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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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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 1: 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, EN 300 401 [1], for DAB (see note 2) 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 2: DAB is a registered trademark owned by one of the Eureka Project 147 partners.

National transposition dates	
Date of adoption of this EN:	19 May 2006
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Date of latest publication of new National Standard or endorsement of this EN (dop/e):	28 February 2007
Date of withdrawal of any conflicting National Standard (dow):	28 February 2007

Introduction

The present document is a complete revision of V1.2.1. It does not change the former MOT specifications but tries to give a much more extensive and understandable description of what MOT is, how it works and how an MOT decoder can be implemented. The present document concentrates on describing the transport related issues; all user application specific issues will now be handled by the user applications specifications.

MOT considers itself the multimedia transport protocol that provides the necessary tools to carry all kind of multimedia data. It is the user application to decide which of the tools provided by MOT it uses and the user applications might also extend or restrict some functionality that is described in the present document.

Some general and transport related MOT parameters (`MimeType`, CA related parameters, `CompressionType`, `ProfileSubset`) were removed from the MOT broadcast web site specification [6] and added to the present document.

User application specific parameters (`TriggerTime`, `Label`) are no longer explained in the present document and will be described in user application specifications (MOT broadcast website [6]; MOT Slide Show [5]).

A clear indication of the differences between MOT header mode and MOT directory mode is given.

Backwards compatible extensions reduce the footprint of the MOT decoder and permit much better user behaviour during changes to a data carousel. MOT directory compression permits better use of the broadcast channel.

A detailed description of a model of an MOT decoder and its interfaces is given in annex C. This should help implementing a fully standard compliant and efficient MOT decoder. Additional clauses describe features that an advanced MOT decoder should use to further improve the performance of the MOT decoder and to enhance the user experience.

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The present document contains identifier fields that require values to be registered. Registered value lists associated with data broadcasting specifications for DAB are maintained by the WorldDAB Information and Registration Centre (WIRC). Since the lists and tables contained within the present document might be outdated, please refer to the most recent versions of TS 101 756 [7]. The present document also describes the procedures for registering values in an existing table as well as registering new tables.

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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 EN 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 2854 [2]) or Multimedia and Hypermedia information coding Experts Group (MHEG) (see ISO/IEC 13522 [3]).

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 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] | ETSI EN 300 401: "Radio Broadcasting Systems; Digital Audio Broadcasting (DAB) to mobile, portable and fixed receivers". |
| [2] | IETF RFC 2854: "The 'text/html' Media Type". |
| [3] | ISO/IEC 13522 (all parts): "Information technology - Coding of multimedia and hypermedia information". |
| [4] | IETF RFC 2045 to 2049: "Multipurpose Internet Mail Extensions (MIME)". |
| [5] | ETSI TS 101 499: "Digital Audio Broadcasting (DAB); MOT Slide Show; User Application Specification". |
| [6] | ETSI TS 101 498-1: "Digital Audio Broadcasting (DAB); Broadcast website; Part 1: User application specification". |
| [7] | ETSI TS 101 756: "Digital Audio Broadcasting (DAB); Registered Tables". |
| [8] | ETSI TS 102 367: "Digital Audio Broadcasting (DAB); Conditional access". |
| [9] | ETSI TR 101 496-2: "Digital Audio Broadcasting (DAB); Guidelines and rules for implementation and operation; Part 2: System features". |
| [10] | ISO/IEC 8859-1: "Information technology - 8-bit single-byte coded graphic character sets - Part 1: Latin alphabet No. 1". |
| [11] | ISO/IEC 10646: "Information technology - Universal Multiple-Octet Coded Character Set (UCS)". |

3 Definitions and abbreviations

3.1 Definitions

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

byte ordering: all numeric values using more than one byte have to be coded in Big Endian Format (most significant byte first)

NOTE: 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): mechanism by which user access to service components can be restricted

content provider: provides data for a user application instance

NOTE: It is his responsibility to provide the data according to the user application standard and to transmit it according to the transport protocol used by the user application. The provided data is transmitted in a data channel of a DAB data or programme service.

DAB receiver: 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 carousel: delivery system that allows the broadcast component of a user application to present a set of distinct objects to a user application decoder by cyclically repeating the contents of the data carousel

NOTE: For some user applications the data carousel may complete only a few or a single cycle.

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

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

directory core: directory core contains basic information describing the data carousel (e.g. number of objects, data carousel period)

NOTE: The directory core does not describe individual objects.

directory extension: directory extension contains additional information about the data carousel. The directory extension does not describe individual objects

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.

Fast Information Channel (FIC): 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 core: header core contains information about the size and the content type of the object, so that the receiver can determine whether it has system resources to decode and present the object or not

header extension: header extension includes additional information about the object

header information: header information consists of the header core and the header extension and describes one MOT body

NOTE: The header information can be sent in an MOT header (the MOT header describes one single MOT body) or an MOT directory (the MOT directory describes all MOT bodies within the data carousel).

MOT body: carries any kind of data of finite length. The MOT body is described by the MOT header information

MOT data service: data service comprises information that is intended to be presented to a user, i.e. text, pictures, video or audio sequences

NOTE: A user 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. 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 directory: within a data carousel the MOT directory contains a complete description of the content of the data carousel

NOTE: It includes the MOT header information of all objects within the data carousel.

MOT entity: single MOT body, a single MOT directory or a single MOT header

MOT header: this MOT entity contains the header information that describes one single MOT body

MOT object: used to transfer data in DAB. The object consists of header information and an MOT body carrying the payload

MOT parameter: MOT parameter provides information about an MOT object or about the data carousel as a whole

NOTE: MOT parameters describing one single MOT object are carried in the header information of the MOT object. MOT parameters describing a data carousel are only available in MOT directory mode and they are carried in the MOT directory extension. MOT parameters can be transport specific (MOT transport parameters) or user application specific (MOT user application specific parameters). The present document defines transport specific MOT parameters. The user application specific MOT parameters are defined in user application standards.

MOT segment: all MOT entities are split into MOT segments for transmission

NOTE: The MOT segments are then mapped to MSC data groups and inserted into a DAB packet mode subchannel or into the X-PAD channel of an audio service component.

MOT stream: MOT stream comprises all data for one user application instance

NOTE: One stream of MOT objects is transferred in an individual service component (packet mode) or as part of the X-PAD of an audio service component. Several MOT entities might be conveyed in parallel by interleaving. Note that within one packet mode subchannel or one X-PAD channel there might be multiple MOT streams carried in parallel.

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

MSC data group: package of data for carrying one segment of an MOT object

NOTE: The MSC data group can be carried in a packet mode subchannel or in the Extended Programme Associated Data (X-PAD) part of an audio subchannel.

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. 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 that is related to the audio data in terms of content and synchronization

NOTE: The PAD field is located at the end of the DAB audio frame.

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

service component: part of a service which carries either audio (including PAD) or data

NOTE: 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 (body and header information) from a stream of such objects

NOTE: It shall be used to indicate the object to which the information carried in the segment belongs or relates. It is valid only during transport of the object.

user application: data application defined in a separate standard and fed with data via DAB

NOTE: A user application using MOT can be carried in a packet mode subchannel or in X-PAD. The stream of MOT objects belonging to a user application instance is called an "MOT stream", see above.

X-PAD (eXtended Programme Associated Data): extended part of the PAD carried towards the end of the DAB audio frame, immediately before the scale factor Cyclic Redundancy Check (CRC)

NOTE: 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 user applications.

3.2 Abbreviations

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

CA	Conditional Access
CRC	Cyclic Redundancy Check
DAB	Digital Audio Broadcasting
ECM	Entitlement Checking Message (Conditional Access related)
EMM	Entitlement Management Message (Conditional Access related)
FFT	Fast Fourier Transform
FIB	Fast Information Block
FIC	Fast Information Channel
FIDC	Fast Information Data Channel
HF	High Frequency
HTML	Hyper Text Markup Language
HTTP	Hyper Text Transfer Protocol
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
MSC	Main Service Channel
PAD	Programme Associated Data
PLI	Parameter Length Indicator
Rfa	Reserved for future addition

NOTE: See TR 101 496-2 [9] (Guidelines DAB).

Rfu Reserved for future use

NOTE: See TR 101 496-2 [9].

UTC	Universal Time Co-ordinated
WIRC	WorldDAB Information and Registration Centre
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 solves

MOT is a transport protocol for the transmission of Multimedia content in broadcast channels to various receiver types with Multimedia capabilities.

Various possibilities for transmitting information are incorporated into a common transport mechanism for different DAB data channels, so that the access to Multimedia content is unified within the DAB system.

MOT ensures interoperability between:

- different data services and user application types;
- different receiver device types and targets;
- equipment from different manufacturers.

Each data service has an associated user application specification, and that specification includes the transport mechanisms for the data content. If the user application uses files of information then these are best transported using the MOT protocol layered onto the DAB transport mechanisms for packet mode and X-PAD.

The MOT protocol allows objects of a finite length from an information source, i.e. the content/service provider to be conveyed to a destination, i.e. the terminal, as shown in figure 1, where in terms of MOT:

The Content/Service provider is capable of processing various types of Multimedia content (e.g. picture and text files) in an appropriate way, so that this data is compliant with the MOT specification and can be fed into a DAB Ensemble multiplexer;

The Terminal is fed from an MOT decoder capable of processing the multimedia content of a DAB Ensemble in an appropriate way, so that it is:

- decoded and presented to the user; or
- forwarded to a following entity, which then processes the content.

The definition of interfaces between the different entities is not within the scope of the MOT specification.

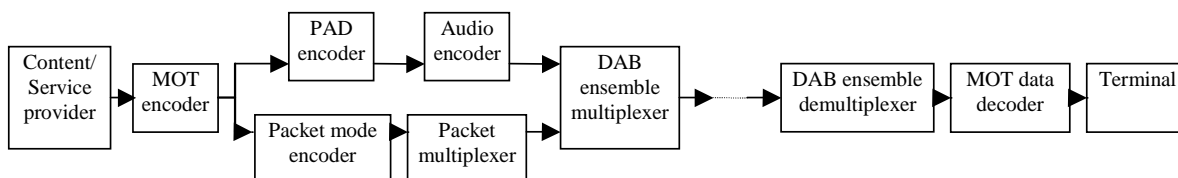


Figure 1: Overview of MOT encoding and decoding

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, and ultimately to the user.

In addition to the Multimedia transport the MOT protocol also supports handling of the Multimedia objects (e.g. object identification or object management on receiver side) and provides additional information that can support a user application.

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 user application.

The structure of the Multimedia content is user application specific and not subject to standardization within the present document.

4.3 Receiver architecture reference model

An example decoding process for MOT objects is shown in figure 2 (data flow top-down).

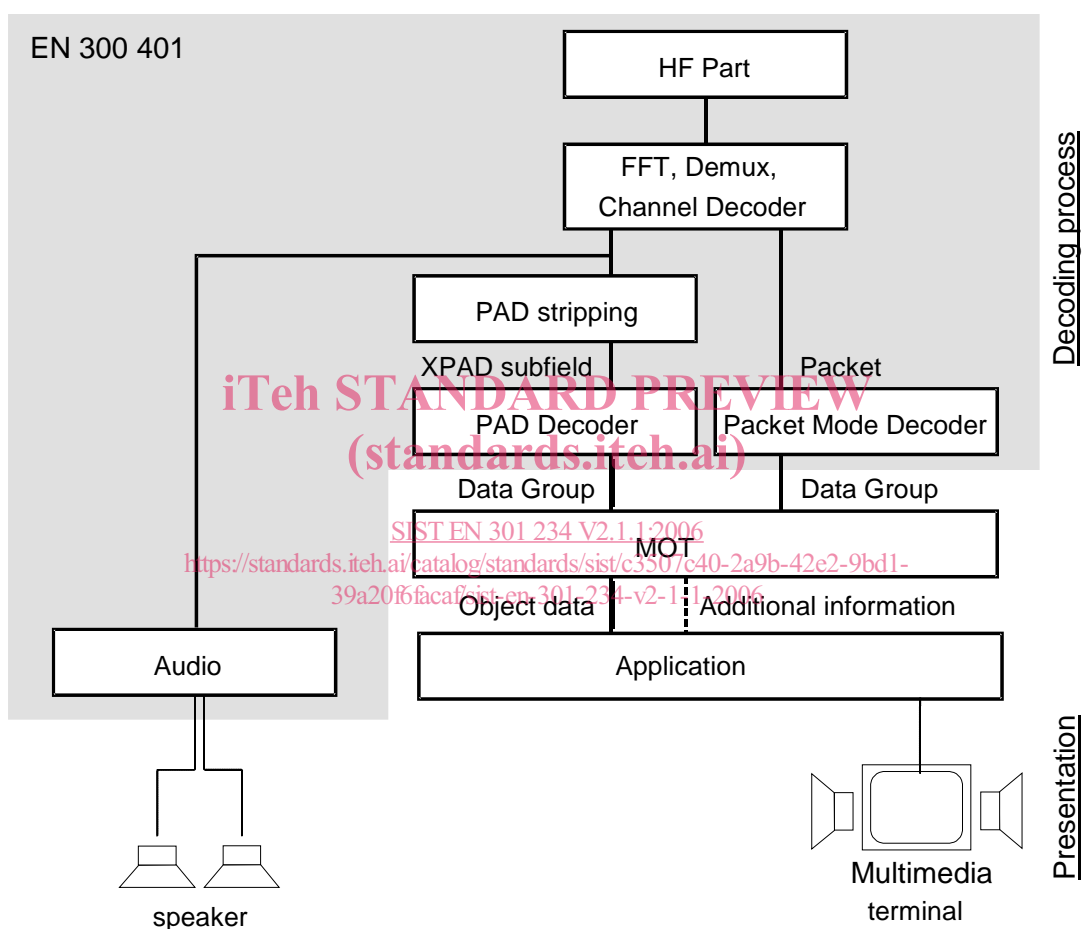


Figure 2: Example scheme for the data decoding part of a DAB receiver

Parts within the grey background (HF part, FFT/demux/channel decoder, PAD stripping, PAD decoder, packet mode decoder and audio decoder) are defined in EN 300 401 [1]).

Interface to the MOT decoder: Communication between PAD/packet mode decoder and MOT decoder uses complete MSC data groups (see EN 300 401 [1]). The session header of a data group cannot be omitted, although it is optional in the DAB specification, since it carries the *TransportId*, which is necessary to reassemble the MOT objects.

Additional information: Additional information is carried in the MOT header information. It is decoded by the MOT decoder and forwarded to the user application decoder.

Object data: Object data is carried in the MOT body.