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Information technology — Multimedia application format (MPEG-A) —

Part 9:
Digital Multimedia Broadcasting application format

AMENDMENT 1: Conformance and reference software

Technologies de l'information — Format pour application multimédia (MPEG-A) —

Partie 9: Format pour application de diffusion générale multimédia numérique

AMENDEMENT 1: Logiciel de référence et conformité

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Amendment 1 to ISO/IEC 23000-9:2008 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 29, *Coding of audio, picture, multimedia and hypermedia information*.

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Page 33, after Table 7

Add the following two new clauses.

8 Conformance

8.1 Introduction

This Clause describes the conformance suite for the DMB-AF standard. The purpose of the conformance suite is to cover the valid features that may be exercised in terms of storage and playback of various DMB contents.

The conformance suite has several aspects: file conformance, player conformance, and creator conformance. Each conformance is defined in the subsequent Subclauses.

Several conformance files are also provided as associated files with this standard. By using the conformance files together with the reference software, most major features of DMB-AF can be exercised and checked.

8.2 File conformance

8.2.1 File conformance in general

A file conforms to a brand of DMB-AF when the following conditions are all satisfied;

- Brand consistency: the major_brand field of 'ftyp' box matches the declared brand name.
- File format conformance: the structure and syntax of the boxes included in the file conform to the box types and structure defined in Table 3 of 6.1.
- Component consistency: all the components contained in the file can be found in the brand entry of Table 5, Table 6, or Table 7 in Clause 7.
- Component conformance: each component in the file such as a media stream or an xml document conforms to the corresponding specification and restrictions listed in Table 1. In addition, the conditions defined in 8.2.2 to 8.2.9 are also satisfied.

When a file conforms to a brand of DMB-AF, the file can be called as DMB-AF file.

8.2.2   DAB and DAB+ stream storage

8.2.2.1   Introduction

DAB (ETSI EN 300 401) audio service is provided by using MPEG Audio Layer II compression and the fixed-length encapsulation of the compressed audio into "DAB audio frames". DAB audio frames may include associated auxiliary data called PAD (Program-Associated Data). The PAD area is composed of a fixed-length PAD (F-PAD) and a variable-length PAD (X-PAD). Through the X-PAD area, auxiliary data associated with the audio can be delivered in a synchronous or in an asynchronous fashion. Representative of such associated services are DLS (Dynamic Label Service) and SLS (Slide Show Service). A dynamic label in DLS delivers a short text message informing the station name, the title and/or singer's name of the on-air music, any message related or not related to the main audio service, etc. Some still images or a sequence of still images can be delivered through the slide show service. Those images can be related to the main audio service such as album cover of the on-air music. Similarly the images can be the ones that are not related to the main audio service. Synchronization between the main audio and the dynamic label and/or the slides is naturally achieved since these auxiliary data is placed at the end of each audio frames that include the compressed audio to which the data is to be synchronized, i.e., to be played together.

DAB+ (ETSI TS 102 563) is an enhanced audio service more efficient than DAB. By using MPEG-4 Audio HE-AAC v2 instead of MPEG Audio Layer II, DAB+ can achieve more bitrate-efficient audio compression. In DAB+, five consecutive DAB audio frames are grouped to hold one DAB+ audio super frame which includes multiple (2 to 6) HE-AAC v2 audio access units (AUs).The particular number of AUs depends on the sampling frequency and the use of SBR (Spectral Band Replication). The auxiliary data encoded as the same way as the PAD of DAB may be included in the first part of each AU. The DLS and SLS can be provided in DAB+ through the auxiliary data area. For DAB+ streams, it is assumed that the decoding of parity bytes due to the Reed-Solomon code is performed with possible corrections before the storage and only the resulting sequence of DAB+ audio super frame data stream is stored within a DMB-AF file.

8.2.2.2   Sample format and random-access points

Sample definitions are determined according to the existence of `stss` (sync sample table) box. In case `stss` is absent, which means every samples are random-accessible, a sample is defined as an integral multiple of consecutive DAB audio frames or DAB+ audio super frames. In case `stss` box exists, then the whole DAB audio frame stream or the whole DAB+ audio super frame stream shall be treated as a single sample. In this case, the `entry_count` in the `stss` box shall take the value of 0, which means that the sync sample positions are unknown.

8.2.2.3   Sample description format

8.2.2.3.1   Syntax

```
class DABSampleEntry() extends HintSampleEntry(name) {
   uint(16)  hinttrackversion = 1;
   uint(16)  highestcompatibleversion = 1;
   uint(8)   pad_type;
  if (name == rdap) {
   uint(16)  audio_super_frame_size;
  }
}
```

8.2.2.3.2   Semantics

`name` is either 'rdab' or 'rdap'. In case of 'rdab', the stored samples are DAB audio frames. In case of 'rdap', the stored samples are DAB+ audio super frames.
`hinttrackversion` is currently 1; the `highestcompatibleversion` field specifies the oldest version with which this track is backward-compatible.
`pad_type` indicates the existence of PAD in the DAB audio frame stream or the DAB+ audio super-frame stream. The following values are defined for `pad_type`:
          '0x00' : PAD type unknown. PAD may or may not exist in the stream.

'0x01' : Only MOT-SLIDE data exists in the stream.
'0x02' : Only DLS data exists in the samples.
'0x03' : Both MOT-SLIDE and DLS data exists in the samples.
'0x04'~'0xFF' : reserved for future use.

`audio_super_frame_size` represents the DAB+ audio super frame size in bytes. For details, refer to ETSI TS 102 563.

8.2.3 T-DMB TS storage

The MPEG-4 SL (Synchronization Layer) over MPEG-2 TS (Transport Stream) structure is used in T-DMB TS. The T-DMB TS is directly stored within a DMB-AF file. It is assumed that the decoding of 16 parity bytes due to the Reed-Solomon code RS(204, 188) is performed with possible corrections before the storage and only the resulting sequence of 188-byte MPEG-2 TS packets are stored within a DMB-AF file. The details of the storage format are specified in 6.5 of this Part of ISO/IEC 23000.

8.2.4 S-DMB TS storage

The MPEG-4 SL (Synchronization Layer) over MPEG-2 TS (Transport Stream) structure may or may not be used in S-DMB TS. The S-DMB TS is directly stored within a DMB-AF file similarly to the T-DMB TS case. It is assumed that the decoding of 16 parity bytes in the Reed-Solomon code RS(204, 188) is performed with possible corrections before the storage and only the resulting sequence of 188-byte MPEG-2 TS packets are stored within a DMB-AF file. The details of the storage format are specified in 6.5 of this Part of ISO/IEC 23000.

8.2.5 MPEG-4 media storage

8.2.5.1 Introduction

Among the MPEG-4 media that the DMB-AF supports are ER-BSAC, HE-AAC2, AVC, AAC+SBR, and BIFS. When BIFS is used for interactive data contents, JPEG or PNG may also be used. ER-BSAC compression specified in ISO/IEC 14496-3 is used without the error-resilience functionality. Also some additional restrictions shall apply according to ETSI TS 102 428. HE-AAC2 compression is used in T-DMB Profile 2 instead of ER-BSAC. It is also used in DAB+ instead of MPEG Audio Layer II. The further restrictions are specified in ETSI TS 102 428 for T-DMB Profile 2 and ETSI TS 102 563 for DAB+, respectively. AAC+SBR audio for S-DMB consists of MPEG-2 AAC LC Profile and MPEG-4 Audio SBR. Further restrictions on AAC+SBR are specified in TTAS.KO-07.0027.

The particular AVC profile and level used in this Part of ISO/IEC 23000 are Baseline Profile and Level 1.3. In addition, several restrictions shall apply according to ETSI TS 102 428.The particular BIFS scene description profile and level used in this specification are Core2D and Level 1, respectively. The particular BIFS graphics profile and level used in this specification are Core2D and Level 1, respectively. In addition, several restrictions shall apply according to ETSI TS 102 428.

Three different storage types are allowed in this specification:
- MPEG-2 TS encapsulated case
- Separate ES case without MPEG-4 Systems context
- Separate ES case with MPEG-4 Systems context

8.2.5.2 MPEG-2 TS encapsulated case

In this case, the MPEG-4 media are encapsulated by MPEG-2 TS. The same rule specified in 8.2.3 is applied.

8.2.5.3 Separate ES case without MPEG-4 Systems context

When a DMB-AF file only includes audio contents encoded by ER-BSAC, HE-AAC2, or AAC+SBR, a single track for each audio content is allocated. Each of the audio ESs is divided into audio samples. A single audio AU or a consecutive multiple audio AUs form a sample. The MP4AudioSampleEntry('mp4a') as specified in ISO/IEC 14496-14 is used for the description of the audio samples.

When a DMB-AF file includes an AVC video with an associated audio encoded with ER-BSAC, HE-AAC2, or AAC+SBR, two tracks are allocated: one for AVC video data and the other for the audio data. The AVC video ES is divided into video samples. The AVCSampleEntry('avc1') as specified in ISO/IEC 14496-15 is used for the description of the video samples. For the associated audio, the same rule as the previous paragraph applies.

8.2.5.4 Separate ES case with MPEG-4 Systems context

A video content can be accompanied by an associated interactive data content based on BIFS. Also an audio-centric content can be accompanied by an associated video and/or interactive data content based on BIFS. In these cases, the storage of the contents into a DMB-AF file requires MPEG-4 Systems context. The required data in the context of MPEG-4 Systems such as IOD, OD ES, and BIFS ES shall be stored together with the audio and video content in a DMB-AF file. According to ISO/IEC 14496-14, IOD is stored in 'iods' box, OD ES and BIFS ES are stored as separate tracks with MpegSampleEntry('mp4s'), AVC video ES and audio ES are stored as separate tracks with MP4VisualSampleEntry('mp4v') and MP4AudioSampleEntry('mp4a'), respectively.

8.2.6 Image storage (JPEG, PNG, MNG)

8.2.6.1 Introduction

Images can be stored as separate items as specified in ISO/IEC 14496-12.

8.2.6.2 Image item storage

Images can be stored as item if no time-synchronization is required. In this case, image items shall be registered by their own CRIDs in the TVA metadata in order that they can be browsed from a TVA browser. The CRIDs shall also be registered into 'crid' box in order for the DMB-AF player to correctly relate each CRID with the corresponding item_id and hence with the physical location in 'mdat' box.

8.2.6.3 Image track storage

Images can also be stored as track if a timely playback is required (e.g., slideshow). In this case, images are stored as media tracks.

8.2.7 3GPP Timed Text storage

3GPP timed text shall be stored as a text track with text sample entry 'tx3g'. The text samples stored in the 'mdat' box and the boxes describing the synchronization information of the text samples shall conform to 3GPP TS 26.245.

8.2.8 NPAD (Non-Program Associated Data) storage

8.2.8.1 Introduction

The DMB-AF specification enables storing NPAD contents as non-movie items. The information about the data is stored in the file format by its location and size inside the media data box. The NPAD contents should be extracted from the DMB-AF file and then executed by an external application or an application embedded in the DMB-AF player according to the NPAD content type.

8.2.8.2 BWS storage

For a BWS package, the information about the relative path of each resource of BWS contents is stored in the item information ('iinf') box of the DMB-AF file. Furthermore, the crid and item location information is also stored. The BWS contents to be stored in to DMB-AF file shall already be contained in a single directory that links to each other in the main web page file. When the DMB-AF player need to extract the BWS contents, it reads the registered list of BWS contents in the crid box, locates the physical file, and calls BWS browser to open the main web page file.

8.2.8.3 Java MIDlet storage

For a Java MIDlet package, the information about the relative path of the compressed package (in 'zip' format) of Java MIDlet contents is stored in the item information ('iinf') box, Furthermore, the crid and item location information. The Java MIDlet contents to be packaged into DMB-AF file shall be already compressed into a zip file. When the DMB-AF player needs to extract the Java MIDlet content, it reads the midlet information in crid box, locates the physical midlet data, unzip the midlet data and finally calls a midlet player to execute the midlet.

8.2.9 Metadata storage (DID, IPMP, REL, TVA)

Metadata stored inside a DMB-AF file shall be annotated according to the structure specified in this Subclause.

The metadata shall be encapsulated in form of MPEG-21 DID as the root container for other types of metadata allowed in this specification. The components of DMB-AF are annotated in the TV-Anytime metadata, therefore Item elements in the DID is not used, unless the components are protected and the protection is signaled using MPEG-21 IPMP as described below.

In the necessity to use the TV-Anytime metadata to annotate the content description, the metadata shall be annotated as Statement in a Descriptor element of MPEG-21 DID.

In the necessity to use the MPEG-21 IPMP to annotate the protection and governance of the components of DMB-AF, the IPMP General Info metadata shall be annotated as Statement in a Descriptor element of DID. The Descriptor/Statement for IPMP shall be different one that used for TV-Anytime metadata. If used, the IPMP DIDL metadata shall be annotated for all the components for which protection and governance are signaled by the IPMP. The protection tool used to protect the protected component is referred to IPMP General Info using IPMP DIDL Identifier. The protected component is referred to the physical location in file format via crid functionality, thus the reference annotated in the IPMP DIDL Contents shall be annotated as the component's crid identifier.

In the necessity to use the MPEG-21 REL to annotate the license information of the components of DMB-AF, the REL metadata shall be annotated according to the existence of MPEG-21 IPMP within the MPEG-21 DID structure. If MPEG-21 IPMP is exist, the REL metadata shall be annotated as License in IPMPInfo License Collection. Otherwise, the REL metadata shall be annotated as Statement in a Descriptor element different to that of TV-Anytime metadata.

Definition of namespaces for different types of metadata can be defined in the DIDL root element of MPEG-21 DID or can be defined separately in each of metadata type root element. It is encouraged to validate the metadata to be stored in the DMB-AF against the schema prior to be added to the DMB-AF.

Figure 16 illustrates the structure of metadata.

```
MPEG-21 DID

<DIDL {xml namespaces}>
<Container>
<Descriptor>
<Statement>

    MPEG-21 IPMP

    <ipmpinfo:IPMPGeneralInfoDescriptor>
    <ipmpinfo:ToolList/>
    <ipmpinfo:LicenseCollection>
    <ipmpinfo:RightsDescriptor>
    <ipmpinfo:License>

        MPEG-21 REL

        <r:license {xml namespaces}>
        ...
        </r:license>

    </ipmpinfo:License>
    </ipmpinfo:RightsDescriptor>
    </ipmpinfo:LicenseCollection>
    </ipmpinfo:IPMPGeneralInfoDescriptor>

</Statement>
</Descriptor>
<Descriptor>
<Statement>

    TV-Anytime

    <dmb_meta:TVAMain {xml namespaces}>
    ...
    </dmb_meta:TVAMain>

</Statement>
</Descriptor>
<Item>
<Component>
<Resource>

    MPEG-21 IPMP

    <ipmpdidl:ProtectedAsset />
    <ipmpdidl:Identifier />
    <ipmpdidl:Contents ref="{crid_id}" />

</Resource>
</Item>
</Container>
</DIDL>
```
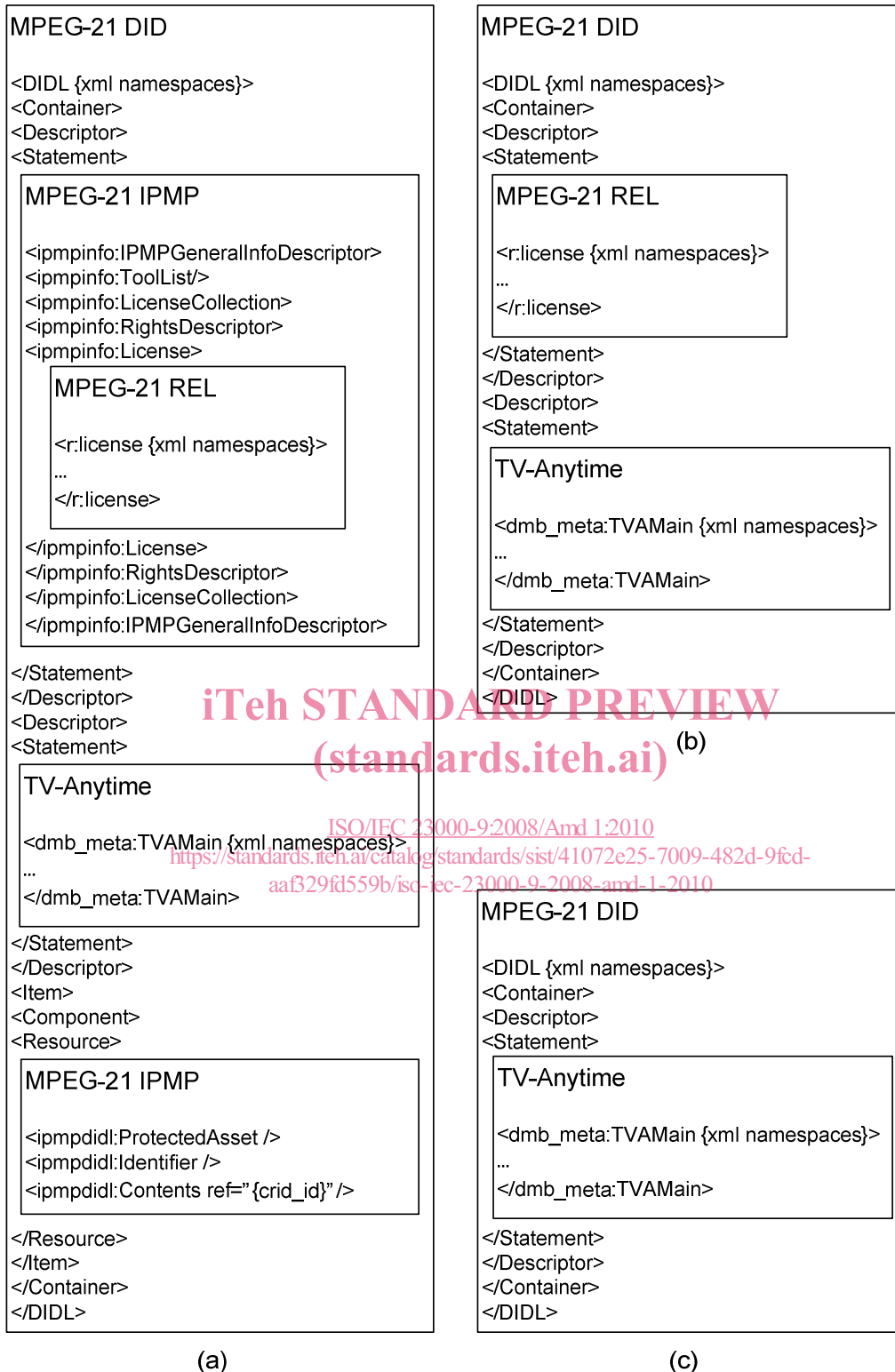
(a)

```
MPEG-21 DID

<DIDL {xml namespaces}>
<Container>
<Descriptor>
<Statement>

    MPEG-21 REL

    <r:license {xml namespaces}>
    ...
    </r:license>

</Statement>
</Descriptor>
<Descriptor>
<Statement>

    TV-Anytime

    <dmb_meta:TVAMain {xml namespaces}>
    ...
    </dmb_meta:TVAMain>

</Statement>
</Descriptor>
</Container>
</DIDL>
```

(b)

```
MPEG-21 DID

<DIDL {xml namespaces}>
<Container>
<Descriptor>
<Statement>

    TV-Anytime

    <dmb_meta:TVAMain {xml namespaces}>
    ...
    </dmb_meta:TVAMain>

</Statement>
</Descriptor>
</Container>
</DIDL>
```

(c)

Figure 16 — (a) Structure of DID metadata in the presence of IPMP, REL and TVA; (b) without the presence of IPMP; (c) only TVA

8.3 Player conformance

A file player conforms to a brand of DMB-AF when the following condition is satisfied;

- The player can correctly parse any file that conforms to the brand and can appropriately play all the components included in the file.

When a file player conforms to a brand of DMB-AF, the player can be called as a DMB-AF player.

8.4 Creator conformance

A file creator (or authoring tool) conforms to a brand of DMB-AF when the following condition is satisfied;

- The creator can produce files that conform to the brand.

When a file creator (or authoring tool) conforms to a brand of DMB-AF, the creator (or authoring tool) can be called as a DMB-AF creator (or authoring tool).

8.5 Conformance files

The following table describes about the conformance files associated to this standard:

File name		01_T-DMB-1_TS.dmb
Description		a music show program (T-DMB Profile 1) with descriptive metadata and caption text
Major brand		dv1b
Compatible brands		dmb1, dv1a
Components Inside the file	An MPEG-2 TS (containing ER-BSAC and AVC)	- stored as an 'm2ts' hint track
	A DID XML (containing TVA and REL)	- each image is stored as an item - a TVA for content description and segment information - a REL for defining a simple license
	14 JPEG images related to TVA	- a program title image - a segment group title image - 12 segment title images
	A 3GPP-TT stream	- caption text for the program

File name		02_T-DMB-1_AV.dmb
Description		the same as file '01'
Major brand		dv1b
Compatible brands		dmb1, dv1a, avc1, mp42
Components Inside the file	AVC, ER-BSAC	- each stream is stored as separate track - AVC as AVCSampleEntry('avc1') - ER-BSAC as MP4AudioSampleEntry('mp4a')
	A DID XML (containing TVA and REL)	- a TVA for content description and segment information - a REL for defining a simple license
	14 JPEG images related to TVA	- each image is stored as an item - a program title image - a segment group title image - 12 segment title images

File name		03_T-DMB-1_BIFS(TS).dmb
Description		a golf program with BIFS multiplexed in TS (T-DMB Profile 1)
Major brand		dv1a
Compatible brands		dmb1, dv1b
Components Inside the file	An MPEG-2 TS (containing ER-BSAC, AVC, OD, BIFS and JPEG images)	- stored as an 'm2ts' hint track

File name	04_T-DMB-1_BIFS(ES).dmb
Description	a golf program with BIFS in a separate track
Major brand	dv1a
Compatible brands	dmb1, dv1b, avc1, mp42

Components Inside the file	AVC, ER-BSAC, OD, BIFS and JPEG images	- each stream is stored as separate a track - AVC as MP4VisualSampleEntry('mp4v') - ER-BSAC as MP4AudioSampleEntry('mp4a') - IOD as ObjectDescriptorBox('iods') - OD as MpegSampleEntry('mp4s') - BIFS as MpegSampleEntry('mp4s') - JPEG as MP4VisualSampleEntry('mp4v')

File name	05_T-DMB-1_IPMP(TS).dmb	
Description	the same as file '01'	
Major brand	dv1b	
Compatible brands	dmb1	
Components Inside the file	An MPEG-2 TS (containing ER-BSAC and AVC)	- stored as an 'm2ts' hint track (the same TS as is in the conformance file 01). - the TS is encrypted with AES-128 CTR (key: "key1")
	A DID XML (containing TVA, REL and IPMP)	- a TVA for content description and segment information (the same TVA as is in the conformance file 01) - an REL for defining a simple license (the same TVA as in the conformance file 01) - a IPMP for describing the protection tool
	14 JPEG images related to TVA	- each image is stored as an item - a program title image - a segment group title image - 12 segment title images (one of the images is protected with the same tool and key as for the TS)

File name	06_T-DMB-1_IPMP(ES).dmb	
Description	the same as file '02'	
Major brand	dv1b	
Compatible brands	dmb1	
Components Inside the file	AVC, ER-BSAC	- each streams is stored as separate track - Each ES is encrypted with AES-128 CTR (key: "key1")
	A DID XML (containing TVA, REL and IPMP)	- a TVA for content description and segment information (the same TVA as is in the conformance file 02) - an REL for defining a simple license (the same TVA as in the conformance file 02) - an IPMP for describing the protection tool
	14 JPEG images related to TVA	- each image is stored as an item - a program title image - a segment group title image - 12 segment title images (one of the images is protected with the same tool and key as for the ESs)

File name	07_DAB_PAD.dmb	
Description	a DAB music program with lyric and slideshow	
Major brand	da0b	
Compatible brands	dmb1, da0a	
Components Inside the file	A DAB Audio Frames Stream (containing MPEG-1 Audio Layer II, DL, and MOT Slides)	- stored as an 'rdab' hint track - DL text and MOT slides reside in the PAD area of the DAB audio frames
	A DID XML (containing TVA)	- a TVA for content description and segment information
	3 JPEG images related to TVA	- each image is stored as an item - a program title image - 2 segment title images

File name	08_DAB_Plus.dmb	
Description	a DAB+ music program	
Major brand	da2a	
Compatible brands	dmb1, da2b, mp42	
Components Inside the file	A DAB+ Audio Frames Stream (containing HE-AAC2)	- stored as an 'rdap' hint track