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Digital Audio Broadcasting (DAB); Guide to DAB standards; Guidelines and Bibliography

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Foreword

This Technical Report (TR) 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 (note 2) which now has world-wide 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.

1 Scope

The present document provides brief explanations about the many different standards and guidelines for Digital Audio Broadcasting (DAB), what they cover and how they interrelate. The so-called "main DAB standard" EN 300 401 [1] is explained first and the remaining documents are grouped into standards/documents related to DAB-receivers, DAB-networks along with transmitters and data transmission via DAB. Finally a brief overview of general literature about DAB is also given.

2 References

For the purposes of this Technical Report (TR), the following references apply:

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

[2] ETSI TR 101 496 (all parts): "Digital Audio Broadcasting (DAB); Guidelines and rules for implementation and operation".

[3] ETSI TS 101 756: "Digital Audio Broadcasting (DAB); Registered Tables".

[4] CENELEC EN 50248: "Characteristics of DAB receivers".

[5] EACEM TR-004: "Application of the EMC Directive 89/336/EEC for Digital Audio Broadcast receivers".

[6] CENELEC EN 50255: "Digital Audio Broadcasting system - Specification of the Receiver Data Interface (RDI)".

[7] CENELEC EN 50320: "Digital audio broadcasting system - Specification of the DAB command set for receivers (DCSR)".

[8] ETSI EN 300 797: "Digital Audio Broadcasting (DAB); Distribution interfaces; Service Transport Interface (STI)".

[9] ETSI EN 300 798: "Digital Audio Broadcasting (DAB); Distribution interfaces; Digital baseband In-phase and Quadrature (DIQ) interface".

[10] ETSI ETS 300 799: "Digital Audio Broadcasting (DAB); Distribution interfaces; Ensemble Transport Interface (ETI)".

[11] Eureka Project 147: "MINIMUM requirements for Terrestrial DAB Transmitters".

[12] EBU BPN 003: "Technical Bases for T-DAB services network planning and compatibility with existing Broadcasting Services".

[13] ETSI EN 301 234: "Digital Audio Broadcasting (DAB); Multimedia Object Transfer (MOT) protocol".

[14] ETSI TS 101 497: "Digital Audio Broadcasting (DAB); Rules of Operation for the Multimedia Object Transfer Protocol".

[15] ETSI ES 201 735: "Digital Audio Broadcasting (DAB); Internet Protocol (IP) Datagram Tunnelling".

[16] ETSI ES 201 736: "Digital Audio Broadcasting (DAB); Network Independent Protocols for Interactive Services".

[17] ETSI ES 201 737: "Digital Audio Broadcasting (DAB); Interaction channel through Global System for Mobile communications (GSM) the Public switched Telecommunications System (PSTN); Integrated Services Digital Network (ISDN) and Digital Enhanced Cordless Telecommunications (DECT)".

[18] ETSI EN 301 700: "Digital Audio Broadcasting (DAB); VHF/FM Broadcasting: cross-referencing to simulcast DAB services by RDS-ODA 147".

[19] 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".

[20] ETSI TS 101 498 (all parts): "Digital Audio Broadcasting (DAB); Broadcast Website".

[21] ETSI TS 101 499: "Digital Audio Broadcasting (DAB); MOT Slide Show; User Application Specification".

[22] ETSI TS 101 759: "Digital Audio Broadcasting (DAB); Data Broadcasting - Transparent Data Channel (TDC)".

[23] ETSI TR 101 758: "Digital Audio Broadcasting (DAB); Signal strengths and receiver parameters; Targets for typical operation".

[24] ETSI TS 102 367: "Digital Audio Broadcasting (DAB); Conditional Access".

[25] ETSI TS 101 757: "Digital Audio Broadcasting (DAB) Conformance testing for DAB Audio".

[26] ISO 13818-3: "Information technology - Generic coding of moving pictures and associated audio information - Part 3: Audio".

[27] CENELEC EN 55013: "Sound and television broadcast receivers and associated equipment - Radio disturbance characteristics - Limits and methods of measurement".

[28] CENELEC EN 55020 (2002): "Sound and television broadcast receivers and associated equipment - Immunity characteristics - Limits and methods of measurement".

[29] ETSI TS 101 860: "Digital Audio Broadcasting (DAB); Distribution interfaces; Service Transport Interface (STI); STI Levels".

[30] ETSI TS 101 993: "Digital Audio Broadcasting (DAB); A Virtual Machine for DAB: DAB Java Specification".

[31] ETSI TS 102 818: "Digital Audio Broadcasting (DAB); XML Specification for DAB Electronic Programme Guide (EPG)".

[32] ETSI TS 102 371: "Digital Audio Broadcasting (DAB); Transportation and Binary Encoding Specification for DAB Electronic Programme Guide (EPG)".

[33] ETSI TS 102 368: "Digital Audio Broadcasting (DAB); DAB - TMC (Traffic Message Channel)".

[34] ETSI EN 302 077 (all parts): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Transmitting equipment for the Terrestrial - Digital Audio Broadcasting (T-DAB) service".

[35] Directive 1999/5/EC of the European Parliament and of the Council of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity (R&TTE Directive).

[36] ETSI TS 102 427: "Digital Audio Broadcasting (DAB); Data Broadcasting - MPEG-2 TS streaming".

[37] ETSI TS 102 428: " Digital Audio Broadcasting (DAB); DMB video service; User Application Specification".

3 Abbreviations

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

API	Application Programming Interface
DAB	Digital Audio Broadcasting
DECT	Digital Enhanced Cordless Telecommunications
EACEM	European Association of Consumer Electronics Manufacturers
EBU	European Broadcasting Union
EMC	Electro Magnetic Compatibility
EPG	Electronic Programme Guide
ETI	Ensemble Transport Interface
FIDC	Fast Information Data Channel
FM	Frequency Modulation
GHz	Giga (10^9) Hertz
GSM	Global System for Mobile communication
HTML	Hyper Text Markup Language
HuMIDAB	Human Machine Interfaces for DAB
IP	Internet Protocol
ISDN	Integrated Services Digital Network
LI	Logical Interface
Mbit/s	Mega (10^6) bits per second
MFN	Multiple Frequency Network
MHEG	Multimedia and Hypermedia information coding Experts Group
MHz	Mega (10^6) Hertz
MOT	Multimedia Object Transfer
OFDM	Orthogonal Frequency Division Multiplexing
PSTN	Public Switched Telecommunications System
RDI	Receiver Data Interface
RDS	Radio Data System
RF	Radio Frequency
SFN	Single Frequency Network
STI	Service Transport Interface
T-DAB	Terrestrial DAB

4 DAB system standards and guidelines

4.1 EN 300 401

EN 300 401 [1] is the so-called "main DAB" standard. It describes 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 frequency bands from 30 MHz to 3 GHz. The DAB system is designed to provide spectrum and power efficient techniques in terrestrial transmitter network planning, known as the Single Frequency Network (SFN). The DAB system is suitable for satellite as well as hybrid/mixed terrestrial/satellite broadcasting.

EN 300 401 [1] 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. EN 300 401 [1] 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.
EN 300 401 [1] 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.

4.2 TR 101 496

TR 101 496 [2] is the main guideline document, developed by the Eureka Project 147, as the major companion document to EN 300 401 [1]. Originally TR 101 496 [2] was developed in three volumes, covering: Outline and Features; Broadcast Network; and System Features, giving considerable detail and explanations to help to implement DAB systems and develop conformant equipment. It is now a single Technical Specification document, in three parts.

4.3 TS 101 756

TS 101 756 [3] contains the current tables for use in the implementation of the Digital Audio Broadcasting (DAB), system as given in the "main DAB standard" EN 300 401 [1] and the MOT standard EN 301 234 [13]. The complete up-to-date set of values is always given in the "Registered tables" document (TS 101 756 [3]).

The tables in TS 101 756 [3] are maintained by the WorldDAB Information and Registration Centre (WorldDAB IRC). They apply an easy procedure for registering new values, to ensure that they may be used without the need to change the so-called "main DAB standard" EN 300 401 [1] and the MOT standard EN 301 234 [13]. The procedure for registering a new value in an existing table or the registration of a new table is described in clause 4 of TS 101 756 [3].

Additionally there are two annexes containing translations of Programme Type Codes and Announcement Type Codes.

4.4 TS 102 367

TS 102 367 [24] describes the conditional access system for DAB. It allows for scrambling to be applied to stream mode audio, stream mode data, packet mode data and FIDC service components. The document specifies the framework for signalling and various configurations of content and access control data.

4.5 TS 101 757

TS 101 757 [25] specifies a test procedure and defines test bitstreams which can be used to verify whether bitstreams and decoders meet the requirements as specified in EN 300 401 [1]. These tests can be used for various purposes such as:

- manufacturers of encoders, and their customers, can use the tests to verify whether the encoder produces valid bitstreams;
- manufacturers of decoders and their customers can use the tests to verify whether the decoder meets the requirements specified in EN 300 401 [1] for the claimed decoder capabilities.

4.6 EN 301 700

EN 301 700 [18] describes a standard method for signalling DAB service information to a receiver tuned to a FM-RDS service. The RDS Open Data Application (RDS-ODA) system which is used is specified in the so called "main RDS standard" (ES 201 737 [17]).

Since some DAB services are simulcasts of existing FM services, usually with RDS, it is possible for receivers able to receive both DAB and FM services to present the listener with the DAB service, but it can fall back to the FM service outside the DAB coverage area. DAB provides the signalling, through the service following information in the Fast Information Channel, to enable a receiver to find the equivalent service on FM. EN 301 700 [18] describes the characteristics of an RDS-ODA for providing frequency information for DAB ensembles. Additionally the ODA can signal various Service Information attributes of DAB services thus allowing a receiver to find an equivalent DAB service.

5 DAB receiver standards and documents

5.1 General

This clause describes a set of standards and recommendations which have evolved over the years to supplement the "main DAB standard" EN 300 401 [1] covering the implementation of DAB receivers. EN 50248 [4] describes characteristics of DAB receivers and EACEM TR-004 [5] identifies the EMC parameters for DAB receivers. EN 50255 [6] (RDI) specifies the interface between DAB receivers and additional data decoders and EN 50320 [7] defines the DAB command set for receivers. TR 101 758 [23] contains general field strength and sensitivity considerations for a DAB system.

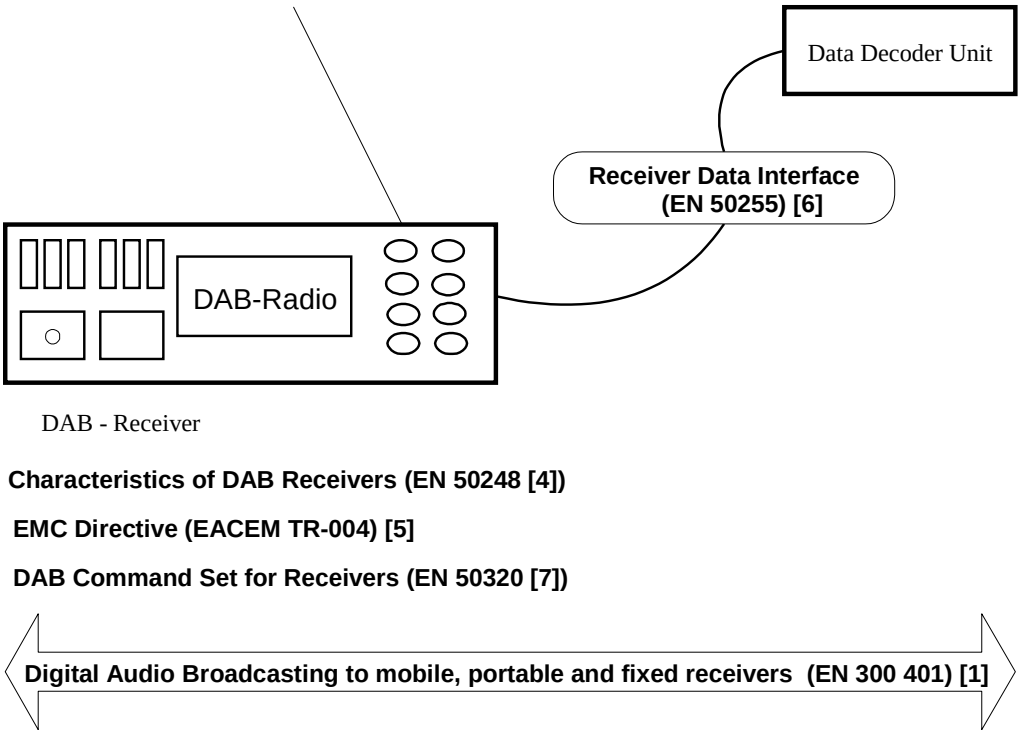

Figure 1: Conceptual DAB receiver showing related standards

5.2 EN 50248

EN 50248 [4] describes DAB receiver characteristics for consumer equipment intended for terrestrial and cable reception operating in Band III and L-Band and for satellite reception in L-Band. Topics such as basic implementation and functional performance requirements, interfaces, recommended centre frequencies for DAB receivers and reference performance levels and measuring methods are covered in EN 50248 [4]. Dedicated receivers for specific applications are not within the scope of EN 50248 [4].

5.3 EACEM TR-004

EACEM TR-004 [5] identifies specific references, requirements, methods and test conditions for EMC tests for DAB receivers. TR-004 [5] is intended to form the basis for future discussion and EACEM's objective is to either amend or redraft current available standards EN 55013 [27] and EN 55020 [28] to include DAB.

5.4 EN 50255

EN 50255 [6] describes an interface between the DAB receiver and data decoders. The maximum DAB data rate of 1,8432 Mbit/s as well as data for receiver control and information on the received transmitters of the SFN can be carried via the RDI. The source for the data to be carried on the Receiver Data Interface is the output bit stream of the channel decoder of a DAB receiver. Dedicated decoders for data applications, computers, etc., but also devices for audio post processing and recording can be connected to the DAB receiver through this interface.

The RDI specification is independent of any physical interfaces and interfaces commonly used in consumer electronics are supported. The use of RDI allows connection of several decoders to a single receiver and it is possible to implement a return channel for receiver control from an application terminal.

5.5 EN 50320

EN 50320 [7] describes a command set which allows to control DAB receivers. The command set is intended for use on different physical bus systems.

5.6 TR 101 758

TR 101 758 [23] describes the general principles for deriving the necessary field strength and compatible receiver sensitivity for satisfactory operation of a DAB system.

6 DAB transmission and network standards and documents

6.1 General

A set of standards and recommendations have evolved over the years to supplement the "main DAB standard" EN 300 401 [1] covering implementation of the requisite broadcast networking interfaces. EN 300 797 [8] describes the Service Transport Interface, EN 300 798 [9] describes the digital baseband in-phase and quadrature interface and ETS 300 799 [10] describes the Ensemble Transport Interface.

The Eureka Project 147 document "Minimum Transmitter Requirements" recommends a minimum set of requirements for terrestrial DAB transmitters and the EBU document BPN 003 [12] may serve as a basis for DAB network planning.

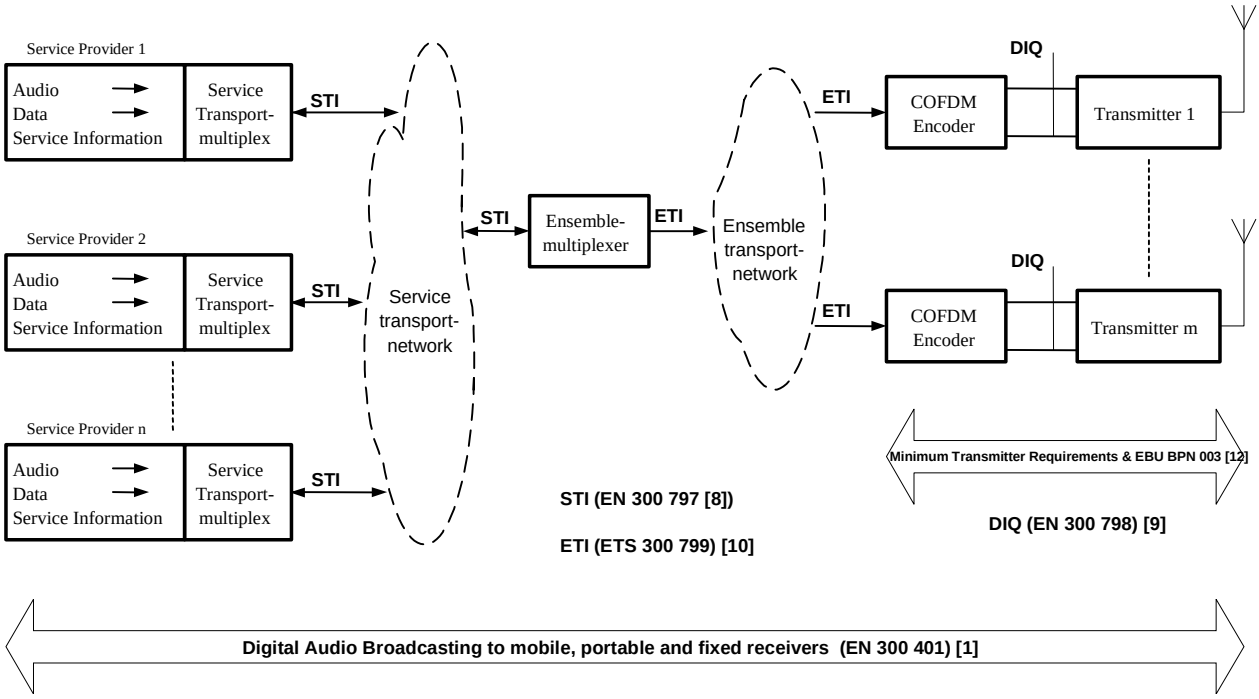

Figure 2: Conceptual DAB transmission network and related standards

6.2 EN 300 797

EN 300 797 [8] has been defined to provide a standardized way of transporting DAB service components, service information and control information in a DAB collection network. The collection network connects the studios of the various Service providers to the Ensemble provider's ensemble multiplexer.

The STI consists of two parts: the data part, STI-D, which carries data intended for broadcast, and the control part, STI-C, which carries data for control and monitoring purposes and is not intended for broadcast. STI-D is unidirectional in nature, whereas STI-C is bidirectional in nature. EN 300 797 [8] specifies first the logical interface for STI-D and STI-C, and then defines various physical implementations for them.

The STI interface is suitable for use on a number of different physical media and telecommunication networks. Provision is made for the inclusion of appropriate error detection and correction and for the management of network transit delay.

6.2.1 TS 101 860

TS 101 860 [29] has been defined to establish guidance in implementation and usage of the functionality described in the STI standard EN 300 797 [8]. Subsets of the STI standard are defined in order to make interoperable solutions possible for different suppliers of STI devices. The subsets are called STI Levels. Interoperability is ensured if the STI Logical Interface (LI) and STI Physical Interfaces (STI-PI, X) are the same for entities transporting DAB Service Components, Service Information and control messages in a DAB collection network.

6.3 EN 300 798

EN 300 798 [9] is applicable to DAB channel coding equipment typically located at each of the transmitter sites in a DAB SFN. The norm describes the characteristics of a suitable interface for the connection of the two major elements of the DAB OFDM generator; the baseband processing equipment and the RF modulator. The interface provides an interconnection between a single source (the baseband processor) and a single destination (the RF modulator). The standard does not cover the generation of the digital I/Q baseband signals since this is covered in EN 300 401 [1].

The digital baseband I/Q interface is unidirectional and does not cover the provision of status nor control information in the reverse direction (i.e. from the modulator back to the baseband processing section of the equipment).

6.4 ETS 300 799

ETS 300 799 [10] establishes a method for the distribution of DAB signals between the ensemble multiplexer, and DAB modulation equipment located at the different transmission sites of an SFN. The data flow of the ETI is unidirectional by nature and the standard specifies first the logical interface the ETI, and then defines various physical implementations for it.

The interface is suitable for use on a number of different physical media including standard 2 Mbit/s switched telecommunication networks. Provision is made for the inclusion of appropriate error detection and correction and for the management of network transit delay. Limited capacity is also made available for signalling from the ensemble multiplexer to other equipment in the distribution network. ETS 300 799 [10] does not cover the provision of status nor control information in the reverse direction (i.e. from transmitters back to the Ensemble provider).

6.5 Minimum Transmitter Requirements

This Eureka Project 147 document [11] recommends a minimum set of requirements for terrestrial DAB transmitters according to EN 300 401 [1]. A transmitter comprises all the functions of a chain starting with the input of an ETI signal and ending with the power output of the DAB signal (including power filter if applicable). Retransmitters receiving RF DAB signals are not under the scope of the document. Required performance, minimum functionality as well as control and monitoring of transmitters in a Single Frequency Network (SFN) or Multiple Frequency Network (MFN) are considered in the document.

The antenna system is not subject to this recommendation, as the local situation may often require individual solutions. However, it is assumed that the deviations of the radiated signal from the power-amplified signal can be derived by taking into account the properties of the antenna system.

In accordance with the R&TTE directive , EN 302 077 [34] has been produced regarding the transmitting equipment for terrestrial DAB. It is a centralized didactic collaboration intended to cover the provisions of article 3.2 of Directive 1999/5/EC [35] (R&TTE Directive), which states that "… radio equipment shall be so constructed that it effectively uses the spectrum allocated to terrestrial/space radio communications and orbital resources so as to avoid harmful interference".

6.6 EBU BPN 003

This EBU document, BPN 003 [12], considers network concepts and the main parameters to be taken into account for planning of terrestrial DAB (T-DAB) networks. Parameters such as re-use and separation distances for various SFN and single transmitter configurations, SFN gain and minimum wanted field strength are covered in BPN 003 [12].

Protection ratios for T-DAB emissions interfered with by television or VHF/FM sound broadcasting emissions and vice versa are also given in the document as well as co-ordination parameters for networks.

7 Additional DAB standards and documents for data transmission

7.1 General

The Multimedia Object Transfer (MOT) standard and its associated Rules of Operation allow broadcasting of data via DAB in a very convenient way. Two DAB data applications are described in the documents entitled "Broadcast Web Site Application" and "Slide Show Application". How to deliver data transparently in the DAB system is described in TS 101 759 [22].

DAB is by definition ideally suited for mobile applications. However, in today's information society, a mobile Internet is being asked for and a combination of DAB as high bitrate downlink and already existing low bitrate communication technologies as return path can achieve this goal. Three further specifications were therefore developed by the Eureka Project 147 specifying: "DAB; IP Datagram Tunnelling", "DAB; Network Independent Protocols for Interactive Services" and "DAB; Interaction Channel through GSM/PSTN/ISDN/DECT". They are the answer to the above requirement and show that DAB is very well suited for mobile Internet applications.

Additional applications have also been defined for an Electronic Programme Guide (EPG) and a universal platform using Java.

7.2 EN 301 234

EN 301 234 [13] describes the MOT protocol which allows broadcasting of various kinds of data using the DAB system. It is tailored to the needs of Multimedia services and the specific constraints given by the broadcasting characteristics of the DAB system. MOT ensures interoperability between different data services and application types as well as equipment form different manufacturers.

EN 301 234 [13] 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) or Multimedia and Hypermedia information coding Experts Group (MHEG ISO).

7.3 TR 101 497

This document provides guidance on the use of V1.x.x of the MOT specification [13]. It is not relevant to V2.1.1 and later versions of the MOT specification [13].

7.4 TS 101 498

TS 101 498 [20] describes the DAB Broadcast Web Site application which gives the opportunity to use HTML as a content format to support information services. This concept allows a service provider to deliver an entire web site to a receiver using only the broadcast channel of DAB and without the need for any form of return channel.

7.5 TS 101 499

TS 101 499 [21] describes the techniques required to deliver a sequence of slides which carry information in the form of images. The main use for this user application will be in context with a programme service component. Examples are: news programme items complemented by photos from the reported events and programme items with popular songs accompanied by photographs of the performers or the covers of their issued CDs. Once activated the Slide Show Application is service provider driven and does not require any interaction from the end-user of the corresponding service component. Each slide appears automatically on the display and will be replaced under the control of the service provider according to the needs of his service.

7.6 TS 101 759

TS 101 759 [22], developed by the Eureka Project 147, describes the techniques required to deliver data transparently within a DAB transmission, where the data concerned does not need to be related to any other parameters of the particular bearer DAB transmission.

7.7 ES 201 735

ES 201 735 [15], developed by the Eureka Project 147, describes how to transport Internet Protocol (IP) datagrams in a Digital Audio Broadcasting (DAB) packet mode service component, a technique described as "IP tunnelling".

The use of IP tunnelling provides DAB with a mechanism for the adaptation of Internet services to DAB and is also a key component for DAB services using two-way interaction with personal DAB. The use of IP tunnelling enables the use of IP as a common network layer protocol, end-to-end, for DAB data services. IP tunnelling through DAB is unidirectional. The tunnel is created from the packet mode encoder on the transmitting side, to the packet mode decoder on the receiving side, of the DAB system.

7.8 ES 201 736

ES 201 736 [16], developed by the Eureka Project 147, describes the protocol stacks to be used for the different types of services that are defined, as local interactive, one-way interactive and two-way interactive service. The specification also defines a protocol PSSC (Personal DAB Service Session Control) which allows the set up of personal DAB service sessions and functionalities like handover between DAB cells, etc. It also defines the message format to be used and allows for further future extensions.

7.9 ES 201 737

ES 201 737 [17], developed by the Eureka Project 147, describes the Interaction Channels through Global System for Mobile communication (GSM), the Public Switched Telecommunications System (PSTN), Integrated Services Digital Network (ISDN), Digital Enhanced Cordless Telecommunications (DECT). It describes low level network management and basically references relevant telecommunication standards and describes how the implementation of low level interaction is handled.

7.10 TS 101 993

TS 101 993 [30] specifies a DAB related API for Java. This API enables the download of Java programs via DAB and the control of their execution. Additionally, it provides an interface to the functionality of DAB.

A DAB extension to the Java API has been designed to provide the software framework for designing, implementing and executing portable applications specifically targeted to the DAB system.

The DAB Java Framework is divided in three basics modules or packages: a DAB specific extension of the Java API, a runtime support for the DAB applications execution environment, and a DAB I/O package for signalling the DAB Java extension over the DAB signal.

7.11 TS 102 818

TS 102 818 [31] defines the XML schema data model for an Electronic Programme Guide (EPG) for Digital Audio Broadcasting (DAB). It is envisaged that this data format could be used both for transmitting schedule data to EPG applications on receivers and as the basis for exchanging information between broadcasters, network operators and content providers.

7.12 TS 102 371

TS 102 371 [32] describes the techniques required to compress the EPG data within a DAB transmission channel to reduce transmitted bit-rate and to profile the data for a range of different receiver capabilities.

7.13 TS 102 368

TS 102 368 [33], developed by the TMC Forum in collaboration with the WorldDAB Forum, describes the mapping required to deliver TMC data via DAB transmission.

7.14 TS 102 427

TS 102 427 [36] specifies how MPEG-2 Transport Stream can be encapsulated within a DAB MSC stream data sub-channel including additional error protection. The error protection mechanism is composed of a Reed-Solomon coder and an interleaver.

7.15 TS 102 428

TS 102 428 [37] specifies the user application for video services carried via DAB. It also includes profile definitions for the application. It defines the components of the video services; the content compression, the synchronization mechanism and multiplexing mechanism, allowing video services to be delivered to suitably equipped terminals.

Annex A:
DAB Bibliography

The cited references may be considered as a starting point for the interested reader to find more useful information on many different aspects of DAB.

A.1 General descriptions on DAB topics

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A.2 Some documents related to DAB

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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).

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

ITU-R Recommendation BS.774 (March 1994): "Digital sound broadcasting to vehicular, portable and fixed receivers using terrestrial transmitters in the VHF/UHF bands".

ITU-R Recommendation BO.789 (March 1994): "Digital sound broadcasting to vehicular, portable and fixed receivers for BSS (sound) in the frequency range 500 - 3 000 MHz".

A.3 Some papers on Audio Coding

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