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G.729.1

Amendment 5

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SERIES G: TRANSMISSION SYSTEMS AND MEDIA, DIGITAL SYSTEMS AND NETWORKS

Digital terminal equipments – Coding of voice and audio signals

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G.729-based embedded variable bit-rate coder: An 8-32 kbit/s scalable wideband coder bitstream interoperable with G.729

Amendment 5: New Annex D (Reference floating-point implementation for G.729.1 Annex C DTX/CNG) and corrections to the main body and Annex B

Recommendation ITU-T G.729.1 (2006) – Amendment 5

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Recommendation ITU-T G.729.1

G.729-based embedded variable bit-rate coder: An 8-32 kbit/s scalable wideband coder bitstream interoperable with G.729

Amendment 5

New Annex D (Reference floating-point implementation for G.729.1 Annex C DTX/CNG) and corrections to the main body and Annex B

Summary

New Annex D introduced by Amendment 5 provides an alternative implementation using floating point arithmetic of the discontinuous transmission (DTX) and comfort noise generation (CNG) of Annex C – which uses fixed-point arithmetic.

Besides this new annex, Amendment 5 to Recommendation ITU-T G.729.1 incorporates changes needed to correct defects identified in the G.729.1 C source code for its main body and Annex B, and provides a revised set of test vectors.

The corrections bring changes necessary to the existing C code (Release 1.3) of the main body and Annex B of Recommendation ITU-T G.729.1. The corrected C code is labelled as *Release 1.4*.

For completeness, the electronic attachment to this amendment comprises:

1) Complete ANSI C source code (version 1.4) for G.729.1 main body and Annex B, including updated test vectors.
2) G.729.1 Annex D floating-point DTX/CNG ANSI C source code (version 1.4).

Source

Amendment 5 to Recommendation ITU-T G.729.1 (2006) was approved on 7 December 2008 by ITU-T Study Group 16 (2009-2012) under Recommendation ITU-T A.8 procedure.

Keywords

Comfort noise generation, discontinuous transmission, noise coding, silence compression.

FOREWORD

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1 Corrections to the C source code for the main body of Recommendation ITU-T G.729.1

1.1 Correction 1

The following change is proposed in G729EV_CELP2S_decod.c around line 567:

```
#ifdef TDBWE_BUG
    nb_celp_param->power_fix[i0_2sub] = L_shl(L_temp2, 2);
#else
    nb_celp_param->power_fix[i0_2sub] = L_temp2;
#endif
```

1.2 Correction 2

In G729EV_CELP2S_encod.c:

```
IF(sub(pCodStat->rate, 12000) >= 0){
    (…)
    G729EV_G729_Syn_filt2(Aq, &exc_enha[i_subfr], &synth[i_subfr], G729EV_G729_L_SUBFR, pCodStat->mem_synth, 1);
}
```

It is proposed to update the following C-code at line 813.

```
/* at this stage DataSynth comprises the synthesis at 12k while synth_ptr comprises
  the synthesis at 8k
  if the rate is 8k, overwrite DataSynth */
IF(sub(pCodStat->rate, 8000) == 0) G729EV_G729_Copy(synth_ptr, synth, G729EV_G729_L_FRAME);
```

With the following one

```
 /* at this stage Synth comprises the synthesis at 12k while synth_ptr comprises
    the synthesis at 8k
    if the rate is 8k, overwrite Synth */
IF (sub(pCodStat->rate, 8000) == 0){
    G729EV_G729_Copy(synth_ptr, synth, G729EV_G729_L_FRAME);
    G729EV_G729_Copy(pCodStat->mem_syn, pCodStat->mem_synth, G729EV_G729_M);
}
```

1.3 Correction 3

In the function G729EV_CELP2S_encod.c the following initialization is done:

G729EV_G729_Set_zero(pCodStat->old_speech, G729EV_G729_L_TOTAL);

It is proposed to correct it with:

G729EV_G729_Set_zero(pCodStat->old_speech, G729EV_G729_MEM_SPEECH);

2 Corrections to the C source code for G.729.1 Annex B

2.1 Correction 1

At line 147 in G729EV_G729B_dec_sid.c change the following line:

*G729EV_G729_Copy((float *) lspcb1[PtrTab_1[index[1]]], tmpbuf, G729EV_G729_M);*

with:

*G729EV_G729_Copy((REAL *) lspcb1[PtrTab_1[index[1]]], tmpbuf, G729EV_G729_M);*

2.2 Correction 2

Update the following C-code at line 607 in G729EV_CELP2S_encod.c.

```
if (pCodStat->rate == 8000)
    G729EV_G729_Copy(synth_ptr, DataSynth, G729EV_G729_L_FRAME);
```

With the following one

```
if (pCodStat->rate == 8000){
    G729EV_G729_Copy(synth_ptr, DataSynth, G729EV_G729_L_FRAME);
    G729EV_G729_Copy(pCodStat->mem_syn, pCodStat->mem_synth, G729EV_G729_M);
}
```

2.3 Correction 3

The change is in G729EV_TDBWE_generate_excitation.c, the following C-code:

return (REAL)tmp;

is replaced with

return (REAL)tmp/(REAL)65536. + (REAL).5;

2.4 Correction 4

In G.729.1 Annex B, in the G.729EV_MAIN_encod.c at line 218, the following initializations are done when the bitrate is higher than 14 kbit/s but the input signal is a narrowband signal (the HB encoding is not done):

```
coder_param_ptr[0] = 0;
coder_param_ptr[1] = 4;
coder_param_ptr[2] = 4;
coder_param_ptr[3] = 0;
coder_param_ptr[4] = 21;
coder_param_ptr[5] = 8;
```

Aligned with the fixed-point C-code where the following initializations are done:

```
coder_param_ptr[0] = (Word16) 28;
coder_param_ptr[1] = (Word16) 71;
coder_param_ptr[2] = (Word16) 71;
coder_param_ptr[3] = (Word16) 30;
coder_param_ptr[4] = (Word16) 26;
coder_param_ptr[5] = (Word16) 1;
```

2.5 Correction 5

In the function G729EV_CELP2S_encod.c the following initialization is done:

G729EV_G729_Set_zero(pCodStat->old_speech, G729EV_G729_L_TOTAL);

It is corrected with:

G729EV_G729_Set_zero(pCodStat->old_speech, G729EV_G729_MEM_SPEECH);

3 New Annex D

Annex D

Reference floating-point implementation for G.729.1 Annex C (DTX/CNG)

D.1 Scope

This annex describes an alternative implementation of G.729.1 Annex C based on floating-point arithmetic. It is fully interoperable with the fixed point version of G.729.1 Annex C.

This annex includes an electronic attachment containing reference C-code for floating-point implementation. The design of a set of test vectors remains for further study.

D.2 References

See clause 2 of Recommendation ITU-T G.729.1.

D.3 Overview

G.729.1 Annex C provides bit-exact, fixed-point specification of a discontinuous transmission (DTX) and comfort noise generation (CNG) algorithm for 8-32 kbit/s scalable wideband coder bitstream interoperable with G.729. Exact details of these specifications are given in bit-exact, fixed-point C-code available as an integral part of G.729.1. This annex describes and defines an alternative implementation of G.729.1 Annex C based on floating-point arithmetic.

D.4 Algorithmic description

This floating-point version of G.729.1 Annex C has the same algorithm steps as the fixed-point version. Similarly, the bitstream is identical to that of G.729.1 Annex C. For algorithmic details, see the description in Annex C.

D.5 ANSI C-Code

The ANSI C-code available as an electronic attachment to Annex D represents the normative specification of this annex. This floating-point implementation is based on the fixed-point implementation approved as part of G.729.1 Annex C. The algorithmic description given by the C-code shall take precedence over the texts contained in G.729.1 Annex D. More recent versions may become available through Corrigenda or Amendments to G.729, and the latest available version from ITU-T is to be used.

The structure of the floating-point source code is related to the corresponding fixed-point source code. The CodecTypedef.h file contains a statement enabling the definition of all floating-point variables and constants as type either double or single. Tables D.1 to D.2 give the list of the software file names with a brief description. Note that files related to basic operators or mathematical operations are not used for floating-point arithmetic. A float-to-short conversion routine has been added to the file G729EV_TDAC_util.c.

Table D.1 – Summary of encoder specific routines

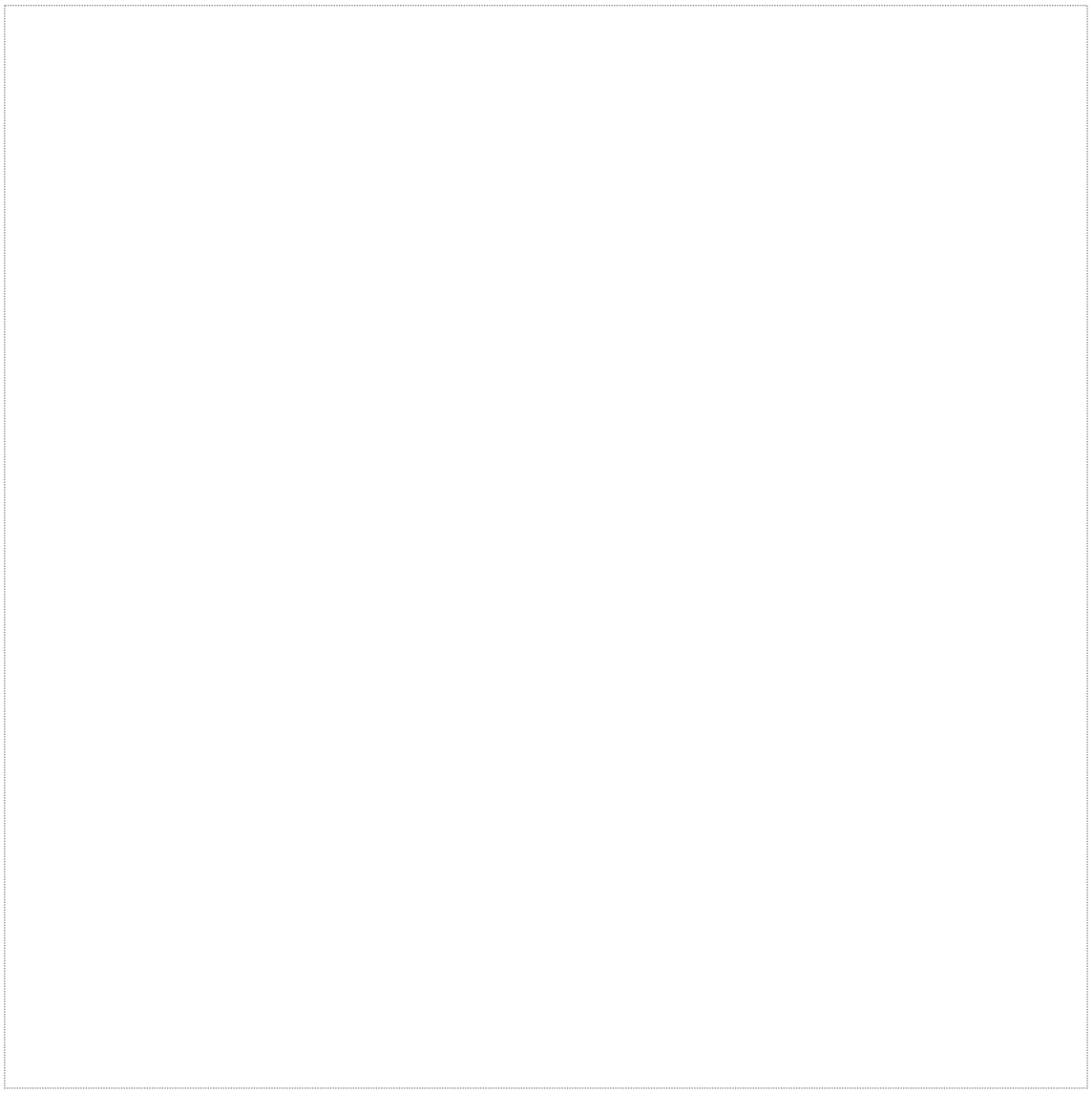
Filename	Description
G729EV_CELP2S_acelp_ca.c	CELP2S fixed codebook search
G729EV_CELP2S_encod.c	CELP2S encoder routine
G729EV_FEC_ferenc.c	FEC encoder routine
G729EV_G729_acelp_ca.c	G729EV fixed codebook search
G729EV_G729_lpc.c	G729 LP analysis
G729EV_G729_pitch.c	G729EV pitch search
G729EV_G729_pwf.c	G729 computation of perceptual weighting coefficients
G729EV_G729_qua_gain.c	G729 gain quantizer
G729EV_G729_qua_lsp.c	G729 LSP quantizer
G729EV_G729B_dtx.c	DTX/SID routine with G.729B embedded
G729EV_G729B_qsidlsf.c	LSF vector quantization routine
G729EV_MAIN_encod.c	MAIN encoder routine
G729EV_TDAC_encod.c	TDAC encoder routine
G729EV_TDBWE_encoder.c	TDBWE encoder routine
G729EV_TDBWE_vector_quantization.c	TDBWE vector quantization

Table D.2 – Summary of decoder specific routines

Filename	Description
G729EV_CELP2S_decod.c	CELP2S decoder routine
G729EV_CELP2S_syn.c	CELP2S core synthesis functions
G729EV_CELP2S_post.c	CELP2S postfiltering
G729EV_FEC_clasdec.c	FEC signal classification routines
G729EV_FEC_decbfi.c	FEC Frame Erasure Concealment functions
G729EV_FEC_ferdec.c	FEC information decoder
G729EV_FEC_onset.c	FEC codebook reconstruction routines
G729EV_FEC_pit_updt.c	FEC pitch update functions
G729EV_G729_de_acelp.c	G729 algebraic codebook decoding
G729EV_G729_dec_gain.c	G729 gain decoding
G729EV_G729_dec_lag3.c	G729 adaptive-codebook index decoding
G729EV_G729_lspdec.c	G729 LSP decoding
G729EV_G729_pst.c	G729 postfilter routines
G729EV_G729B_dec_sid.c	G729B SID decoder
G729EV_G729B_util.c	G729B utility routines
G729EV_MAIN_decod.c	MAIN decoder routine
G729EV_MAIN_envadaption.c	MAIN pre/post echo reduction routines
G729EV_TDAC_decod.c	TDAC decoder routine
G729EV_TDAC_post.c	TDAC post processing

Table D.2 – Summary of decoder specific routines

Filename	Description
G729EV_TDBWE_compression.c	TDBWE post processing
G729EV_TDBWE_decoder.c	TDBWE decoder routine
G729EV_TDBWE_fir.c	TDBWE filter functions
G729EV_TDBWE_frequency_envelope_shaping.c	TDBWE frequency envelope shaping functions
G729EV_TDBWE_generate_excitation.c	TDBWE excitation generation functions
G729EV_TDBWE_time_envelope_shaping.c	TDBWE time envelope shaping functions



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