EBU – Recommendation R134

MXF and Multi Channel Audio

**A Recommendation concerning
MXF-based production equipment**

Geneva
July 2011

Conformance Notation

This document contains both normative text and informative text.

All text is normative except for that in the Introduction, 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.
	OR indicate that a certain course of action is preferred but not necessarily required.
	OR 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.

Default identifies mandatory (in phrases containing "shall") or recommended (in phrases containing "should") presets that can, optionally, be overwritten by user action or supplemented with other options in advanced applications. Mandatory defaults must be supported. The support of recommended defaults is preferred, but not necessarily required.

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.

A conformant implementation is one which includes all mandatory provisions ('shall') and, if implemented, all recommended provisions ('should') as described. A conformant implementation need not implement optional provisions ('may') and need not implement them as described.

Contents

MXF and Multi Channel Audio (MCA)

EBU Committee	First Issued	Revised	Re-issued
TC	2011		

Keywords: Multi Channel Audio, MCA, Material Exchange Format, MXF,

> *Note:* **This recommendation is aimed at manufacturers of MXF-based production equipment.** *The EBU encourages broadcasters to use this document as a reference for the evaluation of MXF equipment.*

The EBU, considering that:

1. Broadcasters increasingly need to use multi channel audio in MXF files; in the short-term the requirement is to support 16 individual, uncompressed audio channels, but it is probable that this number will rise to 32 or 64 channels in the mid-term.

2. Devices such as video servers often support more than 8 audio channels, but there are workflows in use where the user needs to be compatible with the constraints of an acquisition format supporting fewer channels, and where content transfers can occur from servers or NLE (Non Linear Editing) systems back to the acquisition media.

3. These use cases lead to confusion, interoperability issues and even uncontrolled loss of data.

Recommends that:

Production equipment that uses the MXF file format should

1. Support at least 16 individual, uncompressed audio channels in MXF files where possible. Extend this number to 32 or 64 individual, uncompressed audio channels, as the need arises in the mid-term.

2. Provide users the option to select which audio channels they want to use when creating a 'flavour' of MXF with a limited number of audio channels (e.g. transferring an MXF file that holds 16 audio channels back to an acquisition medium with a capacity of only 8 audio channels).

3. Present information to the user if any of the audio channels will be lost during a transcoding or conforming process. The endangered channels should be identified.

4. Use a standardised mechanism to describe the technical and descriptive aspects of multi channel audio within MXF files, based on using descriptors inside the MXF header metadata[1].

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[1] At the time of writing, the definition of these descriptors and their use is currently in standardization in the SMPTE 31FS committee.

1.   Background – MCA and track allocation

There is an ever-increasing use of multi channel audio (MCA) in TV productions. This has already triggered widened requirements concerning the numbers of audio channels and/or audio tracks available on production platforms, e.g. acquisition equipment, editing systems, storage devices and software applications.

At present, the numbers of channels of file-based content that may be accommodated in production systems are very often limited to a certain number, e.g. two, four or eight channels. These limitations often do not meet the requirements of the user and can lead to complicated workarounds and subsequent interoperability problems.

Complication also arises because the audio that is generated or ingested from different sources is very often encoded at different bit depths, bitrates, formats and compression standards for SDTV or HDTV production.

Currently many hybrid environments are in use today, where tape-based material from the archives will be brought together in post-production with freshly acquired file-based material. For interoperability purposes within broadcast environments it is vital that there is wide support for MCA in tape-based as well as in file-based applications.

The EBU has described well-defined profiles/variants of MCA instances in EBU Recommendations R48 and R123 [1] [2], the former relating to tape-based exchange and the latter relating to file-based exchange. Whilst both recommendations are meant to help content exchange between organizations and not to constrain work-flows inside organizations, it was always hoped that they would help inform those (internal) configuration decisions as well. In the long run the MCA variants that are described in the Recommendations will be amended in order to support future use cases.

2.   Background - MXF peculiarities

The Material Exchange Format (MXF) has become the predominant file format within TV production and archive environments.

The core MXF standard, SMPTE 377-1-2009 [3], does not limit the number of audio channels that can be stored in one MXF file. Nevertheless, many implementations are based around constrained MXF profiles, that amongst other things, support a limited number of audio channels in one MXF file (e.g. constrained OP 1a) or a limited number of separated MXF files (e.g. constrained OP Atom).

Often, acquisition formats impose these limitations due to the physical (lack of) space available on an acquisition medium.

Experience also shows that other implementations such as video servers or NLE systems adhere to these constraints in order to guarantee interoperability and, therefore, similarly only support a limited number of audio channels. Some of the limitations are documented in SMPTE standards, some of them in proprietary product specifications. An overview of current implementations is given in **Annex A.**

3.   Bibliography

[1]   **EBU R48**   Allocation of audio tracks on digital television recorders.

[2]   **EBU R123**   EBU Audio Track Allocation for International File Exchange.

[3]   **SMPTE 377-1-2009**   Material Exchange Format (MXF) – File Format Specifications

Annex A: Overview of MCA support in MXF acquisition devices

The following pair of tables reflects the currently available implementations that are known. The tables make no claim to be complete and details may vary among different implementations.

SD formats

Codec	Codec Implementation	Acquisition Medium	Max. number of audio channels	Max. Bit Depth
DV IEC 61834	DV	Tape	4	12*
DV IEC 61834	DVCAM	Tape, optical disk, solid state memory (XDCAM)	2 4	16
DV IEC 61834, DV-based 25	DV, DVCPRO 25	Tape	2	16**
DV-based 50	DVCPRO 50	Tape	4	16**
DV IEC 61834, DV-based 25, DV-based 50	DV, DVCPRO 25, DVCPRO 50	Solid state memory (P2)	2 2 4	16**
D10	IMX 30/40/50	Tape, optical disk, solid state memory (IMX)	4 8	24 16

HD formats

Codec	Codec Implementation	Acquisition Medium	Max. number of audio channels	Max. Bit Depth
MPEG-4 Part 10	AVC-I 50/100	Solid state memory (P2)	4 8	24 16
DV-based 100	DVCPRO 100	Solid state memory (P2)	8	16
MPEG-2 long GOP	MPEG HD	Optical disk (XDCAM: Professional Disk)	4	16
MPEG-2 long GOP	MPEG HD422	Optical disk (XDCAM: Professional Disc)	8	24
MPEG-2 long GOP	MPEG HD	Solid state memory (XDCAM: SxS Memory Card)	4	16
MPEG-2 long GOP	MPEG HD422	Solid state memory (XDCAM: SxS Memory Card)	8	24
D11	HDCAM	Tape (HDCAM)	4	20
MPEG-4 Part 2 SStP	HDCAM SR	Tape (HDCAM SR)	12	24
MPEG-4 Part 2 SStP	SRMASTER	Solid state memory (SRMemory)	16	24

)   Unlocked audio.

**)   Transparent up to bit 15.*