



INTERNATIONAL TELECOMMUNICATION UNION

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

E.528

(02/96)

**TELEPHONE NETWORK AND ISDN
QUALITY OF SERVICE, NETWORK MANAGEMENT
AND TRAFFIC ENGINEERING**

**DIMENSIONING OF DIGITAL CIRCUIT
MULTIPLICATION EQUIPMENT (DCME)
SYSTEMS**

ITU-T Recommendation E.528

(Previously "CCITT Recommendation")

FOREWORD

The ITU-T (Telecommunication Standardization Sector) is a permanent organ of the International Telecommunication Union (ITU). The ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Conference (WTSC), which meets every four years, establishes the topics for study by the ITU-T Study Groups which, in their turn, produce Recommendations on these topics.

The approval of Recommendations by the Members of the ITU-T is covered by the procedure laid down in WTSC Resolution No. 1 (Helsinki, March 1-12, 1993).

ITU-T Recommendation E.528 was prepared by ITU-T Study Group 2 (1993-1996) and was approved under the WTSC Resolution No. 1 procedure on the 19th of February 1996.

NOTE

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

© ITU 1996

All rights reserved. No part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from the ITU.



Documents
Document Sharing Hub

CONTENTS

	<i>Page</i>
1 Scope	1
2 References	1
3 Definitions	2
4 Abbreviations	2
5 Dimensioning elements	3
5.1 Determining Quality of Service (QOS) and Grade of Service (GOS) parameters	3
5.2 General principles of dimensioning method	3
5.3 Parameters relevant to dimensioning calculations	3
5.3.1 General parameters	3
5.3.2 ADPCM mode for low rate encoding	4
5.3.3 Digital speech interpolation	4
5.4 DCME gain determination (in accordance with Recommendation G.766)	4
5.4.1 DCME gain for Voice G_v	4
6 Method for dimensioning of DCME links and gain computation	5
7 Determination of the number of DCME links	5
7.1 Determination of blocking probabilities for point-to-point DCME links	5
7.2 Multiple system configuration	6
Annex A	6
A.1 Effects of specially chosen parameters on DCME dimensioning	6
A.2 An example of DCME dimensioning calculation	10
Annex B	12
Appendix I	12
I.1 Dynamic Load Control (DLC) functionality	12
I.2 Maximum achievable G_v	12
I.3 Maximum allowable percentage of VBD calls	13
I.4 Determination of the blocking probabilities for dimensioning of point-to-point links that include DCME	13
I.4.1 DLC activation and deactivation	13
I.4.2 Bearer channel loading conditions	14
References	14
Appendix II	15

SUMMARY

Digital Circuit Multiplication Equipment (DCME) allows a high degree of utilization of digital circuits in Public Switched Telephone Networks (PSTN) and Integrated Services Digital Networks (ISDN) providing integration of traffic containing voice, Voice Band Data (VBD) and the facsimile portion of Voice Band Data (VBD) traffic.

Dimensioning method for DCME system, described in this Recommendation, deals with a group of trunks (circuit group, as defined in Recommendation E.600) between two switches, where DCMEs are used to achieve a statistical multiplexing gain.

This Recommendation also describes the GOS parameters that play a part in the DCME gain calculation.

This Recommendation deals with a point-to-point DCME single clique operation configuration. Dimensioning of complex multiclique/multidestination types of DCME systems is for further study.

Recommendation E.528

DIMENSIONING OF DIGITAL CIRCUIT MULTIPLICATION EQUIPMENT (DCME) SYSTEMS

(Geneva, 1996)

1 Scope

Digital Circuit Multiplication Equipment (DCME) allows a high degree of utilization of digital circuits in Public Switched Telephone Networks (PSTN) and Integrated Services Digital Networks (ISDN) providing integration of traffic containing voice, Voice Band Data (VBD) and the facsimile portion of Voice Band Data (VBD) traffic.

Dimensioning method for DCME system, described in this Recommendation, deals with a group of trunks (circuit group, as defined in Recommendation E.600) between two switches, where DCMEs are used to achieve a statistical multiplexing gain. The purpose of the dimensioning method is to determine the size of the group of trunks, the number and properties of the DCME output (bearer) channels and the number of DCMEs for specific traffic mixes – voice, VBD and facsimile to provide a satisfactory Grade of Service (GOS) cost-effectively.

Further, this Recommendation also describes the GOS parameters that play a part in the DCME gain calculation. The DCME gain is described in this Recommendation as a ratio of a number of trunk channels to a number of available bearer channels and is used to determine availability and specific properties of the DCME bearer channels.

This Recommendation deals with a point-to-point DCME single clique operation configuration. Dimensioning of complex multiclique/multidestination types of DCME systems is for further study.

2 References

The following Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision: all users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published.

- CCITT Recommendation G.766 (1992), *Facsimile demodulation/remodulation for digital circuit multiplication equipment.*
- ITU-T Recommendation G.763 (1994), *Digital circuit multiplication equipment using ADPCM (Recommendation G.726) and digital speech interpolation.*
- CCITT Recommendation G.726 (1990), *40/32/24/16 kbit/s Adaptive Differential Pulse Code Modulation (ADPCM).*
- ITU-T Recommendation E.301 (1993), *Impact of non-voice applications on the telephone network.*
- CCITT Recommendation E.520 (1988), *Number of circuits to be provided in automatic and/or semi-automatic operation, without overflow facilities.*
- CCITT Recommendation E.721 (1991), *Network grade of service parameters and target values for circuit-switched services in the evolving ISDN.*
- ITU-T Recommendation P.84 (1993), *Subjective listening test method for evaluating digital circuit multiplication and packeted voice systems.*
- ITU-T Recommendation Q.50 (1993), *Signalling between Circuit Multiplication Equipment (CME) and International Switching Centres (ISC).*

3 Definitions

The following terms and definitions applicable to DCME are described in clause 2/G.763. Definitions relating to DCME:

These definitions are used throughout the texts of this Recommendation.

- 3.1 Average Encoding Rate – Average number of Bits per Sample (bit/sample) (ABS)
- 3.2 Bearer Channel (BC)
- 3.3 Trunk Channel (TC)
- 3.4 Clique
- 3.5 DCME gain
- 3.6 Digital Speech Interpolation (DSI) gain
- 3.7 Facsimile demodulation/remodulation
- 3.8 Freezeout
- 3.9 Freezeout fraction
- 3.10 Low Rate Encoding (LRE) gain
- 3.11 Speech Activity Factor (AF)
- 3.12 Variable Bit Rate (VBR)

The following definitions are specific to DCME dimensioning as described in this Recommendation.

3.13 clipping: Clipping is an alteration of the front-end of a speech burst due to lack of sufficient time for processing. Occurs in most cases as a result of speech detectors processing functions employed by DSI systems when detectors try to process a front of a speech burst but lack the sufficient time to operate. Competitive clipping is the impairment caused by the overload control strategy which allows freezeout to occur when bearer channels are temporarily unavailable.

3.14 DCME gain for voice G_v : G_v is the product of Low Rate Encoding (LRE) and Digital Speech Interpolation (DSI) gain factors.

3.15 DCME link: A number of bearer channels between two DCMEs transmitting concentrated information in each direction.

3.16 nibble: Nibble is the term which refers to a 4-bit/sample-coded channel and corresponds to a data rate of 32 kbit/s. It is always associated with the capacity of a bearer channel. The term full bearer channel refers to a channel consisting of 61 nibbles, with the exception of the Time Slot zero and a single nibble used for Assignment Message Channel (AMC).

3.17 time slot (TS): Time Slot is the term which refers to an 8-bit/sample-coded channel and corresponds to data rate of 64 kbit/s. It is also used to refer to a trunk channel.

3.18 point-to-point mode: A DCME operational mode in which the traffic is exchanged between two corresponding DCMEs and the trunk channel traffic is interpolated over available bearer channels for only one destination in each direction.

4 Abbreviations

For the purposes of this Recommendation, the following abbreviations are used:

- ABS Average Bits per Sample
- ADPCM Adaptive Differential Pulse Code Modulation
- AF Activity Factor