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INTERNATIONAL STANDARD

NORME INTERNATIONALE

File format for professional transfer and exchange of digital audio data

Format de fichier pour le transfert et l'échange professionnels de données audionumériques

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FILE FORMAT FOR PROFESSIONAL TRANSFER AND EXCHANGE OF DIGITAL AUDIO DATA

FOREWORD

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The text of this standard is based on the following documents:

CDV	Report on voting
100/3143/CDV	100/3226/RVC

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

INTRODUCTION

The Broadcast Wave format file (BWFF) is based on the Microsoft WAVE[1] audio file format, which is a type of file specified in the Microsoft resource interchange file format (RIFF) [1][2] WAVE files specifically contain audio data. The basic building block of a RIFF file is a chunk which contains specific information, an identification field, and a size field. A RIFF file contains a number of chunks.

The BWFF specifically includes a <Broadcast Audio Extension> chunk to carry certain metadata important for broadcast and professional use. For reliable interchange, some restrictions apply to the format of the audio data.

The Broadcast Wave Format was first developed using ASCII text for all fields. Later, as the format was further developed, it was proposed to use multi-byte characters to internationalize the format. It was understood that to use multi-byte character sets within the existing format would cause compatibility issues when multi-byte metadata was parsed by applications expecting ASCII text. The separate nature of human-readable and machine-readable metadata was established, and a new "universal" chunk was established to carry internationalized human-readable metadata using multi-byte character sets without interoperability issues. This is described in Annex K.

1 Microsoft® is a registered trademark, and Windows™ is a trademark of Microsoft Corp.. This information is given for the convenience of users of this document and does not constitute an endorsement by IEC of the product named. Equivalent products may be used if they can be shown to lead to the same results.

2 Numbers in square brackets refer to the Bibliography.

FILE FORMAT FOR PROFESSIONAL TRANSFER AND EXCHANGE OF DIGITAL AUDIO DATA

1 Scope

This document specifies a file format for interchanging audio data between compliant equipment. It is primarily intended for audio applications in professional recording, production, post-production, and archiving.

It is derived from the AES31-2 [2] but is also compatible with variant specifications including EBU Tech 3285 [3] to [10], ITU-R BR.1352-3-2007 [11] to [14], and the Japan Post Production Association's BWF-J [15].

This document contains the specification of the broadcast audio extension chunk and its use with PCM-coded audio data. Basic information on the RIFF format and how it can be extended to other types of audio data is given in Annex E. Details of the PCM WAVE format are also given in Annex A.

An optional extended format, BWF-E, supports 64-bit addressing to permit file sizes greater than 4 GB.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 10646:2017, *Information technology – Universal Coded Character Set (UCS)*

ISO 8601, *Data elements and interchange formats – Information interchange – Representation of dates and times*

SMPTE ST 330-2011; *SMPTE standard for television – Unique Material Identifier (UMID)*

INTERNET ENGINEERING TASK FORCE (IETF). RFC 3629: *UTF-8, a transformation format of ISO 10646* [online]. Edited by F. Yergeau. November 2003 [viewed 2019-11-26]. Available at https://www.rfc-editor.org/rfc/rfc3629.txt

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1
resource interchange file format
RIFF
file representation upon which the WAVE file format is based

3.2
chunk
data package within RIFF files containing related data

3.3
ASCII
7-bit character code compliant with ISO/IEC 646

3.4
waveform audio file format
WAVE
audio file format based on the RIFF file structure

3.5
Broadcast Wave format file
BWFF
WAVE file containing the bext chunk as described in this document

3.6
broadcast extension chunk
bext
extension chunk to WAVE

3.7
universal broadcast audio extension chunk
ubxt
human-readable information of the bext chunk in multi-byte languages

3.8
UMID
unique material identifier as defined in SMPTE ST 330

3.9
Broadcast Wave format, extended
BWF-E
optional extended format that replaces a RIFF header with an RF64 header to support 64-bit addressing to permit file sizes greater than 4 GB

3.10
RF64
structure equivalent to the RIFF file type supporting 64-bit addressing

3.11
CHAR
8-bit signed integer, representing integer values from −128 to +127

Note 1 to entry: Equivalent C type: "signed char".

3.12
BYTE
8-bit unsigned integer, representing integer values from 0 to 255

Note 1 to entry: Equivalent C type: "unsigned char".

3.13
INT
16-bit signed integer, representing integer values from −32 768 to +32 767

Note 1 to entry: Equivalent C type: "signed short int".

Note 2 to entry: Multi-byte data types are little-endian.

3.14
WORD
16-bit unsigned integer, representing integer values from 0 to +65 535

Note 1 to entry: Equivalent C type: "unsigned short int".

Note 2 to entry: Multi-byte data types are little-endian.

3.15
LONG
32-bit signed integer, representing integer values from −2 147 483 648 to +2 147 483 647

Note 1 to entry: Equivalent C type: "signed long int".

Note 2 to entry: Multi-byte data types are little-endian.

3.16
DWORD
32-bit unsigned integer, representing integer values from 0 to +4 294 967 295

Note 1 to entry: Equivalent C type: "unsigned long int".

Note 2 to entry: Multi-byte data types are little-endian.

4 BWF file

4.1 Existing chunks defined as part of the RIFF Format

This specification uses a number of RIFF chunks which are already defined (see Annex A). These are:

```
<fmt-ck>            Format Chunk
<wave-data>         Audio data chunk
```

4.2 Additional chunks

Additional chunks can be present in the file. Some of these can be outside the scope of this document. Applications may or may not interpret or make use of these chunks, so the integrity of the data contained in such unknown chunks cannot be guaranteed. However, compliant applications should pass on unknown chunks with their contents unchanged (but see also Annex B).

4.3 Contents of a BWFF

A BWFF shall contain the RIFF "WAVE" header and at least the following chunks:

```
<WAVE-form>
RIFF('WAVE'
     <fmt-ck>                       /* Format of the audio signal: PCM/MPEG */
     <broadcast_audio_extension>    /* information on the audio sequence */
     <wave-data> )                  /* sound data */
```

4.4 Broadcast audio extension chunk

Extra parameters needed for exchange of material between broadcasters are added in a specific broadcast audio extension, or bext chunk. The structure of the bext chunk shall be defined as follows:

```
typedef struct chunk_header {
     DWORD ckID;                     /* (broadcastextension)ckID=bext */
     DWORD ckSize;                   /* size of extension chunk */
     BYTE ckData[ckSize];            /* data of the chunk */
}    CHUNK_HEADER;
typedef struct broadcast_audio_extension {
CHAR Description[256];               /* ASCII: "Description of the sound
                                     sequence" */
CHAR Originator[32];                 /* ASCII: "Name of the originator" */
CHAR OriginatorReference[32];        /* ASCII: "Reference of the originator" */
CHAR OriginationDate[10];            /* ASCII: "yyyy-mm-dd" */
CHAR OriginationTime[8];             /* ASCII: "hh:mm:ss" */
DWORD TimeReferenceLow;              /* First sample count since midnight, low
                                     word */
DWORD TimeReferenceHigh;             /* First sample count since midnight, high
                                     word */
WORD Version;                        /* Version of the BWF; unsigned binary
                                     number. See Annex G */
BYTE UMID_0;                         /* Binary byte 0 of SMPTE UMID */
....
BYTE UMID_63;                        /* Binary byte 63 of SMPTE UMID */
INT LoudnessValue;                   /* Integrated Loudness Value of the file in
                                     LKFS (multiplied by 100) see Annex H */
INT LoudnessRange;                   /* Loudness Range of the file in LU
                                     (multiplied by 100), see Annex H */
INT MaxTruePeakLevel;                /* Maximum True Peak Level of the file
                                     expressed as dBTP (multiplied by 100), see
                                     Annex H */
INT MaxMomentaryLoudness;            /* Highest value of the Momentary Loudness
                                     Level of the file in LKFS (multiplied by
                                     100), see Annex H */
INT MaxShortTermLoudness;            /* Highest value of the Short-Term Loudness
                                     Level of the file in LKFS (multiplied by
                                     100), see Annex H */
BYTE Reserved[180];                  /* 180 bytes, reserved for future use, set
                                     to "NULL" */
CHAR CodingHistory[];                /* ASCII: « History coding » */
} BROADCAST_EXT
```


The content of the fields in the bext chunk shall be defined as shown in Table 1. Note that in applications where ASCII text is inappropriate for human-readable information (for example when a character set other than ISO 646 is required), it is necessary to carry it by another means, for example, in a dedicated metadata chunk added to the BWFF. See also Annex K.

All the items except "Description", "Originator", "OriginatorReference" and "CodingHistory" should have the same content as that of each corresponding item of the ubxt chunk (see Annex K), if present. If machine-readable data in the "bext" chunk is updated, the corresponding machine-readable data in the "ubxt" chunk should also be updated identically.

Table 1 – bext field content definitions

Description	Human	ASCII string, 256 characters or fewer, containing a description of the sequence. If line breaks are used, lines shall be terminated by <CR><LF>. If data is not available or if the length of the string is less than 256 characters, the first unused character shall be a null character (00_{16}). To help applications that only display a short description, a summary of the description should be contained in the first 64 characters. The last 192 characters may be used for details.
Originator	Human	ASCII string, 32 characters or fewer, containing the name of the originator of the audio file. If data is not available or if the length of the string is less than 32 characters, the first unused character shall be a null character (00_{16}).
OriginatorReference	Human	ASCII string, 32 characters or fewer, containing a reference allocated by the originating organization. See Annex I. If data is not available or if the length of the string is less than 32 characters, the first unused character shall be a null character (00_{16}).
OriginationDate	Human	ASCII string, 10 characters, containing the date of creation of the audio sequence. Format: ***yyyy-mm-dd*** ***yyyy*** = 4 characters for year shall contain a value between 0000 and 9999 **-** = 1 character ***mm*** = 2 characters for month shall contain a value between 01 and 12 **-** = 1 character ***dd*** = 2 characters for day of month shall contain a value between 01 and 31 All components shall be present. Hyphen characters, "-", shall be used as separators within the date expression in compliance with ISO 8601. For compatibility with alternative implementations, reproducing equipment should also recognise the following separator characters: "_" underscore, ":" colon, " " space, "." period.
OriginationTime	Human	ASCII string, 8 characters, containing the time of creation of the audio sequence in hours, minutes and seconds. If data is unavailable, the default value shall be 00:00:00. Format: ***hh:mm:ss*** ***hh*** = 2 characters for hours shall contain a value between 00 and 23 if time given **:** = 1 character ***mm*** = 2 characters for minutes shall contain a value between 00 and 59 if time given **:** = 1 character ***ss*** = 2 characters for seconds shall contain a value between 00 and 59 All components shall be present. Colon characters, ":", shall be used as separators within the time of day expression in compliance with ISO 8601. For compatibility with alternative implementations, reproducing equipment should also recognise the following characters: "_" underscore, "-" hyphen, " " space, "." period.
TimeReference	Machine	This field shall contain the sample address count [time code] of the sequence. It is a 64-bit unsigned value which contains the sample count since midnight of the first sample in the audio data. The number of samples per second depends on the sample frequency, which is defined in the field **<nSamplesPerSec>** from the **<fmt-ck>**. The default value is zero, corresponding to midnight.

Version	Machine	An unsigned binary number indicating the version of the BWF. For Version 1 it shall be set to 0001_{16} and for Version 2 it shall be set to 0002_{16}. This is set to 0002_{16}. See Annex G.
UMID	Machine	64 bytes containing an extended UMID to SMPTE ST 330. If a 32-byte basic UMID is used, the last 32 bytes shall be filled with zeros. If no UMID is available, the 64 bytes shall be filled with zeros. NOTE The length of the UMID is coded at the head of the UMID itself
LoudnessValue	Machine	The integrated loudness value of the file in LKFS (multiplied by 100). A 16-bit signed integer, being the integer of (100 × the Integrated Loudness value of the file in LKFS) ± 0,5. See Annex H for more details on the method of conversion.
LoudnessRange	Machine	A 16-bit signed integer, representing the loudness range of the file in LU. See Annex H.
MaxTruePeakLevel	Machine	A 16-bit signed integer, being the integer of (100 × the maximum true peak value of the file in dBTP) ± 0,5. See Annex H for more details on the method of conversion.
MaxMomentaryLoudness	Machine	A 16-bit signed integer, being the integer of (100 × the highest value of the momentary loudness level of the file in LKFS) ± 0,5. See Annex H for more details on the method of conversion.
MaxShortTermLoudness	Machine	A 16-bit signed integer, being the integer of (100 × the highest value of the short-term loudness level of the file in LKFS) ± 0,5. See Annex H for more details on the method of conversion.
Reserved	Machine	180 bytes reserved for extension. These 180 bytes shall be set to zero.
CodingHistory	Human	A variable-size block of ASCII characters comprising 0 or more strings each terminated by <CR><LF>. The first unused character shall be a null character (00_{16}). Each string shall contain a description of a coding process applied to the audio data. Each new coding application should add a new string with the appropriate information. See Annex J.

4.5 Filename

A BWF file should be saved with a filename that can be interchanged with the widest range of different computer types. See Annex C.

4.6 Channel usage

Audio files are typically mono (1-channel) or stereo (2-channel). For multi-channel usage in Broadcast Wave format files, see Annex D.

4.7 File size

The 32-bit address space of a WAVE file limits its maximum size to 4 GB. Some practical computer systems may impose a lower limit of 2 GB. For larger file sizes, Annex F describes an extended file format, BWF-E.