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Digital cellular telecommunications system (Phase 2+);
Full rate speech;
Substitution and muting of
lost frames for full rate speech channels
(3GPP TS 46.011 version 12.0.0 Release 12)

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Foreword

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1 Scope

The present document defines a frame substitution and muting procedure which shall be used by the RX DTX handler when one or more lost speech or SID frames are received from the radio subsystem.

The requirements of the present document are mandatory for implementation in all GSM Base Station Systems (BSS) and Mobile Stations (MS).

2 References

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

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

[2] GSM 06.10: "Digital cellular telecommunications system (Phase 2+); Full rate speech; Transcoding".

[3] GSM 06.31: "Digital cellular telecommunications system (Phase 2+); Full rate speech; Discontinuous Transmission (DTX) for full rate speech traffic channel".

3 Definitions and abbreviations

Abbreviations used in the present document are listed in GSM 01.04 [1].

The definitions of terms used in the present document can be found in GSM 06.31 [3].

4 General

The purpose of the frame substitution is to conceal the effect of lost frames.

The purpose of muting the output in the case of several lost frames is to indicate the breakdown of the channel to the user.

5 Requirements

5.1 First lost speech frame

Normal decoding of lost speech frames would result in very unpleasant noise effects. In order to improve the subjective quality, the first lost speech frame shall be substituted with either a repetition or an extrapolation of the previous good speech frame(s). Lost speech frames shall not be delivered to the speech decoder, nor shall the output be muted directly.

5.2 Subsequent lost speech frames

For subsequent lost speech frames, a muting technique shall be used that will gradually decrease the output level, resulting in silencing of the output after a maximum of 320 ms. Clause 6 gives an example solution.

5.3 First lost SID frame

A single lost SID frame shall be substituted by the last valid SID frame and the procedure for valid SID frames be applied as described in GSM 06.31 [3].

5.4 Subsequent lost SID frame

For the second lost SID frame, a muting technique shall be used on the comfort noise that will gradually decrease the output level, resulting in silencing of the output after a maximum of 320 ms. Clause 6 gives an example solution.

For subsequent lost SID frames, the muting of the output shall be maintained.

6 Example solution

For guidance, an example solution is given.

The first lost speech frame is replaced at the speech decoder input by the previous good speech frame. Normal decoding is then performed.

The muting procedure to be used in the case of subsequent lost speech frames or for comfort noise frames following the second lost SID frame is as follows:

The pseudo-logarithmic encoded block amplitude Xmaxcr (GSM 06.10 [2]), coded on the interval from 0 to 63, is decreased with a constant value d=4 in each frame, down to the lowest possible value. Consequently, Xmaxcr will be reduced gradually, and the output muted after a maximum of 320 ms. The grid position parameters are chosen randomly between 0 and 3 during this time.

For subsequent unusable frames, after the frame where Xmaxcr reached the lowest possible value, "silence frames" are passed from the RX DTX handler to the speech decoder to guarantee a low output level under all conditions. The silence frame is defined in table 1.

Table 1: Encoded parameters (GSM 06.10) of the silence frame

Log area ratio 1	= 42
Log area ratio 2	= 39
Log area ratio 3	= 21
Log area ratio 4	= 10
Log area ratio 5	= 9
Log area ratio 6	= 4
Log area ratio 7	= 3
Log area ratio 8	= 2
LTP gain	= 0
LTP lag	= 40
Grid position	= 1
Block amplitude	= 0
RPE pulse no. 1	= 3
RPE pulse no. 2	= 4
RPE pulse no. 3	= 3
RPE pulse no. 4	= 4
RPE pulse no. 5	= 4
RPE pulse no. 6	= 3
RPE pulse no. 7	= 3
RPE pulse no. 8	= 3
RPE pulse no. 9	= 3
RPE pulse no. 10	= 4
RPE pulse no. 11	= 4
RPE pulse no. 12	= 3
RPE pulse no. 13	= 3

- repeated for each subsegment

Annex A (informative): Change history

Change history					
SMG No.	**TDoc. No.**	**CR. No.**	**Section affected**	**New version**	**Subject/Comments**
SMG#07				4.0.4	ETSI Publication
SMG#20				5.0.1	Release 1996 version
SMG#27				6.0.0	Release 1997 version
SMG#28				6.0.1	ETSI Publication
SMG#29				7.0.0	Specification version 6.0.0 upgrade to Release 1998 version 7.0.0
				7.0.1	Version update for Publication
SMG#31				8.0.0	Release 1999 version

Change history							
Date	**TSG #**	**TSG Doc.**	**CR**	**Rev**	**Subject/Comment**	**Old**	**New**
03-2001	11				Version for Release 4		4.0.0
06-2002	16				Version for Release 5	4.0.0	5.0.0
12-2004	26				Version for Release 6	5.0.0	6.0.0
06-2007	36				Version for Release 7	6.0.0	7.0.0
12-2008	42				Version for Release 8	7.0.0	8.0.0
12-2009	46				Version for Release 9	8.0.0	9.0.0
03-2011	51				Version for Release 10	9.0.0	10.0.0
09-2012	57				Version for Release 11	10.0.0	11.0.0
09-2014	65				Version for Release 12	11.0.0	12.0.0

History

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V12.0.0	October 2014	Publication