



INTERNATIONAL TELECOMMUNICATION UNION

**ITU-T**

**G.728  
Implementors'  
Guide**

TELECOMMUNICATION  
STANDARDIZATION SECTOR  
OF ITU

(30 January 2004)

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

Digital terminal equipments – Coding of analogue signals  
by methods other than PCM

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**Implementors' Guide for ITU-T  
Recommendation G.728 (“Coding of speech at  
16 kbit/s using low-delay code excited linear  
prediction”)**

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## **Summary**

This document is an Implementers' Guide for the ITU-T Recommendation of G.728 addressing issues found in particular in its Annex I “Frame or packet loss concealment for the LD-CELP decoder”

This revision contains all updates submitted up to and including those at Study Group 16 meeting in January 2004.

This document was approved by ITU-T Study Group 16 on 30 January 2004.

## Change Log

Revision	Date	Description
1.0	30 January 2004	Approved by ITU-T Study Group 16 (TD 57/PLEN)

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# **IMPLEMENTERS GUIDE FOR RECOMMENDATION G.728 (CODING OF SPEECH AT 16 KBIT/S USING LD-CELP)**

## **1 Scope**

This guide resolves defects in G.728 Annex I and addresses the following categories:

- editorial errors
- technical errors, such as omissions and inconsistencies
- ambiguities

In addition, the Implementors' Guide may include explanatory text found necessary as a result of interpretation difficulties apparent from the defect reports.

This Guide will not address proposed additions, deletions, or modifications to the Recommendations that are not strictly related to implementation difficulties in the above categories. Proposals for new features should be made through contributions to the ITU-T.

## **2 Introduction**

ITU-T Recommendation G.728 defines coding of speech at 16 kbit/s using low-delay code excited linear prediction (LD-CELP) and comprises the following parts:

- G.728 (09/92)- Coding of speech at 16 kbit/s using low-delay code excited linear prediction
- G.728 Annex G (11/94) plus Corrigendum 1 (02/00) - 16 kbit/s fixed point specification
- G.728 Annex H (05/99) - Variable bit rate LD-CELP operation mainly for DCME at rates less than 16 kbit/s
- G.728 Annex I (05/99) - Frame or packet loss concealment for the LD-CELP decoder In force
- G.728 Annex J (09/99) - Variable bit-rate operation of LD-CELP mainly for voiceband-data applications in DCME
- G.728 Appendix I (07/95) - Programs and test sequences for implementation verification of the algorithm of the G.728 16 kbit/s LD-CELP speech coder
- G.728 Appendix II (11/95) - Speech performance

This Implementors' Guide is a compilation of reported defects for all versions of the ITU-T G.728. In this edition of the Guide, reported defects identified as of 2004-01 are given for:

- Annex I - Frame or packet loss concealment for the LD-CELP decoder

The Guide must be read in conjunction with the Recommendation G.728, to serve as an additional source of information for implementors. The changes, clarifications and corrections defined herein are expected to be included in future versions of the affected Recommendations.

## **3 Defect Resolution Procedure**

Upon discovering technical defects with any components of the texts covered by this Implementors Guide, please provide a written description directly to the editors of the affected Recommendation(s) with a copy to the respective Rapporteur. The template for a defect report is located at the end of this Guide. Return contact information should also be supplied so a dialogue

can be established to resolve the matter and an appropriate reply to the defect report can be conveyed. This defect resolution process is open to any interested party. Formal membership in the ITU is not required to participate in this process.

## 4 References

This document refers to the following G.720-series Recommendations:

- ITU-T G.728 Annex I (05/99), Frame or packet loss concealment for the LD-CELP decoder

## 5 Nomenclature

In addition to traditional revision marks, the following marks and symbols are used to indicate to the reader how changes to the text of a Recommendation should be applied:

<b>Symbol</b>	<b>Description</b>
<u>[Begin Correction]</u>	Identifies the start of revision marked text based on extractions from the published Recommendations affected by the correction being described.
<u>[End Correction]</u>	Identifies the end of revision marked text based on extractions from the published Recommendations affected by the correction being described.
...	Indicates that the portion of the Recommendation between the text appearing before and after this symbol has remained unaffected by the correction being described and has been omitted for brevity.
--- <i>SPECIAL INSTRUCTIONS</i> --- {instructions}	Indicates a set of special editing instructions to be followed.

## 6 Technical and Editorial Corrections

### 6.1 Error in fixed-point pseudo code for Block 97FE of G.728 Annex I

As described in Annex B of [TD6-WP3](#), an error was found in the fixed-point pseudo code for Block 97FE of G.728 Annex I that computes the exponent of NLSETRMS. ET is a 15 bit normalized block floating point array with its exponent stored in NLSET, and not fixed Q2, as implied in the comment. At this point in the code, ET was copied from ETPAST. While ETPAST is in Q2 format, ET is normalized after the copy and may no longer be in Q2. The computation of the exponent, NLSETRMS, in line 6 of the original pseudo code incorrectly assumes NLSET is fixed at 2. This error is fixed in the corrected code. The software simulation used for testing the fixed-point G.728 Annex I corresponds to the corrected code and not the incorrect code.

The modifications are:

1. delete the comment "ET is Q2, so AA0 is Q4" from line 3.

2. Change "4" to "NLSET + NLSET" in line 6.

The corrected code should appear as below:

```
AA0 = 0
```

```
For K = 1, ..., IDIM do the next line | compute energy of  
excitation
```

**[Begin Correction]**

```
AA0 = AA0 + ET(K) * ET(K)
```

**[End Correction]**

```
Call VSCALE(AA0, 1, 1, 30, AA0, NLS) | scale AA0
```

```
ETRMS = AA0 >> 16 | take high word of AA0
```

**[Begin Correction]**

```
NLSETRMS = (NLSET + NLSET + NLS) - 16 | NLS of ETRMS
```

**[End Correction]**

## 7 Implementation Clarifications

None.

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<b>Annex A: G.728 Defect Report Form</b>
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<b>DATE:</b>	
<b>CONTACT INFORMATION</b>  <b>NAME:</b> <b>COMPANY:</b> <b>ADDRESS:</b>  <b>TEL:</b> <b>FAX:</b> <b>EMAIL:</b>	
<b>AFFECTED RECOMMENDATIONS:</b>	
<b>DESCRIPTION OF PROBLEM:</b>	
<b>SUGGESTIONS FOR RESOLUTION:</b>	

NOTE - Attach additional pages if more space is required than is provided above.