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Digitalna zvokovna radiodifuzija (DAB) - Protokol za prenos multimedijskih objektov (MOT)

Digital Audio Broadcasting (DAB); Multimedia Object Transfer (MOT) protocol

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Digital Audio Broadcasting (DAB); Multimedia Object Transfer (MOT) protocol

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Foreword

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

NOTE 1: The EBU/ETSI JTC was established in 1990 to co-ordinate the drafting of standards in the specific field of broadcasting and related fields. Since 1995 the JTC 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 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. 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.

NOTE 2: DAB is a registered trademark owned by one of the Eureka 147 partners.

National transposition dates	
Date of adoption of this EN:	5 December 1997
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1 Scope

The present document specifies a transmission protocol, which allows to broadcast various kinds of data using the Digital Audio Broadcasting (DAB) system. It is tailored to the needs of Multimedia services and the specific constraints given by the broadcasting characteristics of the DAB system. After reception this data can be processed and presented to the user.

The present document defines the transport specific encoding for data types not specified in ETS 300 401 [1] according to the transport mechanisms provided by DAB. It allows a flexible utilization of the data channels incorporated in the DAB system, as well as methods to manage and maintain a reliable transmission in a uni-directional broadcast environment. Provisions are also made for the creation and presentation of advanced Multimedia services using formats such as Hyper Text Markup Language (HTML) (see RFC 1866 [3]) or Multimedia and Hypermedia information coding Experts Group (MHEG) (see ISO/IEC CD 13522 [4]).

The present document describes the core transport protocol. Subsequent parts or revisions of the present document will describe backwards compatible extensions.

Aspects related to the further decoding and processing of the data objects carried are outside the scope of the present document. Hardware or software implementation considerations are not covered.

2 Normative references

References may be made to:

a) specific versions of publications (identified by date of publication, edition number, version number, etc.), in which case, subsequent revisions to the referenced document do not apply; or

b) all versions up to and including the identified version (identified by "up to and including" before the version identity); or

c) all versions subsequent to and including the identified version (identified by "onwards" following the version identity); or

d) publications without mention of a specific version, in which case the latest version applies.

A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

[1] ETS 300 401: "Radio broadcasting systems; Digital Audio Broadcasting (DAB) to mobile, portable and fixed receivers".

[2] Sun Microsystems (1994, 1995): "The Java Language: A White Paper". Called "Java" in the present document.

[3] RFC 1866 (November 1995): "Hyper Text Markup Language (HTML) Specification-2.0", T. Berners-Lee, D. Connolly; MIT/LCS onwards.

[4] ISO/IEC CD 13522: "Information Technology - Coding of Multimedia and Hypermedia Information", ISO/IEC JTC1/SC29 - Multimedia and Hypermedia information coding Experts Group (MHEG).

[5] ISO DIS 10918: "Digital Compression and Coding of Continuous-tone Still Images", Joint Photographers Experts Group (JPEG).

[6] ISO-8859-1 (1987): "International Standard; Information Processing; 8-bit Single-Byte Coded Graphic Character Sets; Part 1: Latin alphabet No. 1".

[7] ISO-8859-2 (1987): "International Standard; Information Processing; 8-bit Single-Byte Coded Graphic Character Sets; Part 2: Latin alphabet No. 2".

[8] RFC 1521 (September 1993): "MIME (Multipurpose Internet Mail Extensions) Part One: Mechanisms for Specifying and Describing the Format of Internet Message Bodies", N. Borenstein, N. Freed.

[9] RFC 1945 (May 1996): "Hypertext Transfer Protocol – HTTP/1.0", T. Berners-Lee, R. Fielding, H. Nielsen.

[10] ISO/IEC 646, 3rd edition (1991): "Information Technology - ISO 7-bit coded character set for information interchange".

[11] © CompuServe, Incorporated (June 15, 1987): "GIF ™, Graphics Interchange Format ™": A standard defining a mechanism for the storage and transmission of raster-based graphics information".

[12] BMP: "Device-independent bitmap format used as default graphics file format for Microsoft Windows".

[13] ISO/IEC 11172-3 (March 1993): "Coding of Moving Pictures and Associated Audio for Digital Storage Media at up to 1,5 Mbit/s - Audio Part".

[14] ISO/IEC 13818-3 (November 1994): Generic coding of moving pictures and associated audio - Audio part".

[15] ITU-T Recommendation G.711: "Pulse Code Modulation (PCM) of voice frequencies".

[16] Apple Computer, Incorporated: "Audio Interchange File Format (AIFF): A Standard for Samples Sound Files".

[17] Sony: "Adaptive Transform Acoustic Coding".

[18] Sony: "Adaptive Transform Acoustic Coding II".

[19] ISO/IEC 14496-3 (Working Draft): "Very Low Bitrate Audio-Visual Coding".

[20] ISO/IEC 11172-2 (March 1993): "Coding of Moving Pictures and Associated Audio for Digital Storage Media at up to 1,5 Mbit/s - Video Part".

[21] ISO/IEC 13818-2 (November 1994): Generic coding of moving pictures and associated audio - Video part". It is also standardised by ITU-T as Recommendation H.262.

[22] ISO/IEC 14496-2 (Working Draft): "Very Low Bitrate Audio-Visual Coding".

[23] ITU-T Recommendation H.263: "Video Coding for Low Bitrate Communication".

[24] ISO 7498 (1984): "Open Systems Interconnection (OSI) Basic Reference Model".

[25] EN 50067: "Specification of the Radio Data System (RDS) for VHF/FM broadcasting in the frequency range from 87,5 to 108,0 MHz".

3 Definitions and abbreviations

3.1 Definitions

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

body: The body carries any kind of data, where structure and content of the data are described in the header.

byte ordering: All numeric values using more than one byte have to be coded in Big Endian Format (most significant byte first). In all schematics the bits are ordered with the most significant bit of a byte ("b7") at the left end and least significant bit ("b0") at the right end of the drawing.

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

DAB receiver: The Multimedia Object Transfer (MOT) specific definition of a DAB receiver includes decoding of the DAB signal and resolving the multiplex structure of the main service channel.

data channels: The data channels in DAB (packet mode, X-PAD) provide the functionality on the transport layer in order to convey the objects.

data decoder: The data decoder processes the MOT data stream and applies both packet mode/X-PAD specific decoding and then MOT decoding.

ensemble: The transmitted signal, comprising a set of regularly and closely-spaced orthogonal carriers. The ensemble is the entity which is received and processed. In general, it contains programme and data services.

eXtended Programme Associated Data (X-PAD): The extended part of the PAD carried towards the end of the DAB audio frame, immediately before the scale factor Cyclic Redundancy Check (CRC). It is used to transport information together with an audio stream which is related or synchronized to the X-PAD. No provisions for error detection are included in X-PAD so that additional protocols are required for some applications.

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

header: The header consists of the header core and the header extension.

header core: The header core contains information about the size and the content of the object, so that the receiver can determine whether it has system resources to decode and present the object or not.

header extension: The header extension includes additional information about the body.

Main Service Channel (MSC): A 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.

MOT data service: A data service comprises information which is intended to be presented to a user, i.e. text, pictures, video or audio sequences. An application decoder is required to gain access to the data. This might be a viewer which decodes text and pictures and displays them on a screen. It might also be a Multimedia engine which manages various inputs and outputs a number of different audio-visual media synchronously. In terms of MOT a data services consists of one or an ordered collection of several objects. It is not in the scope of MOT to deal with the content of the object, but to carry information to support both presentation and handling of these objects.

MOT object: A MOT object is used to transfer data in DAB, the object contains a header and a body carrying the payload.

MOT stream: One stream of MOT objects is transferred in an individual service component (packet mode) or as part of the X-PAD of a programme service, where several MOT objects might be conveyed in parallel by interleaving.

packet mode: The mode of data transmission in which data are carried in addressable blocks called packets. Packets are used to convey MSC Data Groups within a sub-channel. The packet mode carries the load in packets of a certain size, separating different streams of packets by specific addresses. Error detection and repetition are already covered by packet mode and thus allow a reliable and flexible data transmission.

Programme Associated Data (PAD): Information which is related to the audio data in terms of content and synchronization. The PAD field is located at the end of the DAB audio frame.

service: The user-selectable output which can be either a programme service or a data service.

service component: A part of a service which carries either audio (including PAD) or data. The service components of a given service are linked together by the Multiplex Configuration Information (MCI). Each service component is carried either in a sub-channel or in the Fast Information Data Channel (FIDC).

service label: Alphanumeric characters associated with a particular service and intended for display in a receiver.

transportId: This 16-bit field shall uniquely identify one data object (file and header information) from a stream of such objects. It shall be used to indicate the object to which the information carried in the segment belongs or relates. It is valid only during the transport time of the object.

transport time: The transport time is the entire duration which is needed to transfer a MOT object completely (including all repetitions), i.e. the time during which a particular TransportId is valid for one MOT object.

X-PAD Data Group: A package of data for carrying one segment of an MOT object in the Extended Programme Associated Data (X-PAD).

3.2 Abbreviations

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

AIFF	Audio Interchange File Format
ASCII	American Standard Code for Information Interchange
ATRAC	Adaptive Transform Acoustic Coding
BMP	Windows Bitmap
CA	Conditional Access
CRC	Cyclic Redundancy Check
DAB	Digital Audio Broadcasting
ECM	Entitlement Checking Message
EMM	Entitlement Management Message
ETS	European Telecommunication Standard
FFT	Fast Fourier Transform
FIB	Fast Information Block
FIC	Fast Information Channel
FIDC	Fast Information Data Channel
GIF	Graphics Interchange Format
HF	High Frequency
HTML	Hyper Text Markup Language
HTTP	Hyper Text Transfer Protocol
JFIF	JPEG File Interchange Format
JPEG	Joint Photographic Experts Group
MCI	Multiplex Configuration Information
MHEG	Multimedia and Hypermedia information coding Experts Group
MIME	Multipurpose Internet Mail Extensions
MJD	Modified Julian Date
MOT	Multimedia Object Transfer
MPEG	Moving Pictures Expert Group
MSC	Main Service Channel
PAD	Programme Associated Data
PCM	Pulse Code Modulation
PLI	Parameter Length Indicator
Rfa	Reserved for future addition
Rfu	Reserved for future use

UTC	Universal Time Co-ordinated
X-PAD	Extended Programme Associated Data

4 General description of the MOT protocol

4.1 Requirements of Multimedia services

Multimedia in general can be referred to as information and its presentation in various formats (visible, audible, etc.) and forms (text, pictures, video, etc.). The material is often structured and packaged into a number of containers or files which shall be either completely available before the presentation or are delivered on request of the user.

Multimedia services require to control the presentation (e.g. the arrangement of visible information on a screen) and therefore direct access to both hardware and software resources of the receiver/terminal is essential. The appropriate time shall also be considered for the presentation. Thus it is required to synchronize the various elements (e.g. video together with the sound), i.e. some kind of a runtime environment is necessary.

4.2 Problems MOT is attempting to solve

The MOT protocol is a data transport protocol specified to provide facilities for the transportation of Multimedia objects in the DAB system. These objects can consist of:

- self-contained Multimedia objects, such as:
    - MHEG (see ISO/IEC CD 13522 [4]); and
    - Java [2]; or
- actual files containing for example:
    - JPEG pictures (see ISO DIS 10918 [5]);
    - American Standard Code for Information Interchange (ASCII) text;
    - Moving Pictures Expert Group (MPEG) video or audio sequences.

For transmission of Multimedia objects, the protocol provides the means to use the following data channels of the DAB system:

- PAD; and
- Packet Mode.

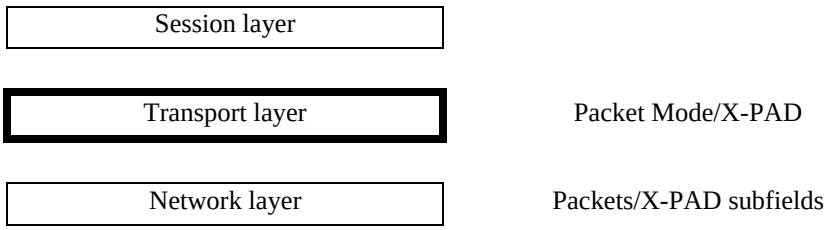

Figure 1: Target for the MOT protocol

MOT interconnects the closed and well defined world of DAB to the open world of Multimedia services with its large variety of systems and data formats. It comprises functionality to carry information to the terminal, respectively the user.

MOT does not cover issues specific to runtime environments to control Multimedia services, i.e. the interpretation and execution of object code, pseudo code or script languages. This shall be included in the particular application.