SLOVENSKI STANDARD

SIST EN 62272-1:2004

september 2004

Digitalni radio Mondiale (DRM) - 1. del: Sistemska specifikacija (IEC 62272-1:2003)

Digital Radio Mondiale (DRM) - Part 1: System specification (IEC 62272-1:2003)

ICS 33.170

Referenčna številka
SIST EN 62272-1:2004(en)

EUROPEAN STANDARD **EN 62272-1**

NORME EUROPÉENNE

EUROPÄISCHE NORM December 2003

ICS 33.060.20

English version

Digital Radio Mondiale (DRM)
Part 1: System specification
(IEC 62272-1:2003)

Digital Radio Mondiale (DRM)
Partie 1: Spécification du système
(CEI 62272-1:2003)

Digital Radio Mondiale (DRM)
Teil 1: Systemspezifikation
(IEC 62272-1:2003)

This European Standard was approved by CENELEC on 2003-09-23. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Lithuania, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and United Kingdom.

CENELEC
European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Ref. No. EN 62272-1:2003 E

Foreword

The text of document 103/32/FDIS, future edition 1 of IEC 62272-1, prepared by IEC TC 103, Transmitting equipment for radiocommunication, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 62272-1 on 2003-09-23.

The following dates were fixed:

– latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2004-07-01

– latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2006-10-01

Annexes designated "normative" are part of the body of the standard.
Annexes designated "informative" are given for information only.
In this standard, annexes D and I are normative and annexes A to C and E to H and J to N are informative.

Endorsement notice

The text of the International Standard IEC 62272-1:2003 was approved by CENELEC as a European Standard without any modification.

NORME INTERNATIONALE

INTERNATIONAL STANDARD

CEI
IEC
62272-1

Première édition
First edition
2003-03

Digital Radio Mondiale (DRM) –

Partie 1:
Spécification du système

Digital Radio Mondiale (DRM) –

Part 1:
System specification

International Electrotechnical Commission, 3, rue de Varembé, PO Box 131, CH-1211 Geneva 20, Switzerland
Telephone: +41 22 919 02 11 Telefax: +41 22 919 03 00 E-mail: inmail@iec.ch Web: www.iec.ch

Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

CODE PRIX
PRICE CODE XJ

Pour prix, voir catalogue en vigueur
For price, see current catalogue

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

Digital Radio Mondiale (DRM)

Part 1: System specification

FOREWORD

1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, the IEC publishes International Standards. Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
2) The formal decisions or agreements of the IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested National Committees.
3) The documents produced have the form of recommendations for international use and are published in the form of standards, technical specifications, technical reports or guides and they are accepted by the National Committees in that sense.
4) In order to promote international unification, IEC National Committees undertake to apply IEC International Standards transparently to the maximum extent possible in their national and regional standards. Any divergence between the IEC Standard and the corresponding national or regional standard shall be clearly indicated in the latter.
5) The IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with one of its standards.
6) Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. The IEC shall not be held responsible for identifying any or all such patent rights.

International standard IEC 62272-1 has been prepared by IEC technical committee 103: Transmitting equipment for radiocommunication.

This standard is based on the technical specification ETSI TS 101 980 V1.2.1 (2002) and was prepared by Joint Rapporteur Group ITU/IEC (CA Decision 110/20) which includes TC 103, Transmitting equipment for radiocommunication, working group dealing with this matter: document 103/18/NP(Digital radio in the bands below 30 MHz - Part 1: System aspects) The joint rapporteur Group has been set up to achieve a double logo standard (IEC and ITU). The double logo standard may be published after the approval of the content of this standard by ITU.

The text of this standard is based on the following documents:

FDIS	Report on voting
103/32/FDIS	103/33/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This standard does not follow the rules for structuring International Standards as given in Part 2 of the ISO/IEC Directives.

NOTE This standard has been reproduced without significant modification to its original content or drafting.

The committee has decided that the contents of this publication will remain unchanged until 2005. At this date, the publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

INTRODUCTION

This part of IEC 62272 describes as follows the frequency bands used for broadcasting below 30 MHz:

- Low frequency (LF) band - from 148,5 kHz to 283,5 kHz, in ITU Region 1 [1]* only;
- Medium frequency (MF) band - from 526,5 kHz to 1 606,5 kHz, in ITU Regions 1 [1] and 3 [1] and from 525 kHz to 1 705 kHz in ITU Region 2 [1];
- High frequency (HF) bands - a set of individual broadcasting bands in the frequency range 2,3 MHz to 27 MHz, generally available on a Worldwide basis.

These bands offer unique propagation capabilities that permit the achievement of:

- Large coverage areas, whose size and location may be dependent upon the time of day, season of the year or period in the (approximately) 11 year sunspot cycle;
- Portable and mobile reception with relatively little impairment caused by the environment surrounding the receiver.

There is thus a desire to continue broadcasting in these bands, perhaps especially in the case of international broadcasting where the HF bands offer the only reception possibilities which do not also involve the use of local repeater stations.

However, broadcasting services in these bands:

- use analogue techniques;
- are subject to limited quality;
- are subject to considerable interference as a result of the long-distance propagation mechanisms which prevail in this part of the frequency spectrum and the large number of users.

As a direct result of the above considerations, there is a desire to effect a transfer to digital transmission and reception techniques in order to provide the increase in quality which is needed to retain listeners who, increasingly, have a wide variety of other programme reception media possibilities, usually already offering higher quality and reliability.

In order to meet the need for a digital transmission system suitable for use in all of the bands below 30 MHz, the Digital Radio Mondiale (DRM) consortium was formed in early 1998. The DRM consortium is a non-profit making body which seeks to develop and promote the use of the DRM system worldwide. Its members include broadcasters, network providers, receiver and transmitter manufacturers and research institutes. More information is available from their website (http://www.drm.org/).

---

* The figures in square brackets refer to the references given in clause 2.

Digital Radio Mondiale (DRM)

Part 1: System specification

1 Scope

This part of IEC 62272 gives the specification for the Digital Radio Mondiale (DRM) system for digital transmissions in the broadcasting bands below 30 MHz.

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 and/or edition number or version number) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.

[1] ITU-R Radio Regulations.

[2] ISO/IEC 14496-3:2001, Information technology - Coding of audio-visual objects - Part 3: Audio

[3] Not used

[4] ETSI EN 300 401: Radio Broadcasting Systems; Digital Audio Broadcasting (DAB) to mobile, portable and fixed receivers

[5] EN 50067: Specification of the radio data system (RDS) for VHF/FM sound broadcasting in the frequency range from 87,5 to 108,0 MHz

[6] ISO/IEC 10646-1: Information technology - Universal Multiple-Octet Coded Character Set (UCS) - Part 1: Architecture and Basic Multilingual Plane

[7] ISO 639-2: Codes for the representation of names of languages - Part 2: Alpha-3 code

[8] ISO 3166 (all parts): Codes for the representation of names of countries and their subdivisions

[9] ISO 8859-1: Information technology - 8-bit single-byte coded graphic character sets - Part 1: Latin alphabet No. 1

[10] ITU-R Recommendation BS.559-2: Objective measurement of radio-frequency protection ratios in LF, MF and HF broadcasting

[11] ITU-R Recommendation SM.328-10: Spectra and bandwidth of emissions

[12] ITU-R Recommendation XXX: RF protection ratios for digital sound broadcasting (DRM system) in the broadcasting bands below 30 MHz. (under consideration)

3 Definitions, symbols, abbreviations and conventions

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

cell: sine wave portion of duration T_s, transmitted with a given amplitude and phase and corresponding to a carrier position

NOTE 1: Each OFDM symbol is the sum of K such sine wave portions equally spaced in frequency.

energy dispersal: operation involving deterministic selective complementing of bits in the logical frame, intended to reduce the possibility that systematic patterns result in unwanted regularity in the transmitted signal

Fast Access Channel (FAC): channel of the multiplex data stream which contains the information that is necessary to find services and begin to decode the multiplex

Main Service Channel (MSC): channel of the multiplex data stream which occupies the major part of the transmission frame and which carries all the digital audio services, together with possible supporting and additional data services

mod: the modulo operator

NOTE 2: (x mod y) = z, where y > 0, such that x = qy + z, q is an integer, and 0 ≤ z < y.

OFDM symbol: transmitted signal for that portion of time when the modulating amplitude and phase state is held constant on each of the equally-spaced carriers in the signal

reserved for future addition (rfa): bits with this designation shall be set to zero

NOTE 3: Receivers shall ignore these bits.

reserved for future use (rfu): bits with this designation shall be set to zero

NOTE 4: Receivers shall check that these bits are zero in order to determine the valid status of the other fields in the same scope.

Service Description Channel (SDC): channel of the multiplex data stream which gives information to decode the services included in the multiplex

NOTE 5: The SDC also provides additional information to enable a receiver to find alternative sources of the same data.

Single Frequency Network (SFN): network of transmitters sharing the same radio frequency to achieve a large area coverage

transmission frame: a number of consecutive OFDM symbols (duration of 400 ms), whereby the first OFDM symbol contains the time reference cells

transmission super frame: three consecutive transmission frames (duration of 1 200 ms), whereby the first OFDM symbols contain the SDC block

logical frame: contains data of one stream during 400 ms

multiplex frame: logical frames from all streams form a multiplex frame (duration of 400 ms)

NOTE 6: It is the relevant basis for coding and interleaving.

3.2 Symbols

For the purposes of the present document, the following symbols apply:

$E[\,]$	expectation value of the expression in brackets
f_c	reference frequency of the emitted signal
K	number of active carriers in the OFDM symbol
$K_{\max}$	carrier index of the upper active carrier in the OFDM signal
$K_{\min}$	carrier index of the lower active carrier in the OFDM signal
L_{MUX}	number of input bits per multiplex frame for the multilevel encoding
N_{MUX}	number of MSC cells (QAM symbols) per multiplex frame
T	elementary time period, equal to $83^{1/3}$ µs (1/12 kHz)
T_f	duration of the transmission frame, equal to 400 ms
T_g	duration of the guard interval

T_s	duration of an OFDM symbol
T_{sf}	duration of the transmission super frame built from three transmission frames
T_u	duration of the useful (orthogonal) part of an OFDM symbol, excluding the guard interval
X^*	complex conjugate of value X
$\lceil\ \rceil$	round towards plus infinity
$\lfloor\ \rfloor$	round towards minus infinity

3.3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

AAC	Advanced Audio Coding
AFS	Alternative Frequency Switching
BER	Bit Error Rate
CELP	Code Excited Linear Prediction
CRC	Cyclic Redundancy Check
DFT	Discrete Fourier Transform
EEP	Equal Error Protection
FAC	Fast Access Channel
HF	High Frequency
HVXC	Harmonic Vector eXcitation Coding
IFFT	Inverse Fast Fourier Transform
ISO	International Organization for Standardization
LF	Low Frequency
LPC	Linear Predictive Coding
LSb	Least Significant bit
LSP	Line Spectral Pairs
MF	Medium Frequency
MPEG	Moving Picture Experts Group
MSb	Most Significant bit
MSC	Main Service Channel
OFDM	Orthogonal Frequency Division Multiplexing
PRBS	Pseudo-Random Binary Sequence
QAM	Quadrature Amplitude Modulation
RF	Radio Frequency
rfa	reserved for future addition
rfu	reserved for future use
SBR	Spectral Band Replication
SDC	Service Description Channel
SFN	Single Frequency Network
SM	Standard Mapping
SPP	Standard Protected Part
UEP	Unequal Error Protection
uimsbf	unsigned integer most significant bit first
VSPP	Very Strongly Protected Part

3.4 Convention

Unless otherwise stated, the following convention, regarding the order of bits within each step of processing is used:

- in figures, the bit shown in the left hand position is considered to be first
- in tables, the bit shown in the left hand position is considered to be first
- in numerical fields, the Most Significant Bit (MSb) is considered to be first and denoted by the higher number. For example, the MSb of a single byte is denoted "b7" and the Least Significant Bit (LSb) is denoted "b0"
- in vectors (mathematical expressions), the bit with the lowest index is considered to be first