



# SLOVENSKI STANDARD

## SIST EN 300 401 V1.4.1:2006

01-september-2006

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**Sistemi radiodifuzije - Digitalna zvokovna radiodifuzija (DAB) za mobilne, prenosne in fiksne sprejemnike**

Radio Broadcasting Systems; Digital Audio Broadcasting (DAB) to mobile, portable and fixed receivers

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European Standard (Telecommunications series)

## Radio Broadcasting Systems; Digital Audio Broadcasting (DAB) to mobile, portable and fixed receivers

European Broadcasting Union

Union Européenne de Radio-Télévision

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## Foreword

This European Standard (Telecommunications series) has been produced by Joint Technical Committee (JTC) Broadcast of the European Broadcasting Union (EBU), Comité Européen de Normalisation ELECtrotechnique (CENELEC) and the European Telecommunications Standards Institute (ETSI).

NOTE: The EBU/ETSI JTC Broadcast was established in 1990 to co-ordinate the drafting of standards in the specific field of broadcasting and related fields. Since 1995 the JTC Broadcast became a tripartite body by including in the Memorandum of Understanding also CENELEC, which is responsible for the standardization of radio and television receivers. The EBU is a professional association of broadcasting organizations whose work includes the co-ordination of its members' activities in the technical, legal, programme-making and programme-exchange domains. The EBU has active members in about 60 countries in the European broadcasting area; its headquarters is in Geneva.

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The Eureka Project 147 was established in 1987, with funding from the European Commission, to develop a system for the broadcasting of audio and data to fixed, portable or mobile receivers. Their work resulted in the publication of European Standard, ETS 300 401 [7], for DAB (see note) which now has worldwide acceptance. The members of the Eureka Project 147 are drawn from broadcasting organizations and telecommunication providers together with companies from the professional and consumer electronics industry.

NOTE: DAB is a registered trademark owned by one of the Eureka Project 147 partners.

The present document on Digital Audio Broadcasting (DAB) is based on the overall system and service requirements adopted by the ITU-R Recommendation BS.774 [1] and ITU-R Recommendation BO.789 [2]. The DAB system has been recommended by the ITU-R, as Digital System A, for terrestrial and satellite delivery. The audio coding algorithm used by the DAB system has been subject to the standardization process within the ISO/Moving Pictures Expert Group (MPEG), see ISO/IEC 11172-3 [3] and ISO/IEC 13818-3 [11]. The layered ISO open system interconnect model ISO 7498-1 [4] has been used to the extent possible, and interfacing to information technology equipment and communications networks has been taken into account where applicable.

The present document defines the nature and content of the transmitted DAB signal with reference to the conceptual emission part. The emphasis is given to the normative elements. Informative elements are included only to the extent necessary to provide interpretative guidance to the DAB system users and equipment manufacturers.

The DAB system is a novel sound broadcasting system intended to supersede the existing analogue amplitude and frequency modulation systems. It is a rugged, yet highly spectrum and power efficient sound and data broadcasting system. It has been designed for terrestrial and satellite as well as for hybrid and mixed delivery. The DAB system has been publicly demonstrated on a number of occasions during its development. It has been subject to extensive field tests and computer simulations in Europe and elsewhere. It is now in regular service in many European countries and throughout the world. In 1995, the European DAB Forum (EuroDab) was established to pursue the introduction of DAB services in a concerted manner world-wide, and it became the World DAB Forum (World DAB) in 1997.

With respect to the previous version of EN 300 401 published in May 2001, the present document contains several refinements to the Eureka 147 DAB system. These refinements were performed and agreed by the World DAB Forum and include the following areas:

- backward compatible changes to PAD to provide greater flexibility;
- addition of Forward Error Correction mechanisms for packet mode service components;
- addition of extended labels and character definition;
- removal of some obsolete service information features;
- conditional access details moved to a separate ETSI document.

<b>National transposition dates</b>	
Date of adoption of this EN:	26 May 2006
Date of latest announcement of this EN (doa):	31 August 2006
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## 1 Scope

The present document establishes a broadcasting standard for the Digital Audio Broadcasting (DAB) system designed for delivery of high-quality digital audio programme and data services for mobile, portable and fixed reception from terrestrial or satellite transmitters in the Very High Frequency (VHF)/Ultra High Frequency (UHF) frequency bands as well as for distribution through cable networks. The DAB system is designed to provide spectrum and power efficient techniques in terrestrial transmitter network planning, known as the Single Frequency Network (SFN) and the gap-filling technique. The DAB system is suitable for satellite as well as hybrid/mixed terrestrial/satellite broadcasting, using a simple, nearly omni-directional receiving antenna. The DAB system meets the required sharing criteria with other radiocommunication services.

The present document defines the DAB transmission signal. It includes the coding algorithms for audio, multiplexing of audio programme and data services, channel coding and modulation. A limited range of supplementary services associated with programme services is defined. Provision is also made for transmission of additional data services which may be programme related or not, within the limit of the total system capacity. The present document provides information on the system configuration which includes information about the ensembles, services, service components and linking of them. Provision is made for a compatible cross-reference to existing Frequency Modulation (FM) services and Amplitude Modulation (AM) services.

The present document describes the nominal characteristics of the emitted DAB signal. The aspects related to the receiver design are outside the scope of the present document. Hardware implementation considerations are not covered.

## 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.

Referenced documents which are not found to be publicly available in the expected location might be found at <http://docbox.etsi.org/Reference>.

- [1] ITU-R Recommendation BS.774 (1994): "Digital sound broadcasting to vehicular, portable and fixed receivers using terrestrial transmitters in the VHF/UHF bands".
- [2] ITU-R Recommendation BO.789 (1994): "Digital sound broadcasting to vehicular, portable and fixed receivers for BSS (sound) in the frequency range 500 - 3 000 MHz".
- [3] ISO/IEC 11172-3 (1993): "Information technology - Coding of moving pictures and associated audio for digital storage media at up to 1,5 Mbit/s - Part 3: Audio".
- [4] ISO 7498-1: "Information technology - Open Systems Interconnection - Basic Reference Model: The Basic Model".
- [5] CENELEC EN 62106: "Specification of the radio data system (RDS) for VHF/FM sound broadcasting in the frequency range from 87,5 to 108,0 MHz".
- [6] ITU-T Recommendation X.25: "Interface between Data Terminal Equipment (DTE) and Data Circuit-terminating Equipment (DCE) for terminals operating in the packet mode and connected to public data networks by dedicated circuit".
- [7] ETSI ETS 300 401 (1997): "Radio broadcasting systems; Digital Audio Broadcasting (DAB) to mobile, portable and fixed receivers".

- [8] ISO 3901 (2001): "Information and documentation - International Standard Recording Code (ISRC)".
- [9] IEC 60958 (all parts): "Digital audio interface".
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## 3 Definitions, abbreviations, mathematical symbols, C-language mathematical symbols and conventions

### 3.1 Definitions

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

**Access Control System (ACS):** particular set of rules for managing entitlement checking and conditional access messages

**alias component:** mirrored signal component resulting from sub-Nyquist sampling

**announcement cluster:** group of services which share the same announcement interruption privileges

**audio bit stream:** sequence of consecutive audio frames

**audio frame:** frame of a duration of 24 ms (at 48 kHz sampling frequency) or of 48 ms (at 24 kHz sampling frequency) which contains a Layer II encoded audio signal ISO/IEC 11172-3 [3], ISO/IEC 13818-3 [11], corresponding to 1 152 consecutive audio samples

NOTE: It is the smallest part of the audio bit stream which is decodable on its own.

**audio mode:** audio coding system provides single channel, dual channel, stereo and joint stereo audio modes

NOTE: In each mode, the complete audio signal is encoded as one audio bit stream.

**Auxiliary Information Channel (AIC):** all or part of sub-channel 63, used to carry information redirected from the Fast Information Channel

**bark:** See "Critical band".

**bit allocation:** time-varying assignment of bits to samples in different sub-bands according to a psychoacoustic model

**bound:** lowest sub-band in which Intensity stereo coding is used, in the case of Joint stereo mode

**Capacity Unit (CU):** the smallest addressable unit (64 bits) of the Common Interleaved Frame (CIF)

**Change Event Indication (CEI):** set of FIG fields with particular values to indicate a change of database content for certain service information features

**Common Interleaved Frame (CIF):** serial digital output from the main service multiplexer which is contained in the Main Service Channel part of the transmission frame

NOTE: It is common to all transmission modes and contains 55 296 bits (i.e. 864 CUs).

**Conditional Access (CA):** mechanism by which the user access to service components can be restricted

**convolutional coding:** coding procedure which generates redundancy in the transmitted data stream in order to provide ruggedness against transmission distortions

**critical band:** psychoacoustic measure in the frequency domain which corresponds to the frequency selectivity of the human ear

NOTE: The unit of this psychoacoustic measure is called Bark. The Bark scale is a non-linear mapping of the frequency scale over the entire audio frequency range.

**DAB audio frame:** same as audio frame, but includes all specific DAB audio-related information

**DAB transmission signal:** transmitted radio frequency signal

**database key:** set of FIG fields that sub-divide a database for certain service information features

**data service:** service which comprises a non-audio primary service component and optionally additional secondary service components

**dual channel mode:** audio mode, in which two audio channels with independent programme contents (e.g. bilingual) are encoded within one audio bit stream

NOTE: The coding process is the same as for the Stereo mode.

**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

**ensemble:** transmitted signal, comprising a set of regularly and closely-spaced orthogonal carriers

NOTE: The ensemble is the entity which is received and processed. In general, it contains programme and data services.

**Ensemble Identifier (EId):** unique 16-bit code, allocated to an ensemble and intended to allow unambiguous world-wide identification of that ensemble

**Equal Error Protection (EEP):** error protection procedure which ensures a constant protection of the bit stream

**Extended Programme Associated Data (X-PAD):** extended part of the PAD carried towards the end of the DAB audio frame, immediately before the Scale Factor Cyclic Redundancy Check (CRC)

NOTE: Its length is variable.

**Fast Information Block (FIB):** data burst of 256 bits

NOTE: The sequence of FIBs is carried by the Fast Information Channel. The structure of the FIB is common to all transmission modes.

**Fast Information Channel (FIC):** part of the transmission frame, comprising the Fast Information Blocks, which contains the multiplex configuration information together with optional service Information and data service components

**Fast Information Data Channel (FIDC):** dedicated part of the Fast Information Channel which is available for non-audio related data services, such as paging

**Fast Information Group (FIG):** package of data used for one feature in the Fast Information Channel. Eight different types are available to provide a classification of the features

**Fixed Programme Associated Data (F-PAD):** fixed part of the PAD contained in the last two bytes of the DAB audio frame

**intensity stereo coding:** method of exploiting stereo irrelevance or redundancy in stereophonic audio programmes

NOTE: It is based on retaining only the energy envelope of the right and left channels at high frequencies. At low frequencies, the fine structure of the left and right channel of a stereophonic signal is retained.

**joint stereo mode:** audio mode in which two channels forming a stereo pair (left and right) are encoded within one bit stream and for which stereophonic irrelevance or redundancy is exploited for further bit reduction

NOTE: The method used in the DAB system is Intensity stereo coding.

**logical frame:** data burst, contributing to the contents of a sub-channel, during a time interval of 24 ms

EXAMPLE: Data bursts at the output of an audio encoder, a Conditional Access scrambler and a convolutional encoder are referred to as logical frames. The number of bits contained in a specific logical frame depends on the stage in the encoding process and the bit rate associated with the sub-channel.

**logical frame count:** value of the CIF counter corresponding to the first CIF which carries data from the logical frame

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

**masking:** property of the human auditory system by which an audio signal cannot be perceived in the presence of another audio signal

**masking threshold:** function of frequency and time, specifying the sound pressure level below which an audio signal cannot be perceived by the human auditory system

**MSC data group:** package of data used for one user application in the Main Service Channel

NOTE: MSC data groups are transported in a series of one or more packets or X-PAD data sub-fields.

**Multiplex Configuration Information (MCI):** information defining the configuration of the multiplex

NOTE: It contains the current (and in the case of an imminent re-configuration, the forthcoming) details about the services, service components and sub-channels and the linking between these entities. It is carried in the FIC in order that a receiver may interpret this information in advance of the service components carried in the Main Service Channel. It also includes identification of the ensemble itself.

**N:** transform length of Fast Fourier Transform (FFT)

**null symbol:** first Orthogonal Frequency Division Multiplex (OFDM) symbol of the transmission frame

**OFDM symbol:** transmitted signal for that portion of time when the modulating phase state is held constant on each of the equi-spaced, equal amplitude carriers in the ensemble

NOTE: Each carrier is four-phase differentially modulated from one symbol to another, giving a gross bit rate of two bits per carrier per symbol.

**packet mode:** mode of data transmission in which data are carried in addressable blocks called packets

NOTE: Packets are used to convey MSC data groups within a sub-channel.

**polyphase filter bank:** set of equal-bandwidth filters with special phase relationship, allowing for efficient implementation of a filter bank