# Technical Specification

December 2015

# ARD_ZDF_SDF02

## MXF Profile with DVbased50, 576i/25 and 8 mono AES3 audio tracks

## Version 1.0


Institut für Rundfunktechnik

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**Ständiges ARD-Büro**
Bertramstraße 8
60320 Frankfurt/Main
Germany

phone: +49 69 59 06 07
fax: +49 69 155 20 75
e-mail: ard-buero@ard.de

**Zweites Deutsches Fernsehen**
ZDF-Straße 1
55100 Mainz (Mayence)
Germany

phone: +49 6131 70 1
fax: +49 6131 70 2157
e-mail: info@zdf.de

**Österreichischer Rundfunk**
Würzburggasse 30
1136 Wien (Vienna)
Austria

phone: +43 1 87878 0
fax: +43 1 87878 12738
e-mail: online@orf.at

**ARTE G.E.I.E**
Postfach 1980
77679 Kehl

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Institut für Rundfunktechnik GmbH (Broadcast Technology Institute)
Floriansmühlstraße 60
80939 München (Munich)
Germany

phone: +49 89 32399 204
fax: +49 89 32399 205
e-mail: presse@irt.de
web site: www.irt.de

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## Contents

# 1. Introduction

The specification provided in this profile was developed within the working group Quality Management (WG QM), a group of the K-Prod/FSBL. The WG QM had the task to investigate and give recommendations on quality management in file based production. In particular, it should provide solutions for interoperability problems with MXF-files.

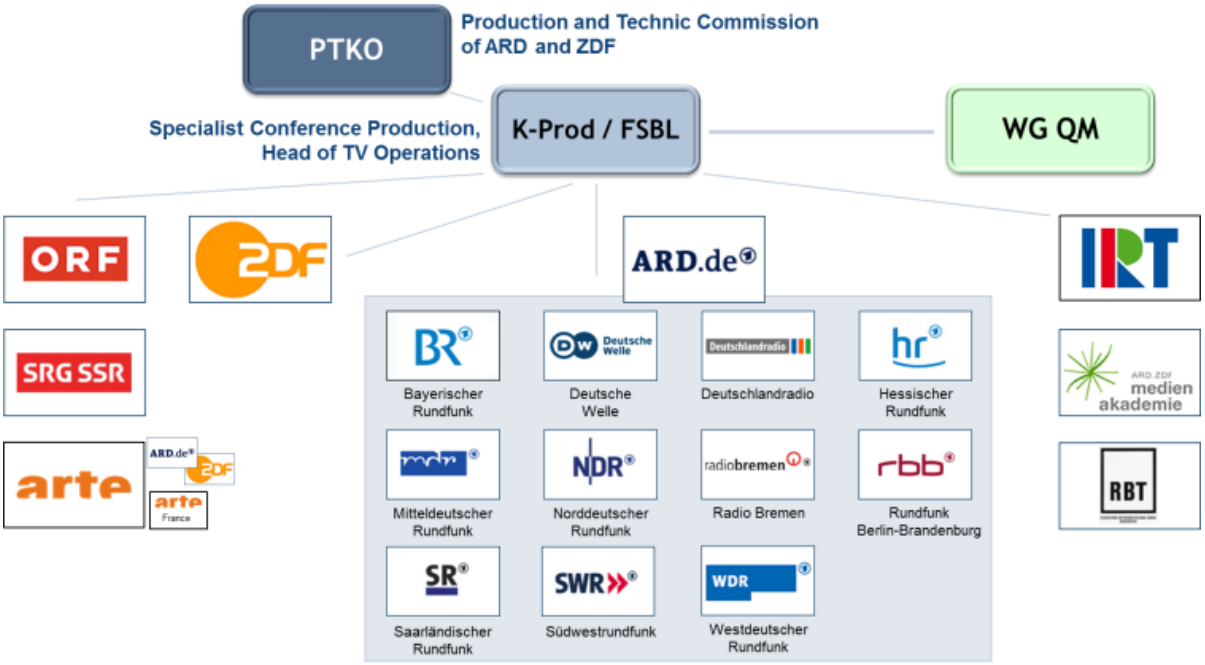


*Figure 1 - Organisation of the working group Quality Management.*

Findings lead to the specification of profiles for MXF-Files. These MXF-Profiles are the basis for the reduction of interoperability problems and a solid ground for automated quality control using file based QC-Tools.

The number of Standard Definition (SD) material that needs to be handled in production environments became more and more insignificant, due to the general switch to HDTV in broadcast. However broadcasters archives hold a great amount of content in SD. The archived SD material sometimes is rerecorded within a new MXF file, usually in large-scale projects. For these cases ARD_ZDF_SDF02 specifies an MXF profile that focus high decoder dependability.

# 2. Conformance Notation

This document contains both normative text and informative text.

All text is normative except for that in the Introduction, and any section explicitly labelled as 'Informative' or individual paragraphs which start with 'Note:'

Normative text describes indispensable or mandatory elements. It contains the conformance keywords 'shall', 'should' or 'may', defined as follows:

| | |
|---|---|
| 'Shall' and 'shall not': | Indicate requirements to be followed strictly and from which no deviation is permitted in order to conform to the document. |
| 'Should' and 'should not': | Indicate that, among several possibilities, one is recommended as particularly suitable, without mentioning or excluding others.<br>OR<br>indicate that a certain course of action is preferred but not necessarily required.<br>OR<br>indicate that (in the negative form) a certain possibility or course of action is deprecated but not prohibited. |
| 'May' and 'need not': | Indicate a course of action permissible within the limits of the document. |

Informative text is potentially helpful to the user, but it is not indispensable and it does not affect the normative text. Informative text does not contain any conformance keywords.

# 3. Specification of MXF file properties

This section contains the core specification for the MXF profile ARD_ZDF_SDF02. The MXF profile provides further restrictions to the MXF standards as defined by SMPTE in st377-1:2011 and Amendment 2:2012 to SMPTE ST 377-1:2011. These standards always apply if not explicitly stated otherwise.

Basis for ARD_ZDF_SDF02 was SMPTE st382 and st383.

To match the ARD_ZDF_SDF02 Profile an MXF file shall comply with all parameters specified in this document.

Figure 2 gives an overview of the MXF file structure according to the profile specified by this document.

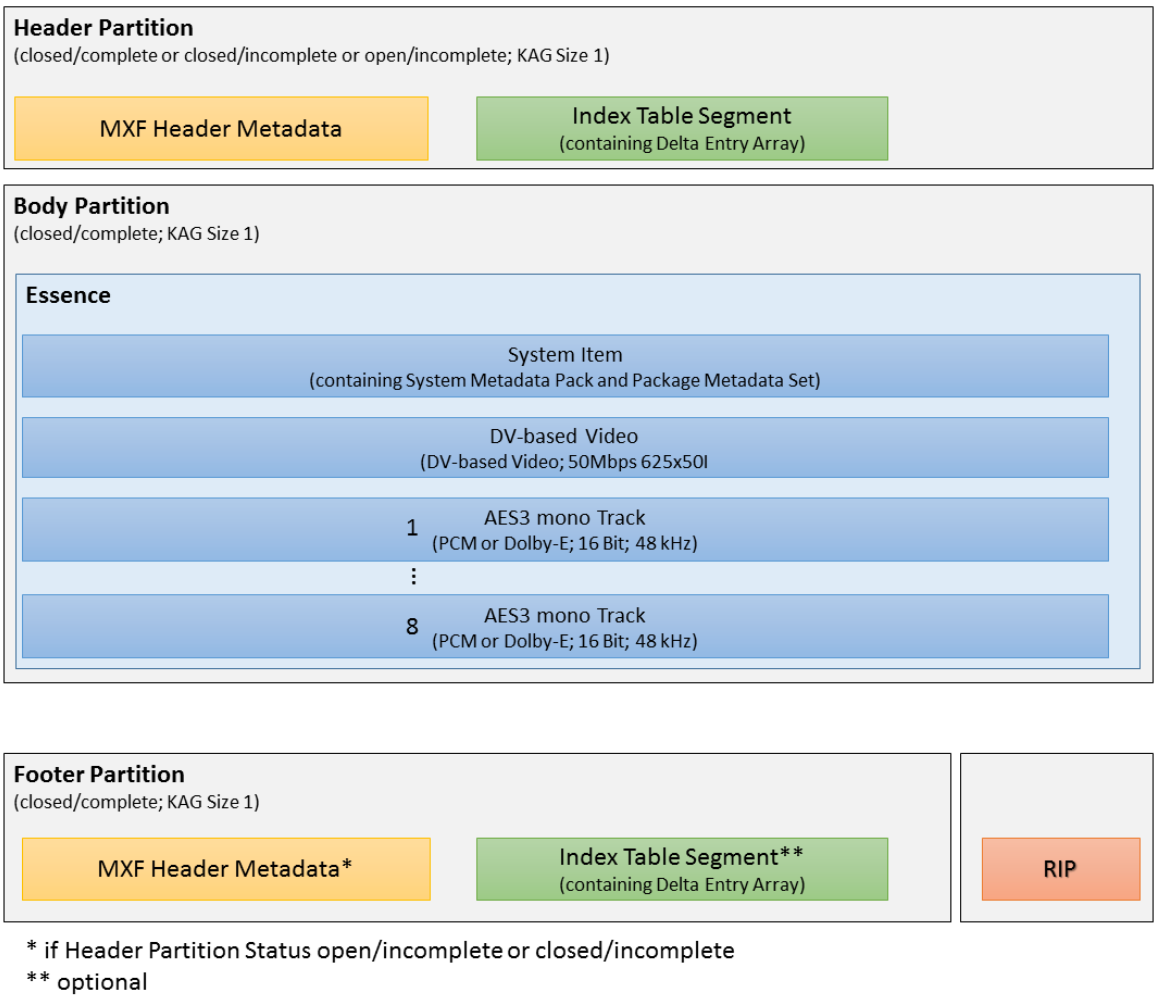


*Figure 2 - Structure of the MXF file according to MXF-Profile ARD_ZDF_SDF02*

**Note:** Not all specified parameters represent concrete items in the MXF Header Metadata. Thus some parameters might be difficult to check automatically with Quality Control Tools.

**Note:** Some parameters specify values that do not restrict the MXF Standards any further. They are listed to express explicitly that all values are supported or that they shall be present.

The following table gives an overview of the nomenclature used for the parameter specification.

| Type | Description | Example Notations |
|---|---|---|
| Concrete Values | Designates those values that directly represent a value in the MXF file, are written in italic letters. Depending on the context, they can be expressed in decimal, hex or binary numbers, or as true or false. | "24", "06.0e.2b.34.04.01.01.01.0d.01.03.01.02.06.03.00" |
| Description | Descriptions for concrete values are written in round brackets after the value itself. | *"130* (= 422P@HL)" |
| Value ranges | If more than one value is valid in the Profile all possible values are listed in square brackets, separated with a comma. Or they are listed as a range with "-" between the smallest and highest possible value. | "[true, false]", "[1-12]" |
| Plain text | Explanation of the corresponding property of the MXF File. | "Shall be present", "8 AES Audio Tracks (containing PCM or Dolby-E)" |

The following table contains the MXF file properties specified by this Profile.

| Property Name | Property Specification |
|---|---|
| **Profile short description** | |
| Type | MXF OP1a /Mapping DV-DIF Data to the MXF Generic Container (SMPTE 383M-2008) |
| MXF structure | Header partition (including Header Metadata and complete Index Table), one Body Partition (including complete essence), Footer partition (including complete Index Table) |
| Essence Mapping | According to SMPTE 383M-2008 |
| Generic Container | Frame-based mapping according to SMPTE st379-2:2010 |
| Scanning raster | 576i/25 |
| Audio | 8 AES Audio Tracks (containing PCM or Dolby-E) |

| General | |
|---|---|
| File format | MXF (SMPTE st377-1:2011) |
| Operational Pattern | OP1a (SMPTE st378:2004) |
| Header Partition Status | Closed, Complete (preferred) / Closed, Incomplete / Open, Incomplete |
| Body Partition Status | Closed, Complete |
| Body partition duration | Minimum 1 Frame |
| Footer Partition Status | Closed, Complete |
| KAG Size | *1* (consistent in all partition packs) |
| Header Metadata in Header Partition | The size of header metadata in Header Partition shall be at least 2 000 000 Byte. The size can be achieved using one or more KLV Fill Items |
| System Item | Shall be present (SMPTE st326 and st385) includes System Metadata Pack and Package Metadata Set |

| | |
|---|---|
| Essence location | Complete Essence in one Body Partition |
| Index table location | The Index Table segment shall be located in the Header Partition (Forward Indexing). |
| Header Metadata Location | Header Metadata shall be located in the Header Partition.<br>If the Header Partition Status is "Open, incomplete" or "Closed, incomplete" (e.g. update needed because of "on the fly generation") they shall be completed ("Closed, completed") in Footer Partition. |
| Descriptive Metadata | Shall not be present |
| Random Index Pack | Shall be present |
| Essence Elements in Essence Container | Shall be in the order: System Item, Picture Item, Sound Item.<br>The Sound Elements within the Sound Item shall be in the order: Audio Essence Element 1, […], Audio Essence Element 8. (1) |
| Tracks in Material Package | The Material Package shall contain 1 Timecode Track, 1 Video Track, 8 Audio Tracks.<br>The track order shall be the same as defined for tracks in the source package. (1) |
| Tracks in Source Package | The Source Package shall contain 1 Timecode Track, 1 Video Track, 8 Audio Tracks.<br>The track order shall match with the order of the essence elements in the essence container. (1) |
| Timecode Material Package | Shall be present |
| Timecode Source Package | The Timecode Track shall contain one Timecode Component Set. The start value shall match with the timecode value of the first System Item. |
| Timecode System Item | Shall be present |

[1] In order to have the possibility to link an audio track to an external channel assignment (e.g. from Technical Production Guidelines).

| **Index Table Segment Set** | |
|---|---|
| Index Edit Rate | 25 / 1 |
| Index Start Position | 0 |
| Index Duration | shall either be set to 0 or to the total number of Edit Units in the Essence Container |
| Edit Unit Byte Count | >0 |
| Slice Count | 0 (only CBE elements) |
| Delta Entry Array | Shall be present and complete |
| Index Entry Array | Shall not be present |

| **Timeline Track** | |
|---|---|
| Edit Rate | 25 / 1 |
| Origin (Pre-Charge) | May be present (0) |

| Video | |
|---|---|
| Essence Container Label<br>(Video essence mapping) | *06.0e.2b.34.04.01.01.01.0d.01.03.01.02.02.51.01*<br>(= MXF-GC Frame-wrapped DV-based 625x50I 50Mbps) |
| Picture Element Key | *06.0e.2b.34.01.02.01.01.0d.01.03.01.18.01.01.00*<br>(= MXF Generic Container Version 1 DV-DIF Frame Wrapped Compound Essence) |
| Picture Descriptor (CDCI Descriptor) | |
| Picture Essence Coding | *06.0e.2b.34.04.01.01.01.04.01.02.02.02.02.04.00*<br>(= DV-based Video 50Mbps 625x50I) |
| Aspect Ratio | [16:9, 4:3, 0:0] (0:0 if aspect ratio is unknown) |
| Sample Rate | 25 / 1 |
| Container Duration | Shall be present and identical with audio Container Duration. If the partition status is incomplete, the value may be absent. |
| Field Dominance | *1* (= Field 1 is first in temporal order) |
| Signal Standard | *1* (= ITU-R BT.601 and BT.656, also SMPTE ST 125 (525 and 625 line interlaced)) |
| Frame Layout | *1* (= separate_fields) |
| Display Width x Display Height | 720 x 288 |
| Sample Width x Sample Height | 720 x 288 |
| Stored Width x Stored Height | 720 x 288 |
| Stored F2 Offset | *0* |
| Sampled X Offset | *0* |
| Sampled Y Offset | *0* |
| Display X Offset | *0* |
| Display Y Offset | *0* |
| Display F2 Offset | *0* |
| Active Format Descriptor | 0000 0000 (= undefined, aspect ratio 4:3)<br>0010 0000 (= letterbox, aspect ratio 4:3)<br>0100 0000 (= full frame, aspect ratio 4:3)<br>0101 0000 (= letterbox, aspect ratio 4:3)<br><br>0000 0100 (= undefined, aspect ratio 16:9)<br>0010 0100 (= letterbox, aspect ratio 16:9)<br>0100 0100 (= full frame, aspect ratio 16:9)<br>0100 1100 (= pillarbox, aspect ratio 16:9) |
| Video Line Map | *23, 335* (= for Interlace) |
| Capture Gamma (st377-2009 Transfer Characteristic) | *06.0E.2B.34.04.01.01.01.04.01.01.01.01.01.00.00*<br>(= ITU-R BT470 Transfer Characteristic) |
| Image Start Offset | 0 |
| Image End Offset | 0 |

| | |
|---|---|
| Color Siting | *0* (= coSiting as in ITU-R Rec 601) |
| Padding Bits | 0 |
| Black Ref Level | 16 |
| White Ref Level | 235 |
| Color Range | 225 |
| Horizontal Subsampling | *2* (= 4:2:2) |
| Vertical Subsampling | *1* (= 4:2:2) |
| Component Depth | 8 bit |

| **Audio** | |
|---|---|
| Essence Container Label<br>(Audio essence mapping) | *06.0e.2b.34.04.01.01.01.0d.01.03.01.02.06.03.00*<br>(= MXF-GC Frame-wrapped AES3 audio data) |
| Sound Element Key | *06.0e.2b.34.01.02.01.01.0d.01.03.01.16.08.03.0x*<br>(= MXF Generic Container Version 1 SMPTE 382M AES Frame-wrapped Sound Essence, "x" depends on the audio track) |
| Audio channels per Sound Element | One channel per AES Sound Element. |
| AES3AudioEssenceDescriptor (st382:2007) | |
| Sound Essence Coding<br>/ Sound Essence Compression | PCM:<br>06.0e.2b.34.04.01.01.0A.04.02.02.01.01.00.00.00<br>(= PCM)<br><br>Undefined:<br>*06.0e.2b.34.04.01.01.01.04.02.02.01.7f.00.00.00*<br>(= Uncompressed Sound Coding, Undefined Sound Coding)<br><br>Dolby-E:<br>*06.0E.2B.34.04.01.01.01.04.02.02.02.03.02.1C.00*<br>(= Dolby-E Compressed Audio) |
| Sample Rate | 48000 / 1 |
| Container Duration | Shall be present and identical with video Container Duration. If the partition status is incomplete, the value may be absent. |
| Audio sampling rate | 48000 / 1 |
| Locked/Unlocked | *1* (= locked) |
| Dial Norm | If available the correct gain to be applied to normalize perceived loudness of the clip, defined by ITU-R BS.1196-2:2010 |
| Audio Ref Level | If the value is known it shall be present |
| Channel Count | 1 |
| Quantization bits | 16 |

| **Ancillary Data** | |
|---|---|
| Data content (EssenceContainers) | Shall not be present |

| Other | |
|---|---|
| Dark Metadata | Private user data (Metadata Class 14) shall not be present. Only SMPTE Metadata Classes 1-7 and 13 are allowed. |

# 4. Appendix B: Additional Decoder requirements (informative)

The following table is a collection of common MXF file properties that differ from the ARD_ZDF_SDF02 Profile.
A decoder should be able to handle these properties.

| Property Name | Additional Decoder requirements |
|---|---|
| **Profile short description** | |
| Audio | 8 AES Audio Tracks |

| **General** | |
|---|---|
| Header Metadata Location | May be located in other partitions |
| Descriptive Metadata | May be present |
| Tracks in Material Package | Optional ANC data track |
| Tracks in Source Package | Optional ANC data track |
| Timecode Material Package | May be absent |
| Timecode Source Package | May be absent<br>If present, TC can be different from System Item |
| Timecode System Item | May be absent<br>If present, TC can be different from Source Package |

| **Video** | |
|---|---|
| Picture Descriptor (MPEG Video Descriptor; st381-2:2011) | |
| Container Duration | May be absent |
| Frame Layout | 3 (= mixed_fields) |
| Active Format Descriptor | Optional (including all values) |
| Color Siting | *4* (= Siting in accordance with ITU-R Rec 601) |

| **Audio** | |
|---|---|
| Generic Sound Essence Descriptor | |
| Sample Rate | 25 / 1 |
| Channel count | 8 |
| Quantization Bits | 24 |

| **Ancillary Data** | |
|---|---|
| Data content (EssenceContainers) | May be present |

| **Other** | |
|---|---|
| Dark Metadata | May be present |

**Institut für Rundfunktechnik**
(Broadcast Technology Institute)
Floriansmühlstraße 60
80939 München (Munich)
Germany
www.irt.de
phone: +49 89 32399 – 204
fax: +49 89 32399 – 205
presse@irt.de

Registry Court Munich Entry Department
B Vol. 65 No. 5191