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Technical Specification

**3rd Generation Partnership Project (3GPP);
TSG-SA Codec Working Group
Mandatory Speech Codec speech processing functions;
AMR Speech Codec Frame Structure**

General description

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Intellectual Property Rights

Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project, Technical Specification Group Services and System Aspects, Working Group 4 (Codec).

The contents of this TS may be subject to continuing work within the 3GPP and may change following formal TSG-S4 approval. Should the TSG-S4 modify the contents of this TS, it will be re-released with an identifying change of release date and an increase in version number as follows:

Version m.t.e

where:

- m indicates [major version number]
- x the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
- y the third digit is incremented when editorial only changes have been incorporated into the specification.

1 Scope

The present document outlines the frame format for all codec modes of the mandatory Adaptive Multi-Rate (AMR) speech coder.

Annex A describes an octet aligned format which shall be used when octet alignment is required.

2 Normative references

This TS 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 TS only when incorporated in it by amendment or revision. For undated references, the latest edition of the publication referred to applies.

- [1] TS 26.011 : "AMR Speech Codec Speech Transcoding Functions".
- [2] TS 26.016 : "AMR Speech Codec; Source Controlled Rate Operation".
- [3] TS 26.014 : "AMR Speech Codec; Comfort Noise Aspects".

3 Definitions and abbreviations

3.1 Definitions

Definition of terms used in this TS can be found in TS 26.xx, ... [T.B.A.].

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

[T.B.A]

4 Adaptive multi rate frame format

In this section the frame format for the speech and SID frames of the Adaptive Multi-Rate speech codec [1][2] are described. This format is referred to as AMR Interface Format 1 (AMR IF1). Annex A describes AMR IF2.

4.1 SPEECH frame

Each AMR codec mode follows the generic AMR frame structure depicted in Figure 1 below. The frame is divided into two parts, the AMR header and the AMR core speech frame. The AMR header includes the Mode Indication and Mode Request fields, the RX/TX type field and the Internal CRC¹ field. The AMR core speech frame part consists of the reordered speech codec parameter bits.

The speech coder delivers a sequence of blocks of data. One block of data corresponds to one speech frame and the block length is different in each of the codec modes. This section also describes the reordering of the speech coder output bits into three classes (Class A, B and C) according to the subjective importance of the bits.

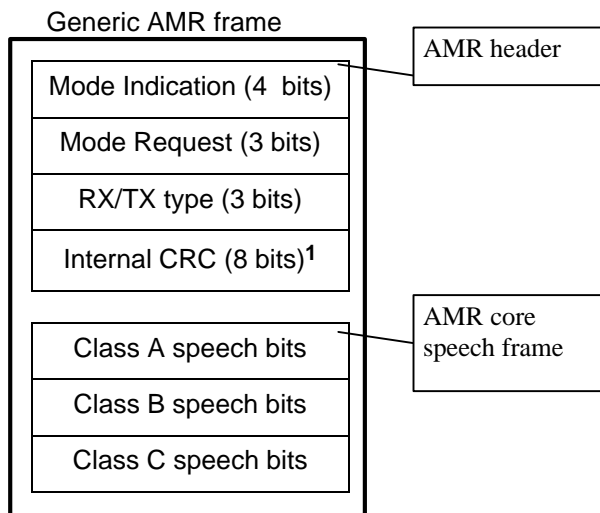


Figure 1. General frame structure

Table 1 below defines the mode indices used with the 4-bit Mode Indication message. The Mode Request field is 3-bits and uses correspondingly only indices 0...7 from this same table.

¹ In case the network can provide suitable error detection (i.e. Unequal Error Detection) this field will be removed.

Mode_index	Mode
7 (Amr12-2k)	12.2 kbit/s (GSM EFR)
6 (Amr10-2k)	10.2 kbit/s
5 (Amr7-95k)	7.95 kbit/s
4 (Amr7-40k)	7.40 kbit/s (IS-641)
3 (Amr6-70k)	6.70 kbit/s (PDC-EFR-A)
2 (Amr5-90k)	5.90 kbit/s
1 (Amr5-15k)	5.15 kbit/s
0 (Amr4-75k)	4.75 kbit/s
8	GsmAmr Comfort Noise Frame
9	Gsm-Efr Comfort Noise Frame
10	IS-641 Comfort Noise frame
11	Pdc-Efr Comfort Noise Frame
12-14	For future use
15	No transmission

Table 1. Definition of mode indicies

The content of the RX/TX type field is defined in [2].

4.1.1 Ordering according to subjective importance

The bits delivered by the speech encoder, $\{s(1),s(2),\dots,s(K_d)\}$ [1], are rearranged according to subjective importance before they are sent to the RAN. Tables 4 to 10 define the correct rearrangement for the speech codec modes 12.2 kbit/s, 10.2 kbit/s, 7.95 kbit/s, 7.40 kbit/s, 6.70 kbit/s, 5.90 kbit/s, 5.15 kbit/s and 4.75 kbit/s, respectively. In the tables speech codec parameters are numbered in the order they are delivered by the corresponding speech encoder according to TS 26.011 [1] and the rearranged bits are labelled $\{d(0),d(1),\dots,d(K_d-1)\}$, defined in the order of decreasing importance. Index K_d refers to the number of bits delivered by the speech encoder, see Table 2 below.

The ordering algorithm is in pseudo code as:

for $j = 0$ to K_d-1 $d(j) := s(\text{table}(j)+1)$; where $\text{table}(j)$ is read line by line left to right

The rearranged bits are further divided into three classes according to subjective importance. The three classes are then subject to error protection in the network [TBD].

The protection classes are:

- Class A - Data protected with the internal CRC and Error Protection scheme 1 (EP1).
- Class B - Data protected with Error Protection scheme 2 (EP2).
- Class C - Data protected with Error Protection scheme 3 (EP3).

The number of speech bits, class A, class B and class C bits is shown in Table 2 below.

Codec Mode	Number of speech bits delivered per block (K_d)	Number of class A bits per block	Number of class B bits per block	Number of class C bits per block
AMR12.2	244	81	103	60
AMR10.2	204	65	99	40
AMR7.95	159	75	84	0
AMR7.4	148	61	87	0
AMR6.7	134	55	79	0
AMR5.9	118	55	63	0
AMR5.15	103	49	54	0
AMR4.75	95	39	56	0

Table 2. Number of bits in different classes

4.1.2 Internal CRC for speech frames

Each codec mode uses an 8-bit internal CRC for error-detection. These eight parity bits are generated by the cyclic generator polynomial: $G(x)=D^8 + D^6 + D^5 + D^4 + 1$ from the K_{dA} bits of class A, where K_{dA} refers to number of bits in protection class A as shown below for each codec mode.

Codec mode	Mode indication bits (K_i)	Mode request bits (K_m)	RX/TX type bits (K_x)	CRC bits (K_{dA})	Speech Encoded bits (K_d)	Number of bits after first encod step ($K_u = K_d + 8$)
AMR12.2	4	3	3	81	244	252
AMR10.2	4	3	3	65	204	212
AMR7.95	4	3	3	75	159	167
AMR7.4	4	3	3	61	148	156
AMR6.7	4	3	3	55	134	142
AMR5.9	4	3	3	55	118	126
AMR5.15	4	3	3	49	103	111
AMR4.75	4	3	3	39	95	103

Table 3. Number of CRC bits in each codec modes

4.1.3 Final frame structure

The mode indication bits ($mi(k)$), mode request bits ($mr(k)$), parity bits ($p(k)$) and information bits ($d(k)$) are merged to form the final frame with AMR header $a(k)$ and AMR core speech frame $u(k)$. Thus the AMR header $a(k)$ and core speech frame $u(k)$ will be defined by the following contents for each codec mode. Consequently the reverse operation is taking place at the receiving end.

$a(k) = mi(k)$	for $k = 0, 1, 2, 3$	(Mode indication bits)
$a(k) = mr(k-4)$	for $k = 4, 5, 6$	(Mode request bits)
$a(k) = x(k-7)$	for $k = 7, 8, 9$	(RX/TX type)
$a(k) = p(k-10)$	for $k = 10, 11, \dots, 17$	(CRC bits)
$u(k) = d(k)$	for $k = 0, 1, \dots, K_d-1$	(Class A, B, C bits)

Table 4: Subjective importance of the speech encoded bits for AMR12.2

0	1	2	3	4	5	6	7	8	9
10	11	12	13	14	23	15	16	17	18
19	20	21	22	24	25	26	27	28	38
141	39	142	40	143	41	144	42	145	43
146	44	147	45	148	46	149	47	97	150
200	48	98	151	201	49	99	152	202	86
136	189	239	87	137	190	240	88	138	191
241	91	194	92	195	93	196	94	197	95
198	29	30	31	32	33	34	35	50	100
153	203	89	139	192	242	51	101	154	204
55	105	158	208	90	140	193	243	59	109
162	212	63	113	166	216	67	117	170	220
36	37	54	53	52	58	57	56	62	61
60	66	65	64	70	69	68	104	103	102
108	107	106	112	111	110	116	115	114	120
119	118	157	156	155	161	160	159	165	164
163	169	168	167	173	172	171	207	206	205
211	210	209	215	214	213	219	218	217	223
222	221	73	72	71	76	75	74	79	78
77	82	81	80	85	84	83	123	122	121
126	125	124	129	128	127	132	131	130	135
134	133	176	175	174	179	178	177	182	181
180	185	184	183	188	187	186	226	225	224
229	228	227	232	231	230	235	234	233	238
237	236	96	199						

Table 5: Subjective importance of the speech encoded bits for AMR10.2

7	6	5	4	3	2	1	0	16	15
14	13	12	11	10	9	8	26	27	28
29	30	31	115	116	117	118	119	120	72
73	161	162	65	68	69	108	111	112	154
157	158	197	200	201	32	33	121	122	74
75	163	164	66	109	155	198	19	23	21
22	18	17	20	24	25	37	36	35	34
80	79	78	77	126	125	124	123	169	168
167	166	70	67	71	113	110	114	159	156
160	202	199	203	76	165	81	82	92	91
93	83	95	85	84	94	101	102	96	104
86	103	87	97	127	128	138	137	139	129
141	131	130	140	147	148	142	150	132	149
133	143	170	171	181	180	182	172	184	174
173	183	190	191	185	193	175	192	176	186
38	39	49	48	50	40	52	42	41	51
58	59	53	61	43	60	44	54	194	179
189	196	177	195	178	187	188	151	136	146
153	134	152	135	144	145	105	90	100	107
88	106	89	98	99	62	47	57	64	45
63	46	55	56						

Table 6: Subjective importance of the speech encoded bits for AMR7.95

1	2	5	6	0	4	7	8	3	14
16	9	10	12	13	15	11	17	20	22
24	23	19	18	21	25	26	56	88	122
154	57	89	123	155	58	90	124	156	52
84	118	150	53	85	119	151	54	86	120
152	30	96	29	95	28	94	27	93	61
127	62	128	63	129	31	97	59	91	125

157	64	130	32	98	33	99	34	100	55
87	121	153	60	92	126	158	65	131	66
132	51	50	49	48	83	82	81	80	117
116	115	114	149	148	147	146	47	46	45
44	43	42	41	40	39	38	37	36	35
79	78	77	76	75	74	73	72	71	70
69	68	67	113	112	111	110	109	108	107
106	105	104	103	102	101	145	144	143	142
141	140	139	138	137	136	135	134	133	

Table 7: Subjective importance of the speech encoded bits for AMR7.4

0	1	2	3	4	5	6	7	8	9
10	11	12	13	14	15	16	26	87	27
88	28	89	29	90	30	91	51	80	112
141	52	81	113	142	54	83	115	144	55
84	116	145	58	119	59	120	21	22	23
17	18	19	31	60	92	121	56	85	117
146	20	24	25	50	79	111	140	57	86
118	147	49	78	110	139	48	77	53	82
114	143	109	138	47	76	108	137	32	33
61	62	93	94	122	123	41	42	43	44
45	46	70	71	72	73	74	75	102	103
104	105	106	107	131	132	133	134	135	136
34	63	95	124	35	64	96	125	36	65
97	126	37	66	98	127	38	67	99	128
39	68	100	129	40	69	101	130		

Table 8: Subjective importance of the speech encoded bits for AMR6.7

0	1	4	3	5	6	13	7	2	8
9	11	15	12	14	10	28	82	29	83
27	81	26	80	30	84	16	55	109	56
110	31	85	57	111	48	73	102	127	32
86	51	76	105	130	52	77	106	131	58
112	33	87	19	23	53	78	107	132	21
22	18	17	20	24	25	50	75	104	129
47	72	101	126	54	79	108	133	46	71
100	125	128	103	74	49	45	70	99	124
42	67	96	121	39	64	93	118	38	63
92	117	35	60	89	114	34	59	88	113
44	69	98	123	43	68	97	122	41	66
95	120	40	65	94	119	37	62	91	116
36	61	90	115						

Table 9: Subjective importance of the speech encoded bits for AMR5.9

0	1	4	5	3	6	7	2	13	15
8	9	11	12	14	10	16	28	74	29
75	27	73	26	72	30	76	51	97	50
71	96	117	31	77	52	98	49	70	95
116	53	99	32	78	48	69	94	115	47
68	93	114	19	21	23	46	67	92	113
22	33	79	18	17	20	24	25	45	66
91	112	54	100	111	43	89	110	64	65
42	63	88	109	41	62	87	108	40	61
86	107	39	60	85	106	38	59	84	105
37	58	83	104	36	57	82	103	35	56
81	102	34	55	80	101	44	90		

Table 10: Subjective importance of the speech encoded bits for AMR5.15

7	6	5	4	3	2	1	0	15	14
13	12	11	10	9	8	23	24	25	26
27	46	65	84	45	44	43	64	63	62
83	82	81	102	101	100	42	61	80	99
28	47	66	85	18	41	60	79	98	29
48	67	17	20	22	40	59	78	97	21
30	49	68	86	19	16	87	39	38	58
57	77	35	54	73	92	76	96	95	36
55	74	93	32	51	33	52	70	71	89
90	31	50	69	88	37	56	75	94	34
53	72	91							

Table 11: Subjective importance of the speech encoded bits for AMR4.75

0	1	2	3	4	5	6	7	8	9
10	11	12	13	14	15	23	24	25	26
27	28	48	49	61	62	82	83	47	46
45	44	81	80	79	78	17	18	20	22
77	76	75	74	29	30	43	42	41	40
38	39	16	19	21	50	51	59	60	63
64	72	73	84	85	93	94	32	33	35
36	53	54	56	57	66	67	69	70	87
88	90	91	34	55	68	89	37	58	71
92	31	52	65	86					

4.2

4.3 SID_UPDATE and SID_FIRST

In this section the frame formats for the additional types defined by the Source Controlled Rate handler [2] are described.

The SID TX frame types are mapped to the SID transmission payload according to Table 12.

TX_TYPE	Mode indication bits (K_{mi})	Mode request bits (K_{mr})	CN encoded bits (K_{CN})	SID type indicator (K_t)	Mode bits (K_m)	CRC protected bits (K_{crc})	Number of bits after first encoding step ($K_u = K_d + 8$)
SID_UPDATE	4	3	35	1	3	39	47
SID_FIRST	4	3	35	1	3	39	47

Where $K_d = K_{CN} + K_t + K_m$

Table 12. Number of bits in SID TX frame type

4.2.1 Final SID frame structure

The mode indication and request bits ($mi(k)$, $mr(k)$), mode bits ($m(k)$), information bits ($d(k)$) and parity bits ($p(k)$) are merged to form the final frame. The SID type indicator is set to 1 for SID_UPDATE and 0 for SID_FIRST. All the CN parameter bits are set to 0 if the frame is a SID_FIRST frame. The 35 CN information bits $d(k)$ are defined in [3].

Thus, after the first encoding step $u(k)$ will be defined by the following contents for each SID TX_TYPE:

SID_UPDATE:

$u(k) = mi(k)$	for $k = 0, 1, 2$	
$u(k) = mr(k-3)$	for $k = 3, 4, 5$	
$u(k) = p(k-6)$	for $k = 6, 7, \dots, 13$	
$u(k) = d(k-14)$	for $k = 14, 15, \dots, 48$	
$u(k) = m(k-49)$	for $k = 49, 50, 51$	
$u(k) = 1$	for $k = 52$	(SID type indicator)

SID_FIRST:

$u(k) = mi(k)$	for $k = 0, 1, 2$	
$u(k) = mr(k-3)$	for $k = 3, 4, 5$	
$u(k) = p(k-6)$	for $k = 6, 7, \dots, 13$	
$u(k) = 0$	for $k = 14, 15, \dots, 48$	
$u(k) = m(k-49)$	for $k = 49, 50, 51$	
$u(k) = 0$	for $k = 52$	(SID type indicator)

Annex A: Definition of mode signaling and bit stuffing to achieve octet alignment

This section defines the mode signalling needed for AMR use in the ITU-T H series of recommendations and the octet frame structure. This is referred to as AMR Interface Format 2 (AMR IF2). The size of the speech frames of the AMR codec in the different modes is not a multiple of eight. For that reason bit stuffing is needed to achieve octet structure.

Table A.1 maps all the AMR modes into specific mode numbers. Mode numbers are reserved also for silence suppression. Table A.11 specifies a no transmission frame. All the other tables in this section refer to the existing parameters described in TS 26.011.

Table A.1: Mapping of the AMR speech coding modes defined in TS 26.011 to mode index bits in transmitted octets.

Mode_index (4 bits)	Naming in TS 26.011
7 (Amr12-2k)	12.2 kbit/s mode (GSM EFR)
6 (Amr10-2k)	10.2 kbit/s mode
5 (Amr7-95k)	7.95 kbit/s mode
4 (Amr7-40k)	7.40 kbit/s mode (IS-641)
3 (Amr6-70k)	6.70 kbit/s mode (PDC-EFR-A)
2 (Amr5-90k)	5.90 kbit/s mode
1 (Amr5-15k)	5.15 kbit/s mode
0 (Amr4-75k)	4.75 kbit/s mode
8	GsmAmr Comfort Noise Frame
9	Gsm-Efr Comfort Noise Frame
10	IS-641 Comfort Noise frame
11	Pdc-Efr Comfort Noise Frame
12-14	For future use
15	No transmission

Table A.2: Mapping of speech encoded bits from TS 26.011 to octets for the mode index 7 (Bits from s1 to s244 refer to table 12a in TS 26.011)

Transmitted Octets	ParX By,
1	index of 1st LSF submatrix (s1-s4), Mode_Index
2	index of 2st LSF submatrix (s8-s12), index of 1st LSF submatrix (s5-s7)
3	index of 3st LSF submatrix (s16-s20), index of 2st LSF submatrix (s13-s15)
4	index of 4st LSF submatrix (s24-s28), index of 3st LSF submatrix (s21-s23)
5	index of 5st LSF submatrix (s33-s36), index of 4st LSF submatrix (s29-s32)
6	adaptive codebook index(s39-s44), index of 5st LSF submatrix (s37-s38)
7	sign information for 1st and 6 th pulses(s52), adaptive codebook gain(s48-s51), adaptive codebook index(s45-s47)
8	sign information for 3rd and 8 th pulses(s60), position of 1st pulse(s57-s59), sign information for 2nd and 7 th pulses(s56), position of 1st pulse(s53-s55)
9	sign information for 5th and 10th pulses(s68), position of 4th pulse(s65-s67), sign information for 4 th and 9 th pulses(s64), position of 3rd pulse(s61-s63)
10	position of 7th pulse(s75-76), position of 6th pulse(s72-s74), position of 5th pulse(s69-s71)
11	position of 10 th pulse(s84), position of 9th pulse(s81-s83), position of 8th pulse(s78-s80), position of 7th pulse(s77)
12	adaptive codebook index (relative)(s92), fixed codebook gain(s87-s91), position of 10 th pulse(s85-s86)
13	adaptive codebook gain(s99-s100), adaptive codebook gain(s98), adaptive codebook index

	(relative)(s93-s97)
14	position of 2nd pulse(s107-s108), sign information for 2nd and 7 th pulses(s106), position of 1 st pulse(s103-s105), sign information for 1st and 6 th pulses(s102), adaptive codebook gain(s101)
15	position of 4th pulse(s115-116), sign information for 4th and 9 th pulses(s114), position of 3rd pulse(s111-s113), sign information for 3rd and 8 th pulses(s110), position of 2nd pulse(s109)
16	position of 6th pulse(s122-124), position of 5th pulse(s119-121), sign information for 5th and 10 th pulses(s118), position of 4th pulse(s117)
17	position of 9th pulse(s131-s132), position of 8th pulse(s128-s130), position of 7th pulse(s125-s127)
18	fixed codebook gain(s137-140), position of 10th pulse(s134-136), position of 9 th pulse(s133)
19	adaptive codebook index(s142-s148), fixed codebook gain(s141)
20	position of 1st pulse(s156), sign information for 1st and 6 th pulses(s155), adaptive codebook gain(s151-s154), adaptive codebook index(s149-s150)
21	sign information for 3rd and 8 th pulses(s164), position of 2nd pulse(s161-s163), sign information for 2nd and 7 th pulses(s160), position of 1st pulse(s157-s159)
22	sign information for 5th and 10 th pulses(s172), position of 4th pulse(s169-s171), sign information for 4 th and 9 th pulses(s168), position of 3rd pulse(s165-s167)
23	position of 7 th pulse(s179-s180), position of 6th pulse(s176-s178), position of 5th pulse(s173-s175)
24	position of 10th pulse(s188), position of 9th pulse(s185-s187), position of 8th pulse(s182-s184), position of 7th pulse(s181)
25	adaptive codebook index (relative)(s195-s196), fixed codebook gain(s191-s194), position of 10th pulse(s189-s190)
26	adaptive codebook gain(s201-s204) adaptive codebook index(relative)(s197-s200)
27	position of 2nd pulse(s210-s212), sign information for 2nd and 7 th pulses(s209), position of 1 st pulse(s206-s208), sign information for 1st and 6 th pulses(s205)
28	position of 4th pulse(s218-s220), sign information for 4th and 9 th pulses(s217), position of 3 rd pulse(s214-s216), sign information for 3rd and 8 th pulses(s213)
29	position of 7 th pulse (s228), position of 6th pulse(s225-s227), position of 5 th pulse(s222-s224), sign information for 5th and 10 th pulses(s221)
30	position of 9 th pulse(s234-s236), position of 8 th pulse(s231-s233), position of 7th pulse(s229-s230)
31	fixed codebook gain(s240-s244), position of 10 th pulse(s237-s239)

Table A.3: Mapping of speech encoded bits from TS 26.011 to octets for the mode index 6 (Bits from s1 to s204 refer to table 12b in TS 26.011)

Transmitted Octets	ParX By,
1	index of 1st LSF subvector (s1-s4), Mode_Index
2	index of 2st LSF subvector (s9-s12), index of 1st LSF subvector (s5-s8)
3	index of 3st LSF subvector (s18-s20), index of 2st LSF subvector (s13-s17)
4	adaptive codebook index(s27-s28), index of 3st LSF subvector (s21-s26)
5	sign information for 2 nd and 6 th pulses(s36), sign information for 1st and 5 th pulses(s35), adaptive codebook index(s29-s34)
6	position for 1st, 2 nd , and 5th pulses(s39-s44), sign information for 4 th and 8 th pulses(s38), sign information for 3rd and 7 th pulses(s37)
7	position for 3rd, 6 th , and 7th pulses(s49-s52), position for 1st, 2nd, and 5th pulses(s45-s48)
8	position for 4th and 8th pulses(s59-s60), position for 3rd, 6th, and 7th pulses(s53-s58)
9	codebook gains(s66-s68), position for 4 th and 8th pulses(s61-s65)
10	adaptive codebook index(relative)(s73-s76), codebook gains(s69-s72)
11	position for 1 st , 2nd, and 5th pulses(s82-s84), sign information for 4 th and 8 th pulses(s81), sign information for 3 rd and 7 th pulses(s80), sign information for 2 nd and 6 th pulses(s79), sign information for 1st and 5 th pulses(s78), adaptive codebook index(relative)(s77)
12	position for 3 rd , 6th, and 7th pulses(s92), position for 1st, 2nd, and 5 th pulses(s85-s91)
13	position for 3 rd , 6th, and 7th pulses(s99-s100), position for 3rd, 6th, and 7th pulses(s93-s98)
14	position for 4 th and 8th pulses(s102-s108), position for 3rd, 6th, and 7th pulses(s101)
15	adaptive codebook index(s116), codebook gains(s109-s115)
16	sign information for 1st and 5 th pulses(s124), adaptive codebook index(s117-s123)
17	position for 1 st , 2nd, and 5th pulses(s128-s132), sign information for 4 th and 8 th pulses(s127), sign

	information for 3 rd and 7 th pulses(s126), sign information for 2 nd and 6 th pulses(s125)
18	position for 3 rd , 6 th , and 7 th pulses(s138-140), position for 1 st , 2 nd , and 5 th pulses(s133-s137)
19	position for 4 th and 8 th pulses(s148), position for 3 rd , 6 th , and 7 th pulses(s141-147)
20	codebook gains(s155-s156), position for 4 th and 8 th pulses(s149-s154)
21	adaptive codebook index(relative)(s162-s164), codebook gains(s157-s161)
22	position for 1 st , 2 nd , and 5 th pulses(s171-s172), sign information for 4 th and 8 th pulses(s170), sign information for 3 rd and 7 th pulses(s169), sign information for 2 nd and 6 th pulses(s168), sign information for 1 st and 5 th pulses(s167), adaptive codebook index(relative)(s165-s166)
23	position for 1 st , 2 nd , and 5 th pulses(s173-s180)
24	position for 3 rd , 6 th , and 7 th pulses(s181-188)
25	position for 4 th and 8 th pulses(s191-s196), position for 3 rd , 6 th , and 7 th pulses(s189-190)
26	codebook gains(s198-s204), position for 4 th and 8 th pulses(s197)

Table A.4: Mapping of speech encoded bits from TS 26.011 to octets for the mode index 5 (Bits from s1 to s159 refer to table 12c in TS 26.011)

Transmitted Octets	ParX By,
1	index of 1 st LSF subvector (s1 – s4) ,Mode_Index
2	index of 2 nd LSF subvector (s10 – s12) ,index of 1st LSF subvector (s5 – s9)
3	index of 3 rd LSF subvector (s19 – s20), index of 2nd LSF subvector (s13 – s18)
4	adaptive codebook index (s28), index of 3rd LSF subvector (s21 – s27)
5	position of 1st pulse (s36), adaptive codebook index (s29 – s35)
6	position of 3rd pulse (s42-s44), position of 2nd pulse (s39 – s41), position of 1st pulse (s37 – s38)
7	sign information for 4th pulse (s52), sign information for 3rd pulse (s51), sign information for 2nd pulse (s50), sign information for 1st pulse (s49), position of 4th pulse (s45 – s48)
8	fixed codebook gain (s57 – s60), adaptive codebook gain (s53 – s56)
9	position of 1st pulse (s68), adaptive codebook index (s62 – s67), fixed codebook gain (s61)
10	position of 3rd pulse (s74-s76), position of 2nd pulse (s71 – s73), position of 1st pulse (s69 – s70)
11	sign information for 4th pulse (s84), sign information for 3 rd pulse (s83), sign information for 2nd pulse (s82), sign information for 1st pulse (s81), position of 4th pulse (s77 – s80)
12	fixed codebook gain (s89 – s92), adaptive codebook gain (s85 – s88)
13	adaptive codebook index, (s94 – s100), fixed codebook gain (s93)
14	position of 3rd pulse (s108), position of 2nd pulse (s105 – s107), position of 1st pulse (s102 – s104), adaptive codebook index (s101)
15	sign information for 2nd pulse (s116), sign information for 1st pulse (s115), position of 4th pulse (s111 – s114), position of 3rd pulse (s109 – s110)
16	fixed codebook gain (s123-s124), adaptive codebook gain (s119 – s122), sign information for 4th pulse (s118), sign information for 3rd pulse (s117),
17	adaptive codebook index (s128 – s132), fixed codebook gain (s125 –s127)
18	position of 3rd pulse (s140), position of 2nd pulse (s137 – s139), position of 1st pulse (s134 – s136), adaptive codebook index (s133)
19	sign information for 2nd pulse (s148), sign information for 1st pulse (s147), position of 4 th pulse (s143 – s146), position of 3rd pulse (s141 - s142)
20	fixed codebook gain (s155 – s156), adaptive codebook gain (s151 – s154), sign information for 4th pulse (s150), sign information for 3 rd pulse (s149)
21	UB, UB, UB, UB, UB, fixed codebook gain (s157-s159)

Table A.5: Mapping of speech encoded bits from TS 26.011 to octets for the mode index 4 (Bits from s1 to s148 refer to table 12d in TS 26.011)

Transmitted Octets	ParX By,
1	index of 1 st LSF subvector (s1 – s4) ,Mode_Index
2	index of 2 nd LSF subvector (s9 – s12) ,index of 1st LSF subvector (s5 – s8)
3	index of 3 rd LSF subvector (s18 – s20), index of 2nd LSF subvector (s13 – s17)
4	adaptive codebook index (s27 – s28), index of 3rd LSF subvector (s21 – s26)
5	position of 1st pulse (s35 – s36), adaptive codebook index (s29 – s34)

6	position of 4th pulse (s44), position of 3 rd pulse (s41-s43), position of 2nd pulse (s38 – s40), position of 1 st pulse (s37)
7	codebook gains (s52), sign information for 4th pulse (s51), sign information for 3rd pulse (s50), sign information for 2nd pulse (s49), sign information for 1st pulse (s48), position of 4 th pulse (s45 – s47)
8	adaptive codebook index (s59 – s60), codebook gains (s53 – s58)
9	position of 2nd pulse (s67 – s68), position of 1st pulse (s64 – s66), adaptive codebook index (s61 – s63)
10	position of 4th pulse (s73 – s76), position of 3rd pulse (s70-s72), position of 2nd pulse (s69),
11	codebook gains (s81 – s84), sign information for 4th pulse (s80), sign information for 3 rd pulse (s79), sign information for 2nd pulse (s78), sign information for 1st pulse (s77),
12	adaptive codebook index, (s88 – s92), codebook gains (s85 – s87)
13	position of 2nd pulse (99 – s100), position of 1st pulse (96 – s98), adaptive codebook index, (s93 – s95)
14	position of 4th pulse (s105 – s108), position of 3rd pulse (s102 – s104), position of 2nd pulse (s101)
15	codebook gains (s113 – s116), sign information for 4th pulse (s112), sign information for 3 rd pulse (s111), sign information for 2nd pulse (s110), sign information for 1st pulse (s109),
16	adaptive codebook index (s120 – 124), codebook gains (s117 – s119)
17	position of 3rd pulse (s131 – s132), position of 2nd pulse (s128 – s130), position of 1st pulse (s125 – s127)
18	sign information for 3rd pulse (s140), sign information for 2nd pulse (s139), sign information for 1st pulse (s138), position of 4 th pulse (s134 – s137), position of 3rd pulse (s133)
19	codebook gains (s142 – s148), sign information for 4th pulse (s141)

Table A.6: Mapping of speech encoded bits from TS 26.011 to octets for the mode index 3 (Bits from s1 to s134 refer to table 12e in TS 26.011)

Transmitted Octets	ParX By,
1	index of 1 st LSF subvector (s1 – s4) ,Mode_Index
2	index of 2 nd LSF subvector (s9 – s12) ,index of 1st LSF subvector (s5 – s8)
3	index of 3 rd LSF subvector (s18 – s20), index of 2nd LSF subvector (s13 – s17)
4	adaptive codebook index (s27 – s28), index of 3rd LSF subvector (s21 – s26)
5	position of 1st pulse (s35 – s36), adaptive codebook index (s29 – s34)
6	position of 3 rd pulse (s42-s44), position of 2nd pulse (s38 – s41), position of 1st pulse (s37)
7	codebook gains (s49-s52), sign information for 3rd pulse (s48), sign information for 2nd pulse (s47), sign information for 1st pulse (s46), position of 3rd pulse (s45)
8	position of 1st pulse (s60), adaptive codebook index (s56 – s59), codebook gains (s53 – s55)
9	position of 3rd pulse (s67-s68), position of 2nd pulse (s63 – s66), position of 1st pulse (s61 – s62)
10	codebook gains (s74 – s76), sign information for 3 rd pulse (s73), sign information for 2nd pulse (s72), sign information for 1st pulse (s71), position of 3rd pulse (s69-s70)
11	adaptive codebook index, (s81 – s84), codebook gains (s77 – s80),
12	position of 2nd pulse (s92), position of 1st pulse (89 – s91), adaptive codebook index, (s85 – s88)
13	sign information for 1st pulse (s100), position of 3rd pulse (s96 – s99), position of 2nd pulse (s93 – s95)
14	codebook gains (s103 – s108), sign information for 3 rd pulse (s102), sign information for 2nd pulse (s101),
15	position of 1st pulse (s114 – s116), adaptive codebook index (s110 – s113), codebook gains (s109)
16	position of 3rd pulse (s121 – s124), position of 2nd pulse (s117 – s120),
17	codebook gains (s128 – s132), sign information for 3rd pulse (s127), sign information for 2nd pulse (s126), sign information for 1st pulse (s125)

18	UB, UB, UB, UB, UB, UB, codebook gains (s133 – s134)
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Table A.7: Mapping of speech encoded bits from TS 26.011 to octets for the mode index 2 (Bits from s1 to s118 refer to table 12f in TS 26.011)

Transmitted Octets	ParX By,
1	index of 1 st LSF subvector (s1 – s4) ,Mode_Index
2	index of 2 nd LSF subvector (s9 – s12) ,index of 1st LSF subvector (s5 – s8)
3	index of 3 rd LSF subvector (s18 – s20), index of 2nd LSF subvector (s13 – s17)
4	adaptive codebook index (s27 – s28), index of 3rd LSF subvector (s21 – s26)
5	position of 1st pulse (s35 – s36), adaptive codebook index (s29 – s34)
6	sign information for 1st pulse (s44), position of 2nd pulse (s39 – s43), position of 1st pulse (s37 –s38)
7	adaptive codebook index (s52), codebook gains (s46-s51),sign information for 2nd pulse (s45),
8	position of 2nd pulse (s60), position of 1st pulse (s56 – s59), adaptive codebook index (s53 – s55)
9	codebook gains (s67 – s68), sign information for 2nd pulse (s66), sign information for 1st pulse (s65), position of 2nd pulse (s61 – s64)
10	adaptive codebook index, (s73 – s76), codebook gains (s69 – s72),
11	position of 1st pulse (s81 – s84), adaptive codebook index, (s77 – s80)
12	codebook gains (s92), sign information for 2nd pulse (s91), sign information for 1st pulse (s90) position of 2nd pulse (s85 – s89)
13	adaptive codebook index (s98 – s100), codebook gains (s93 – s97),
14	position of 2nd pulse (s106 – s108), position of 1 st pulse (s102 – s105), adaptive codebook index (s101)
15	codebook gains (s113 –s116), information for 2nd pulse (s112), sign information for 1st pulse (s111), position of 2nd pulse (s109 – s110),
16	UB, UB, UB, UB, UB, UB; codebook gains (s117 – s118)

Table A.8: Mapping of speech encoded bits from TS 26.011 to octets for the mode index 1 (Bits from s1 to s103 refer to table 12g in TS 26.011)

Transmitted Octets	ParX By,
1	index of 1 st LSF subvector (s1 – s4) ,Mode_Index
2	index of 2 nd LSF subvector (s9 – s12) ,index of 1st LSF subvector (s5 – s8)
3	index of 3 rd LSF subvector (s17 – s20), index of 2nd LSF subvector (s13 – s16)
4	adaptive codebook index (s24 – s28), index of 3rd LSF subvector (s21 – s23)
5	position of 2nd pulse (s36), position of 1st pulse (s33 – s35) position subset (s32), adaptive codebook index (s29 – s31)
6	codebook gains (s41-s44), sign information for 2nd pulse (s40), sign information for 1st pulse (s39), position of 2nd pulse (s37 – s38)
7	position of 1st pulse (s52), position subset (s51), adaptive codebook index (s47- s50), codebook gains (s45-s46),
8	codebook gains (s60), sign information for 2nd pulse (s59), sign information for 1st pulse (s58), position of 2nd pulse (s55 – s57), position of 1st pulse (s53 – s54),
9	adaptive codebook index, (s66 – s68), codebook gains (s61 – s65)
10	position of 2nd pulse (s74 – s76), position of 1 st pulse (s71-s73), position subset (s70), adaptive codebook index, (s69)
11	codebook gains (s79-s84), sign information for 2nd pulse (s78), sign information for 1st pulse (s77)
12	position of 1 st pulse (s90 – s92), position subset (s89) adaptive codebook index (s85 – s88)
13	codebook gains (s98 – s100), sign information for 2nd pulse (s97), sign information for 1st pulse (s96) , position of 2nd pulse (s93 – s95),
14	UB, UB, UB, UB, UB, codebook gains (s101 – s103)

Table A.9: Mapping of speech encoded bits from TS 26.011 to octets for the mode index 0 (Bits from s1 to s95 refer to table 12h in TS 26.011)

Transmitted Octets	ParX By,
1	index of 1st LSF subvector (s1-s4), Mode_Index
2	index of 2st LSF subvector (s9-s12), index of 1st LSF subvector (s5-s8)
3	index of 3st LSF subvector (s17-s20), index of 2st LSF subvector (s13-s16)
4	adaptive codebook index(s24-s28), index of 3st LSF subvector (s21-s23)
5	position of 2nd pulse(s36), position of 1st pulse(s33-s35), position subset(s32), adaptive codebook index(s29-s31)
6	codebook gains(s41-s44), sign information for 2 nd pulse(s40), sign information for 1 st pulse(s39), position of 2nd pulse(s37-s38)
7	adaptive codebook index(relative)(s49-s52), codebook gains(s45-s48)
8	sign information for 1 st pulse(s60), position of 2 nd pulse(s57-59), position of 1 st pulse(s54-s56), position subset(s53)
9	position of 1st pulse(s67-s68), position subset(s66), adaptive codebook index(relative)(s62-s65), sign information for 2 nd pulse(s61)
10	codebook gains(s75-s76), sign information for 2 nd pulse(s74), sign information for 1 st pulse(s73), position of 2 nd pulse(s70-s72), position of 1st pulse(s69)
11	adaptive codebook index(relative)(s83-s84), codebook gains(s77-s82)
12	position of 2 nd pulse(s91-s92), position of 1st pulse(s88-s90), position subset(s87), adaptive codebook index(relative)(s85-s86)
13	UB, UB, UB, UB, UB, sign information for 2 nd pulse(s95), sign information for 1 st pulse(s94), position of 2 nd pulse(s93)

Table A.10: Mapping of Comfort Noise descriptor bits from TS 26.14 to octets for the mode index 8 (Bits from s1 to s35 refer to TS 26.14)

Transmitted Octets	ParX By,
1	index of 1 st LSF subvector (s4), index of LSF reference vector (s1-s3), Mode_Index
2	index of 2 nd LSF subvector (s12), index of 1 st LSF subvector (s5-s11)
3	index of 2 nd LSF subvector (s13-s20)
4	index of 3 rd LSF subvector (s21-s28)
5	SID type bit(s36), frame energy(s30-35), index of 3 rd LSF subvector (s29),
6	UB, UB, UB, UB, UB, Speech_Mode_Indication (s37-s39)

Table A.11: The definition of the no transmission frame the mode index 15

Transmitted Octets	Frame content
1	UB, UB, UB, UB, Mode_Index

History

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V. 0.0.1	April 1999	First version (TSGS4#4(99)096)
v. 1.0.0	April 1999	Changes based on TSG-S4 review