 0...6 | | |
| Code 1-1 | 0...6 | | |
| GSP 0-4 | 0 | | |
| GSP 0-3 | 0 | | |
| GSP 0-2 | 0 | | |
| GSP 0-1 | 0 | | |
| LPC 2 | 0 | | |
| GSP 0-4 | 1 | | |
| GSP 0-3 | 1 | | |
| GSP 0-2 | 1 | | |
| GSP 0-1 | 1 | | |
| LPC 1 | 1...4 | ...d72 | |
| LPC 1 | 5 | d73... | |
| GSP 0-4 | 3 | | |
| GSP 0-3 | 3 | | |
| GSP 0-2 | 3 | | |
| GSP 0-1 | 3 | | |
| LPC2 | 6...8 | | 1 |
| GSP 0-4 | 4 | | |
| GSP 0-3 | 4 | | with |
| GSP 0-2 | 4 | | parity |
| GSP 0-1 | 4 | | check |
| LPC 1 | 6...9 | | |
| R0 | 2 | | |
| LPC 1 | 10 | | |
| R0 | 3,4 | | |
| Mode | 0,1 | ...d94 | |
| Code 2-4 | 0...6 | d95... | |
| Code 1-4 | 0...6 | | 2 |
| Code 2-3 | 0...2 | ...d111 | |

**Table 3b: Subjective importance of encoded bits for the half rate speech TCH for voiced speech frames (Parameter names and bit indices refer to GSM 06.20)**

| Parameter name | Bit index | Label | Class |
|---|---|---|---|
| LPC 1 | 2,1 | d0, d1 | |
| LPC 2 | 6...4 | d2... | |
| GSP 0-1 | 4 | | |
| GSP 0-2 | 4 | | |
| GSP 0-3 | 4 | | |
| GSP 0-4 | 4 | | |
| GSP 0-1 | 3 | | |
| GSP 0-2 | 3 | | |
| GSP 0-3 | 3 | | |
| GSP 0-4 | 3 | | |
| GSP 0-1 | 2 | | |
| GSP 0-2 | 2 | | |
| GSP 0-3 | 2 | | |
| GSP 0-4 | 2 | | |
| Code 1 | 8...0 | | |
| Code 2 | 8...5 | | |
| Code 2 | 2...0 | | |
| Code 3 | 8 | | |
| Code 2 | 4,3 | | |
| GSP 0-1 | 1 | | |
| GSP 0-2 | 1 | | |
| GSP 0-3 | 1 | | |
| GSP 0-4 | 1 | | 1 |
| GSP 0-1 | 0 | | |
| GSP 0-2 | 0 | | without |
| GSP 0-3 | 0 | | parity |
| GSP 0-4 | 0 | | check |
| INT-LPC | 0 | | |
| LPC 2 | 0 | | |
| LPC 3 | 0 | | |
| LAG 4 | 0 | | |
| LPC 3 | 1 | | |
| LPC 2 | 1 | | |
| LAG 4 | 1 | | |
| LAG 3 | 0 | | |
| LAG 2 | 0 | | |
| LAG 1 | 0 | | |
| LAG 4 | 2 | | |
| LAG 3 | 1 | | |
| LAG 2 | 1 | | |
| LAG 1 | 1 | | |
| LPC 3 | 2...4 | | |
| LPC 2 | 2 | | |
| LPC 3 | 5,6 | | |
| LPC 2 | 3 | | |
| R0 | 0 | | |
| LPC 3 | 7 | | |
| LPC 1 | 0 | | |
| LAG 4 | 3 | | |
| LAG 3 | 2 | | |
| LAG 2 | 2 | | |
| LAG 1 | 2 | | |
| R0 | 1 | ...d72 | |

| Parameter name | Bit index | Label | Class |
|---|---|---|---|
| LAG 3 | 3 | d73... | |
| LAG 2 | 3 | | |
| LAG 1 | 3,4 | | 1 |
| LPC 2 | 7,8 | | |
| LPC 1 | 3...6 | | with |
| R0 | 2 | | parity |
| LAG 1 | 5...7 | | check |
| LPC 1 | 7...10 | | |
| R0 | 3,4 | | |
| Mode | 0,1 | ...d94 | |
| Code 4 | 0...8 | d95... | 2 |
| Code 3 | 0...7 | ...d111 | |

**Table 4: Reordering and partitioning of a coded block of 228 bits into 4 sub-blocks for TCH/HS**

| b= | 0 | 1 |
|---|---|---|
| i=0 | k=0 | 150 |
| 2 | 38 | 188 |
| 4 | 76 | 226 |
| 6 | 114 | 14 |
| 8 | 152 | 52 |
| 10 | 190 | 90 |
| | 18 | 128 |
| | 56 | 166 |
| | 94 | 204 |
| | 132 | 32 |
| 20 | 170 | 70 |
| | 208 | 108 |
| | 8 | 146 |
| | 46 | 184 |
| | 84 | 222 |
| 30 | 122 | 10 |
| | 160 | 48 |
| | 198 | 86 |
| | 28 | 124 |
| | 66 | 162 |
| 40 | 104 | 200 |
| | 142 | 30 |
| | 180 | 68 |
| | 218 | 106 |
| | 4 | 144 |
| 50 | 42 | 182 |
| | 80 | 220 |
| | 118 | 6 |
| | 156 | 44 |
| | 194 | 82 |
| 60 | 22 | 120 |
| | 60 | 158 |
| | 98 | 196 |
| | 136 | 24 |
| | 174 | 62 |
| 70 | 212 | 100 |
| | 12 | 138 |
| | 50 | 176 |
| | 88 | 214 |
| | 126 | 2 |
| 80 | 164 | 40 |
| | 202 | 78 |
| | 34 | 116 |
| | 72 | 154 |
| | 110 | 192 |
| 90 | 148 | 26 |
| | 186 | 64 |
| | 224 | 102 |
| | 16 | 140 |
| | 54 | 178 |
| 100 | 92 | 216 |
| | 130 | 20 |
| | 168 | 58 |
| | 206 | 96 |
| | 36 | 134 |
| 110 | 74 | 172 |
| 112 | 112 | 210 |

| b= | 2 | 3 |
|---|---|---|
| i=1 | k=1 | 151 |
| 3 | 39 | 189 |
| 5 | 77 | 227 |
| 7 | 115 | 15 |
| 9 | 153 | 53 |
| 11 | 191 | 91 |
| | 19 | 129 |
| | 57 | 167 |
| | 95 | 205 |
| | 133 | 33 |
| 21 | 171 | 71 |
| | 209 | 109 |
| | 9 | 147 |
| | 47 | 185 |
| | 85 | 223 |
| 31 | 123 | 11 |
| | 161 | 49 |
| | 199 | 87 |
| | 29 | 125 |
| | 67 | 163 |
| 41 | 105 | 201 |
| | 143 | 31 |
| | 181 | 69 |
| | 219 | 107 |
| | 5 | 145 |
| 51 | 43 | 183 |
| | 81 | 221 |
| | 119 | 7 |
| | 157 | 45 |
| | 195 | 83 |
| 61 | 23 | 121 |
| | 61 | 159 |
| | 99 | 197 |
| | 137 | 25 |
| | 175 | 63 |
| 71 | 213 | 101 |
| | 13 | 139 |
| | 51 | 177 |
| | 89 | 215 |
| | 127 | 3 |
| 81 | 165 | 41 |
| | 203 | 79 |
| | 35 | 117 |
| | 73 | 155 |
| | 111 | 193 |
| 91 | 149 | 27 |
| | 187 | 65 |
| | 225 | 103 |
| | 17 | 141 |
| | 55 | 179 |
| 101 | 93 | 217 |
| | 131 | 21 |
| | 169 | 59 |
| | 207 | 97 |
| | 37 | 135 |
| 111 | 75 | 173 |
| 113 | 113 | 2 |
| | | 11 |

**Table 5: Enhanced Full rate Source Encoder output parameters in order of occurrence and bit allocation within the speech frame of 244 bits/20 ms(Parameter names and bit indices refer to GSM 06.60)**

| Bits (MSB-LSB) | Description |
|---|---|
| s1 - s7 | index of 1st LSF submatrix |
| s8 - s15 | index of 2nd LSF submatrix |
| s16 - s23 | index of 3rd LSF submatrix |
| s24 | sign of 3rd LSF submatrix |
| s25 - s32 | index of 4th LSF submatrix |
| s33 - s38 | index of 5th LSF submatrix |
| **subframe 1** | |
| s39 - s47 | adaptive codebook index |
| s48 - s51 | adaptive codebook gain |
| s52 | sign information for 1st and 6th pulses |
| s53 - s55 | position of 1st pulse |
| s56 | sign information for 2nd and 7th pulses |
| s57 - s59 | position of 2nd pulse |
| s60 | sign information for 3rd and 8th pulses |
| s61 - s63 | position of 3rd pulse |
| s64 | sign information for 4th and 9th pulses |
| s65 - s67 | position of 4th pulse |
| s68 | sign information for 5th and 10th pulses |
| s69 - s71 | position of 5th pulse |
| s72 - s74 | position of 6th pulse |
| s75 - s77 | position of 7th pulse |
| s78 - s80 | position of 8th pulse |
| s81 - s83 | position of 9th pulse |
| s84 - s86 | position of 10th pulse |
| s87 - s91 | fixed codebook gain |
| **subframe 2** | |
| s92 - s97 | adaptive codebook index (relative) |
| s98 - s141 | same description as s48 - s91 |
| **subframe 3** | |
| s142 - s194 | same description as s39 - s91 |
| **subframe 4** | |
| s195 - s244 | same description as s92 - s141 |

**Table 6: Ordering of enhanced full rate speech parameters for the channel encoder (subjective importance of encoded bits) (after preliminary channel coding) (Parameter names refers to GSM 06.60)**

| Description | Bits (Table 5) | Bit index within parameter |
|---|---|---|
| **CLASS 1a: 50 bits (protected by 3 bit TCH-FS CRC)** | | |
| LTP-LAG 1 | w39 - w44 | b8, b7, b6, b5, b4, b3 |
| LTP-LAG 3 | w146 - w151 | b8, b7, b6, b5, b4, b3 |
| LTP-LAG 2 | w94 - w95 | b5, b4 |
| LTP-LAG 4 | w201 - w202 | b5, b4 |
| LTP-GAIN 1 | n48 | b3 |
| FCB-GAIN 1 | w89 | b4 |
| LTP-GAIN 2 | w100 | b3 |
| FCB-GAIN 2 | w141 | b4 |
| LTP-LAG 1 | w45 | b2 |
| LTP-LAG 3 | w152 | b2 |
| LTP-LAG 2 | w96 | b3 |
| LTP-LAG 4 | w203 | b3 |
| LPC 1 | w2 - w3 | b5, b4 |
| LPC 2 | w8 | b7 |
| LPC 2 | w10 | b5 |
| LPC 3 | w18 - w19 | b6, b5 |
| LPC 3 | w24 | b0 |
| LTP-LAG 1 | w46 - w47 | b1, b0 |
| LTP-LAG 3 | w153 - w154 | b1, b0 |
| LTP-LAG 2 | w97 | b2 |
| LTP-LAG 4 | w204 | b2 |
| LPC 1 | w4 - w5 | b3, b2 |
| LPC 2 | w11 - w12 | b4, b3 |
| LPC 3 | w16 | b8 |
| LPC 2 | w9 | b6 |
| LPC 1 | w6 - w7 | b1, b0 |
| LPC 2 | w13 | b2 |
| LPC 3 | w17 | b7 |
| LPC 3 | w20 | b4 |
| LTP-LAG 2 | w98 | b1 |
| LTP-LAG 4 | w205 | b1 |
| **CLASS 1b: 132 bits (protected)** | | |
| LPC 1 | w1 | b6 |
| LPC 2 | w14 - w15 | b1, b0 |
| LPC 3 | w21 | b3 |
| LPC 4 | w25 - w26 | b7, b6 |
| LPC 4 | w28 | b4 |
| LTP-GAIN 3 | w155 | b3 |
| LTP-GAIN 4 | w207 | b3 |
| FCB-GAIN 3 | w196 | b4 |
| FCB-GAIN 4 | w248 | b4 |
| FCB-GAIN 1 | w90 | b3 |
| FCB-GAIN 2 | w142 | b3 |
| FCB-GAIN 3 | w197 | b3 |
| FCB-GAIN 4 | w249 | b3 |

(continued)

**Table 6 (continued): Ordering of enhanced full rate speech parameters for the channel encoder (subjective importance of encoded bits) (after preliminary channel coding) (Parameter names refers to GSM 06.60)**

| Description | Bits (Table 5) | Bit index within parameter |
|---|---|---|
| CRC-POLY | w253 - w260 | b7, b6, b5, b4, b3, b2, b1, b0 |
| LTP-GAIN 1 | w49 | b2 |
| LTP-GAIN 2 | w101 | b2 |
| LTP-GAIN 3 | w156 | b2 |
| LTP-GAIN 4 | w208 | b2 |
| LPC 3 | w22 - w23 | b2, b1 |
| LPC 4 | w27 | b5 |
| LPC 4 | w29 | b3 |
| PULSE 1_1 | w52 | b3 |
| PULSE 1_2 | w56 | b3 |
| PULSE 1_3 | w60 | b3 |
| PULSE 1_4 | w64 | b3 |
| PULSE 1_5 | w68 | b3 |
| PULSE 2_1 | w104 | b3 |
| PULSE 2_2 | w108 | b3 |
| PULSE 2_3 | w112 | b3 |
| PULSE 2_4 | w116 | b3 |
| PULSE 2_5 | w120 | b3 |
| PULSE 3_1 | w159 | b3 |
| PULSE 3_2 | w163 | b3 |
| PULSE 3_3 | w167 | b3 |
| PULSE 3_4 | w171 | b3 |
| PULSE 3_5 | w175 | b3 |
| PULSE 4_1 | w211 | b3 |
| PULSE 4_2 | w215 | b3 |
| PULSE 4_3 | w219 | b3 |
| PULSE 4_4 | w223 | b3 |
| PULSE 4_5 | w227 | b3 |
| FCB-GAIN 1 | w91 | b2 |
| FCB-GAIN 2 | w143 | b2 |
| FCB-GAIN 3 | w198 | b2 |
| FCB-GAIN 4 | w250 | b2 |
| LTP-GAIN 1 | w50 | b1 |
| LTP-GAIN 2 | w102 | b1 |
| LTP-GAIN 3 | w157 | b1 |
| LTP-GAIN 4 | w209 | b1 |
| LPC 4 | w30 - w32 | b2, b1, b0 |
| LPC 5 | w33 - w36 | b5, b4, b3, b2 |
| LTP-LAG 2 | w99 | b0 |
| LTP-LAG 4 | w206 | b0 |
| PULSE 1_1 | w53 | b2 |
| PULSE 1_2 | w57 | b2 |

(continued)

**Table 6 (continued): Ordering of enhanced full rate speech parameters for the channel encoder (subjective importance of encoded bits) (after preliminary channel coding) (Parameter names refers to GSM 06.60)**

| Description | Bits (Table 5) | Bit index within parameter |
|---|---|---|
| PULSE 1_3 | w61 | b2 |
| PULSE 1_4 | w65 | b2 |
| PULSE 1_5 | w69 | b2 |
| PULSE 2_1 | w105 | b2 |
| PULSE 2_2 | w109 | b2 |
| PULSE 2_3 | w113 | b2 |
| PULSE 2_4 | w117 | b2 |
| PULSE 2_5 | w121 | b2 |
| PULSE 3_1 | w160 | b2 |
| PULSE 3_2 | w164 | b2 |
| PULSE 3_3 | w168 | b2 |
| PULSE 3_4 | w172 | b2 |
| PULSE 3_5 | w176 | b2 |
| PULSE 4_1 | w212 | b2 |
| PULSE 4_2 | w216 | b2 |
| PULSE 4_3 | w220 | b2 |
| PULSE 4_4 | w224 | b2 |
| PULSE 4_5 | w228 | b2 |
| PULSE 1_1 | w54 | b1 |
| PULSE 1_2 | w58 | b1 |
| PULSE 1_3 | w62 | b1 |
| PULSE 1_4 | w66 | b1 |
| PULSE 2_1 | w106 | b1 |
| PULSE 2_2 | w110 | b1 |
| PULSE 2_3 | w114 | b1 |
| PULSE 2_4 | w118 | b1 |
| PULSE 3_1 | w161 | b1 |
| PULSE 3_2 | w165 | b1 |
| PULSE 3_3 | w169 | b1 |
| PULSE 3_4 | w173 | b1 |
| PULSE 4_1 | w213 | b1 |
| PULSE 4_3 | w221 | b1 |
| PULSE 4_4 | w225 | b1 |
| FCB-GAIN 1 | w92 | b1 |
| FCB-GAIN 2 | w144 | b1 |
| FCB-GAIN 3 | s199 | b1 |
| FCB-GAIN 4 | w251 | b1 |
| LTP-GAIN 1 | w51 | b0 |
| LTP-GAIN 2 | w103 | b0 |
| LTP-GAIN 3 | w158 | b0 |
| LTP-GAIN 4 | w210 | b0 |
| FCB-GAIN 1 | w93 | b0 |
| FCB-GAIN 2 | w145 | b0 |
| FCB-GAIN 3 | w200 | b0 |

(continued)

**Table 6 (continued): Ordering of enhanced full rate speech parameters for the channel encoder (subjective importance of encoded bits) (after preliminary channel coding) (Parameter names refers to GSM 06.60)**

| Description | Bits (Table 5) | Bit index within parameter |
|---|---|---|
| FCB-GAIN 4 | w252 | b0 |
| PULSE 1_1 | w55 | b0 |
| PULSE 1_2 | w59 | b0 |
| PULSE 1_3 | w63 | b0 |
| PULSE 1_4 | w67 | b0 |
| PULSE 2_1 | w107 | b0 |
| PULSE 2_2 | w111 | b0 |
| PULSE 2_3 | w115 | b0 |
| PULSE 2_4 | w119 | b0 |
| PULSE 3_1 | w162 | b0 |
| PULSE 3_2 | w166 | b0 |
| PULSE 3_3 | w170 | b0 |
| PULSE 3_4 | w174 | b0 |
| PULSE 4_1 | w214 | b0 |
| PULSE 4_3 | w222 | b0 |
| PULSE 4_4 | w226 | b0 |
| LPC 5 | w37 - w38 | b1, b0 |
| **CLASS 2: 78 bits (unprotected)** | | |
| PULSE 1_5 | w70 | b1 |
| PULSE 1_5 | w72 - w73 | b1, b1 |
| PULSE 2_5 | w122 | b1 |
| PULSE 2_5 | w124 - s125 | b1, b1 |
| PULSE 3_5 | w177 | b1 |
| PULSE 3_5 | w179 - w180 | b1, b1 |
| PULSE 4_5 | w229 | b1 |
| PULSE 4_5 | w231 - w232 | b1, b1 |
| PULSE 4_2 | w217 - w218 | b1, b0 |
| PULSE 1_5 | w71 | b0 |
| PULSE 2_5 | w123 | b0 |
| PULSE 3_5 | w178 | b0 |
| PULSE 4_5 | w230 | b0 |
| PULSE 1_6 | w74 | b2 |
| PULSE 1_7 | w77 | b2 |
| PULSE 1_8 | w80 | b2 |
| PULSE 1_9 | w83 | b2 |
| PULSE 1_10 | w86 | b2 |
| PULSE 2_6 | w126 | b2 |
| PULSE 2_7 | w129 | b2 |
| PULSE 2_8 | w132 | b2 |
| PULSE 2_9 | w135 | b2 |
| PULSE 2_10 | w138 | b2 |
| PULSE 3_6 | w181 | b2 |
| PULSE 3_7 | w184 | b2 |
| PULSE 3_8 | w187 | b2 |
| PULSE 3_9 | w190 | b2 |

(continued)

**Table 6 (concluded): Ordering of speech parameters for the channel encoder (subjective importance of encoded bits) (after preliminary channel coding) (Parameter names refers to GSM 06.60)**

| Description | Bits (Table 5) | Bit index within parameter |
|---|---|---|
| PULSE 3_10 | w193 | b2 |
| PULSE 4_6 | w233 | b2 |
| PULSE 4_7 | w236 | b2 |
| PULSE 4_8 | w239 | b2 |
| PULSE 4_9 | w242 | b2 |
| PULSE 4_10 | w245 | b2 |
| PULSE 1_6 | w75 | b1 |
| PULSE 1_7 | w78 | b1 |
| PULSE 1_8 | w81 | b1 |
| PULSE 1_9 | w84 | b1 |
| PULSE 1_10 | w87 | b1 |
| PULSE 2_6 | w127 | b1 |
| PULSE 2_7 | w130 | b1 |
| PULSE 2_8 | w133 | b1 |
| PULSE 2_9 | w136 | b1 |
| PULSE 2_10 | w139 | b1 |
| PULSE 3_6 | w182 | b1 |
| PULSE 3_7 | w185 | b1 |
| PULSE 3_8 | w188 | b1 |
| PULSE 3_9 | w191 | b1 |
| PULSE 3_10 | w194 | b1 |
| PULSE 4_6 | w234 | b1 |
| PULSE 4_7 | w237 | b1 |
| PULSE 4_8 | w240 | b1 |
| PULSE 4_9 | w243 | b1 |
| PULSE 4_10 | w246 | b1 |
| PULSE 1_6 | w76 | b0 |
| PULSE 1_7 | w79 | b0 |
| PULSE 1_8 | w82 | b0 |
| PULSE 1_9 | w85 | b0 |
| PULSE 1_10 | w88 | b0 |
| PULSE 2_6 | w128 | b0 |
| PULSE 2_7 | w131 | b0 |
| PULSE 2_8 | w134 | b0 |
| PULSE 2_9 | w137 | b0 |
| PULSE 2_10 | w140 | b0 |
| PULSE 3_6 | w183 | b0 |
| PULSE 3_7 | w186 | b0 |
| PULSE 3_8 | w189 | b0 |
| PULSE 3_9 | w192 | b0 |
| PULSE 3_10 | w195 | b0 |
| PULSE 4_6 | w235 | b0 |
| PULSE 4_7 | w238 | b0 |
| PULSE 4_8 | w241 | b0 |
| PULSE 4_9 | w244 | b0 |
| PULSE 4_10 | w247 | b0 |

# Annex A (informative): Summary of Channel Types

| | |
|---|---|
| TCH/EFS: | enhanced full rate speech traffic channel |
| TCH/FS: | full rate speech traffic channel |
| TCH/HS: | half rate speech traffic channel |
| TCH/F9.6: | 9.6 kbit/s full rate data traffic channel |
| TCH/F4.8: | 4.8 kbit/s full rate data traffic channel |
| TCH/H4.8: | 4.8 kbit/s half rate data traffic channel |
| TCH/F2.4: | 2.4 kbit/s full rate data traffic channel |
| TCH/H2.4: | 2.4 kbit/s half rate data traffic channel |

| | |
|---|---|
| SACCH: | slow associated control channel |
| FACCH/F: | fast associated control channel at full rate |
| FACCH/H: | fast associated control channel at half rate |
| SDCCH: | stand-alone dedicated control channel |
| BCCH: | broadcast control channel |
| PCH: | paging channel |
| AGCH | access grant channel |
| RACH: | random access channel |
| SCH: | synchronization channel |
| CBCH: | cell broadcast channel |

# Annex B (informative): Summary of Polynomials Used for Convolutional Codes

| | |
|---|---|
| $G0 = 1 + D^3 + D^4$ | TCH/FS, TCH/EFS, TCH/F9.6, TCH/H4.8, SDCCH, BCCH, PCH, SACCH, FACCH, AGCH, RACH, SCH |
| $G1 = 1 + D + D^3 + D^4$ | TCH/FS, TCH/EFS, TCH/F9.6, TCH/H4.8, SACCH, FACCH, SDCCH, BCCH,PCH, AGCH, RACH, SCH, TCH/F4.8, TCH/F2.4, TCH/H2.4 |
| $G2 = 1 + D^2 + D^4$ | TCH/F4.8, TCH/F2.4, TCH/H2.4 |
| $G3 = 1 + D + D^2 + D^3 + D^4$ | TCH/F4.8, TCH/F2.4, TCH/H2.4 |
| $G4 = 1 + D^2 + D^3 + D^5 + D^6$ | TCH/HS |
| $G5 = 1 + D + D^4 + D^6$ | TCH/HS |
| $G6 = 1 + D + D^2 + D^3 + D^4 + D^6$ | TCH/HS |

# History

| Document history | | | |
|---|---|---|---|
| March 1996 | Publication of GTS 05.03 version 5.0.0 | | |
| May 1996 | Publication of GTS 05.03 version 5.1.0 | | |
| August 1996 | Publication of GTS 05.03 version 5.2.0 | | |
| November 1996 | Unified Approval Procedure | UAP 58: | 1996-11-18 to 1997-03-14 |
| March 1997 | One-step Approval Procedure (Second Edition) | OAP 9729: | 1997-03-21 to 1997-07-18 |
| April 1997 | First Edition | | |
| August 1997 | Second Edition | | |

ISBN 2-7437-1674-6
Dépôt légal : Août 1997