Technical Specification Group Services and System Aspects **TSGS#23(04)0644**
Meeting #25, Palm Springs, USA
13-16 September 2004

Source: **TSG-SA WG4**

Title: CRs TS 26.101 on Generic Frame Structure for GSM-EFR SID and Error Corrections (Release 6)

Document for: **Approval**

Agenda Item: **7.4.3**

The following CRs, agreed at the TSG-SA WG4 meeting #32, are presented to TSG SA #25 for approval.

Spec	CR	Rev	Phase	Subject	Cat	Vers	WG	Meeting	S4 doc
26.101	009	2	Rel-6	Generic Frame Structure for GSM-EFR SID	F	5.0.0	S4	TSG-SA WG4#32	S4-040570
26.101	010	1	Rel-6	Error Corrections	F	5.0.0	S4	TSG-SA WG4#32	S4-040571

3GPP TSG-SA4 Meeting #32 ***Tdoc ⌘S4-040570***
Prague, Czech Republic, 16-20 August 2004

CR-Form-v7

CHANGE REQUEST

⌘ **TS 26.101 CR 009** ⌘**rev 2** ⌘ Current version: **5.0.0** ⌘

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Proposed change affects: UICC apps⌘ ☐ ME ☐ Radio Access Network ☐ Core Network **X**

Title:	⌘	Generic Frame Structure for GSM-EFR SID
Source:	⌘	TSG SA WG4
Work item code:	⌘	TrFO
Date:	⌘	2004-09-14
Category:	⌘	**F**
Release:	⌘	REL-6

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:

2	*(GSM Phase 2)*
R96	*(Release 1996)*
R97	*(Release 1997)*
R98	*(Release 1998)*
R99	*(Release 1999)*
Rel-4	*(Release 4)*
Rel-5	*(Release 5)*
Rel-6	*(Release 6)*

Reason for change:	⌘	The Generic Frames Structure for GSM-EFR SID is missing. SA2 has identified this missing specification in BARS, see TR 23.977
Summary of change:	⌘	Specification of the Generic Frame Structure for GSM-EFR SID.
Consequences if not approved:	⌘	GSM-EFR cannot be used for TrFO on the Nb-Interface

Clauses affected:	⌘	1, 2, 4,			
Other specs affected:	⌘	**Y** / **N**	Other core specifications	⌘	TS 26.102
		X /	Test specifications		
		/ **X**	O&M Specifications		
Other comments:	⌘				

How to create CRs using this form:
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3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

FIRST CHANGE

1 Scope

The present document describes a generic frame format for the Adaptive Multi-Rate (AMR) speech codec and the Enhanced Full Rate (GSM-EFR) speech codec. This format shall be used as a common reference point when interfacing speech frames between different elements of the 3G system and between different systems. Appropriate mappings to and from this generic frame format will be used within and between each system element.

Annex A describes a second frame format which shall be used when octet alignment of AMR frames is required.

NEXT CHANGE

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

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

[1] TS 26.090: "AMR Speech Codec; Speech Transcoding Functions".

[2] TS 26.093: "AMR Speech Codec; Source Controlled Rate Operation".

[3] TS 26.092: "AMR Speech Codec; Comfort Noise Aspects".

[4] TS 46.060: "EFR Speech Codec; Speech Transcoding Functions".

[5] TS 46.062: "EFR Speech Codec; Comfort Noise Aspects".

NEXT SUBSECTION FOR INFORMATION

4.1.1 Frame Type, Mode Indication, and Mode Request

Table 1a defines the 4-bit Frame Type field. Frame Type can indicate the use of one of the eight AMR codec modes, one of four different comfort noise frames, or an empty frame. In addition, three Frame Type Indices are reserved for future use. The same table is reused for the Mode Indication and Mode Request fields which are 3-bit fields each and are defined only in the range 0…7 to specify one of the eight AMR codec modes.

**Table 1a: Interpretation of Frame Type,
Mode Indication and Mode Request fields**

Frame Type	Mode Indication	Mode Request	Frame content (AMR mode, comfort noise, or other)
0	0	0	AMR 4,75 kbit/s
1	1	1	AMR 5,15 kbit/s
2	2	2	AMR 5,90 kbit/s
3	3	3	AMR 6,70 kbit/s (PDC-EFR)
4	4	4	AMR 7,40 kbit/s (TDMA-EFR)
5	5	5	AMR 7,95 kbit/s
6	6	6	AMR 10,2 kbit/s
7	7	7	AMR 12,2 kbit/s (GSM-EFR)
8	-	-	AMR SID
9	-	-	GSM-EFR SID
10	-	-	TDMA-EFR SID
11	-	-	PDC-EFR SID
12-14	-	-	For future use
15	-	-	No Data (No transmission/No reception)

NEXT SUBSECTIONS FOR INFORMATION

4.3 AMR frame composition

The generic AMR frame is formed as a concatenation of AMR Header, AMR Auxiliary Information and the AMR Core Frame, in this order. The MSB of the Frame Type is placed in bit 8 of the first octet (see example in table 5 below), the LSB of the Frame Type is placed in bit 5. Then the next parameter follows, which is the Frame Quality Indicator, and so on. Between Mode Request and Codec CRC five spare bits are inserted to align the Codec CRC and the AMR Core frame to the octet boundary. The first bit of the AMR Core frame d(0) is placed in bit 8 of octet 4. The last bit of the generic AMR frame is the last bit of AMR Core Frame, which is the last bit of speech bits or the last bit of comfort noise bits, as defined in subclauses 4.2.1 and 4.2.3. Table 5 shows the composition for the example of the Codec Mode 6.7kbit/s and table 6 shows the composition for the AMR SID frame.

Table 5: Mapping of an AMR speech coding mode into the generic AMR frame, AMR IF1, example: AMR 6.7 kbit/s, "good frame", Mode Request = 1.

	MSB	Mapping of bits AMR 6.7						LSB
Octet	**bit 8**	**bit 7**	**bit 6**	**bit 5**	**bit 4**	**bit 3**	**bit 2**	**bit 1**
1	Frame Type (=3)				FQI	Mode Indication (=3)		
	0	0	0	1	1	0	1	1
2	Mode Request (=1)			spare				
	0	0	1	0	0	0	0	0
3	Codec CRC							
	CRC(7)	CRC(6)	CRC(5)	CRC(4)	CRC(3)	CRC(2)	CRC(1)	CRC(0)
4	AMR Core Frame (octet 1)							
	d(0)	d(1)	d(2)	d(3)	d(4)	d(5)	d(6)	d(7)
5..19								
20	AMR Core Frame (octet 17)						undefined	
	d(128)	d(129)	d(130)	d(131)	d(132)	d(133)		

Table 6: Mapping of an AMR SID frame into the generic AMR frame, AMR IF1, example: AMR SID_Update, "good frame", Mode Indication = 3, Mode Request = 2.

	MSB	Mapping of bits AMR SID						LSB
Octet	**bit 8**	**bit 7**	**bit 6**	**bit 5**	**bit 4**	**bit 3**	**bit 2**	**bit 1**
1	Frame Type (=8)				FQI	Mode Indication		
	1	0	0	0	1	undefined		
2	Mode Request (=2) MSB … LSB			spare				
	0	1	0	0	0	0	0	0
3	Codec CRC							
	CRC(7)	CRC(6)	CRC(5)	CRC(4)	CRC(3)	CRC(2)	CRC(1)	CRC(0)
4	AMR Core Frame (octet 1)							
	d(0)=s(1)	d(1)=s(2)	d(2)	d(3)	d(4)	d(5)	d(6)	d(7)
5..7								
8				STI	Mode Indication (=3) LSB	…	MSB	undef.
	d(32)	d(33)	d(34) = s(35)	1	1	1	0	

Table 7 summarizes all possible AMR frame format combinations in terms of number of bits in each field.

Table 7. Number of bits for different fields in different AMR frame compositions

Frame Type Index	Frame Type	Frame Quality Indicator	Mode Indication	Mode Request	Codec CRC	Class A	Class B	Class C	Total
						AMR Core Frame			
0	4	1	3	3	8	42	53	0	114
1	4	1	3	3	8	49	54	0	122
2	4	1	3	3	8	55	63	0	137
3	4	1	3	3	8	58	76	0	153
4	4	1	3	3	8	61	87	0	167
5	4	1	3	3	8	75	84	0	178
6	4	1	3	3	8	65	99	40	223
7	4	1	3	3	8	81	103	60	263
8	4	1	3	3	8	39	0	0	58
9	4	1	3	3	8	43	0	0	62
10	4	1	3	3	8	38	0	0	57
11	4	1	3	3	8	37	0	0	56
12	Not used								
13	Not used								
14	Not used								
15	4	0	0	0	0	0	0	0	4

NEXT CHANGE

4.4 GSM-EFR Frame Composition

This subclause contains the description of the generic GSM-EFR Frame of Figure 1. The descriptions for the generic GSM-EFR Frame with speech bits and with comfort noise bit are given separately.

4.4.1 GSM-EFR Frame with speech bits

The generic GSM-EFR frame for speech data bits is formed like for the AMR mode 12.2 kbit/s.
The same Frame Type (Frame Type 7) is used also for GSM-EFR. The Mode Indication and Mode Request fields are set to "7". The GSM-EFR Core Frame for speech data bits is identical to the AMR Core Frame for speech data bits in the AMR mode with 12.2 kbit/s.

4.4.2 GSM-EFR Frame with comfort noise bits

The GSM-EFR Frame content for the additional frame type with Frame Type Index 9 in Table 1a are described in this subclause. This consists of the frame related to GSM-EFR Comfort Noise Aspects as specified in [4] and [5].

The comfort noise bits are all mapped to Class A. Classes B and C are not used (see Table 7).

The contents of GSM-EFR SID is the Comfort Noise Parameters (s(i)) as defined in [4]. The Comfort noise parameters are computed as described in [5] by the GSM-EFR speech encoder and are denoted as s(i) = {*s*(1),*s*(2),...,s(38), s(87),s(88),…,s(91)}. The notation *s*(*i*) follows that of [4] (Table 6). The notation *d*(*j*) = {d(0) … d(42)} is local to the present document and is formed as defined by the pseudo code below.

```
for j = 0 to 37
    d(j) := s(j+1); /* LSP parameters in s(1) to s(38) */;

for j = 38 to 42
    d(j) := s(j+49);  /* fixed codebook  gain parameter in s(87)-s(91) */
```

Table 8 shows the composition for the generic GSM-EFR SID frame.

Table 8: Mapping of the GSM-EFR SID frame into the generic AMR frame format, AMR IF1, Example of a good GSM-EFR SID frame (FQI=1).

	MSB	Mapping of bits for GSM-EFR SID						LSB
Octet	**bit 8**	**bit 7**	**bit 6**	**bit 5**	**bit 4**	**bit 3**	**bit 2**	**bit 1**
1	Frame Type (=9)				FQI	Mode Indication (=7)		
	1	0	0	1	1	1	1	1
2	Mode Request (=7)			spare				
	1	1	1	0	0	0	0	0
3	Codec CRC							
	CRC(7)	CRC(6)	CRC(5)	CRC(4)	CRC(3)	CRC(2)	CRC(1)	CRC(0)
4	Core Frame (octet 1)							
	d(0)=s(1)	d(1)=s(2)	d(2)	d(3)	d(4)	d(5)	d(6)	d(7)
5..7								
8								
	d(32))	d(33)	d(34)	d(35)	d(36)=s(37)	d(37)=s(38)	d(38)=s(87)	d(39)=s(88)
9				spare				
	d(40)=s(89)	d(41)=s(90)	d(42)=s(91)	0	0	0	0	0

END of CHANGES

3GPP TSG-SA4 Meeting #32
Prague, Czech Republic, 16-20 August 2004

Tdoc ⌘S4-040571

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CHANGE REQUEST

⌘ **TS 26.101** **CR** **010** ⌘ **rev** **1** ⌘ Current version: **5.0.0** ⌘

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Proposed change affects: UICC apps⌘ ☐ ME ☐ Radio Access Network ☐ Core Network **X**

Title:	⌘	Error Corrections
Source:	⌘	TSG SA WG4
Work item code:	⌘	TrFO
Date:	⌘	2004-09-14
Category:	⌘	**F**
Release:	⌘	REL-6

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:

2	*(GSM Phase 2)*
R96	*(Release 1996)*
R97	*(Release 1997)*
R98	*(Release 1998)*
R99	*(Release 1999)*
Rel-4	*(Release 4)*
Rel-5	*(Release 5)*
Rel-6	*(Release 6)*

Reason for change:	⌘	Correction of Errors
Summary of change:	⌘	Introduction of term “GSM-EFR SID” in table 1c; correction of references in 4.2.3; correction of reference in table A.3
Consequences if not approved:	⌘	Potentially misunderstandings and incompatibilities

Clauses affected:	⌘	4, A.3			
Other specs affected:	⌘	**Y**	**N**		
			X	Other core specifications	⌘
			X	Test specifications	
			X	O&M Specifications	
Other comments:	⌘	As requested in SA4#31..			

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NEXT SUBSECTION FOR INFORMATION

4.1.1 Frame Type, Mode Indication, and Mode Request

Table 1a defines the 4-bit Frame Type field. Frame Type can indicate the use of one of the eight AMR codec modes, one of four different comfort noise frames, or an empty frame. In addition, three Frame Type Indices are reserved for future use. The same table is reused for the Mode Indication and Mode Request fields which are 3-bit fields each and are defined only in the range 0…7 to specify one of the eight AMR codec modes.

Table 1a: Interpretation of Frame Type, Mode Indication and Mode Request fields

Frame Type	Mode Indication	Mode Request	Frame content (AMR mode, comfort noise, or other)
0	0	0	AMR 4,75 kbit/s
1	1	1	AMR 5,15 kbit/s
2	2	2	AMR 5,90 kbit/s
3	3	3	AMR 6,70 kbit/s (PDC-EFR)
4	4	4	AMR 7,40 kbit/s (TDMA-EFR)
5	5	5	AMR 7,95 kbit/s
6	6	6	AMR 10,2 kbit/s
7	7	7	AMR 12,2 kbit/s (GSM-EFR)
8	-	-	AMR SID
9	-	-	GSM-EFR SID
10	-	-	TDMA-EFR SID
11	-	-	PDC-EFR SID
12-14	-	-	For future use
15	-	-	No Data (No transmission/No reception)

First CHANGE

4.1.3 Mapping to TX_TYPE and RX_TYPE

Table 1c shows how the AMR Header data (FQI and Frame Type) maps to the TX_TYPE and RX_TYPE frames defined in [2].

Table 1c: Mapping of Frame Quality Indicator and Frame Type to TX_TYPE and RX_TYPE [2], respectively

Frame Quality Indicator	Frame Type Index	TX_TYPE or RX_TYPE	Comment
1	0-7	SPEECH_GOOD	The specific Frame Type Index depends on the bit-rate being used.
0	0-7	SPEECH_BAD	The specific Frame Type Index depends on the bit-rate being used. The corrupted data may be used to assist error concealment.
1	8 8	SID_FIRST or SID_UPDATE	For AMR: SID_FIRST and SID_UPDATE are differentiated using one Class A bit: STI.
0	8	SID_BAD	For AMR
1	9	GSM-EFR SID	For GSM-EFR
0	9	GSM-EFR SID_BAD	For GSM-EFR
1	~~9~~-10-11	SID_UPDATE	For TDMA-EFR and PDC-EFR
0	~~9~~-10-11	SID_BAD	For TDMA-EFR and PDC-EFR
1	15	NO_DATA	Typically a non-transmitted frame or an erased or stolen frame with no data usable to assist error concealment.

NEXT CHANGE

4.2.3 AMR Core Frame with comfort noise bits

The AMR Core Frame content for the additional frame type~~s~~ with Frame Type Inde~~x~~i~~ces~~ ~~8 15~~ 8 in table 1a is~~are~~ described in this subclause. Th~~ese mainly~~ consist~~s~~ of the frame~~s~~ related to Source Controlled Rate Operation specified in [2].

The data content (comfort noise bits) of the additional frame types is carried in AMR Core Frame. The comfort noise bits are all mapped to Class A of AMR Core Frame and Classes B and C are not used. This is a notation convention only and the class division has no meaning for comfort noise bits.

The number of bits in each class (Class A, Class B, and Class C) for the AMR comfort noise bits (Frame Type Index 8) is shown in table 3. The contents of SID_UPDATE and SID_FIRST are divided into three parts (SID Type Indicator (STI), Mode Indication (mi(i)), and Comfort Noise Parameters (s(i)) as defined in [2]. In case of SID_FIRST the Comfort Noise Parameters bits (s(i)) shall be set to "0".

The comfort noise parameter bits produced by the AMR speech encoder are denoted as s(i) = {*s*(1),*s*(2),...,*s*(*35*)}. The notation *s*(*i*) follows that of [3]. These bits are numbered in the order they are produced by the AMR encoder without any reordering. These bits are followed by the SID Type Indicator **STI** and the Mode Indication mi(i) ={*mi*(0), *mi*(1), *mi*(2)} ={L*SB* .. *MSB~~MLB~~*}. Thus, the AMR SID or comfort noise bits {*d*(0),*d*(1),…,*d*(38)}are formed as defined by the pseudo code below.

- for *j* = 0 to 34;
- *d*(*j*) := *s*(*j*+1);
- *d*(35) := **STI**;
- for *j* = 36 to 38;
- *d*(*j*) := *mi*(*j*-36). Note: This mapping is different to the usual mapping: LSB first.

Note: The alternative would be: *d*(*j*) := *mi*(38-j): MSB first.

Table 3. Bit classification for Frame Type 8 (AMR SID)

Frame Type Index	FQI	AMR TX_TYPE or RX_TYPE	Total number of bits	Class A			Class B	Class C
				SID Type Indicator (STI)	Mode Indication mi(i)	Comfort Noise Parameter s(i)		
8	1	SID_UPDATE	39	1 (= "1")	3	35	0	0
8	1	SID_FIRST	39	1 (= "0")	3	35 (= "0")	0	0
8	0	SID_BAD	39	1	3	35	0	0

The number of bits in each class (Class A, Class B, and Class C) for the comfort noise bits of Frame Types 9-11 is shown in ~~t~~Table 7. ~~4.~~

Table 4: void ~~Bit classification for Frame Types 9-11~~

~~TABLE FOR FURTHER STUDY~~

NEXT CHANGE

Table A.3: Mapping of bits for Frame Type 9 (GSM-EFR SID)
(Bits s1 to s91 refer to GSM ~~06.60~~ 46.060)

	MSB	Mapping of bits GSM-EFR SID						LSB
Octet	**bit 8**	**bit 7**	**bit 6**	**bit 5**	**bit 4**	**bit 3**	**bit 2**	**bit 1**
1	Index of 1st LSF subMatrix				Frame Type (= 9)			
	s4	s3	s2	s1	1	0	0	1
2	Index of 2nd LSF submatrix					index of 1st LSF subMatrix		
	s12	s11	s10	s9	s8	s7	s6	s5
3	Index of 3rd LSF submatrix					Index of 2nd LSF submatrix		
	s20	s19	s18	s17	s16	s15	s14	s13
4	index of 4th LSF submatrix				sign of 3rd LSF submatrix	index of 3rd LSF submatrix		
	s28	s27	s26	s25	s24	s23	s22	s21
5	index of 5th LSF submatrix				index of 4th LSF submatrix			
	s36	s35	s34	s33	s32	s31	s30	s29
6	Stuffing bit	fixed codebook gain					index of 5th LSF submatrix	
	UB	s91	s90	s89	s88	s87	s38	s37