FINAL
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AMENDMENT

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Information technology — MPEG audio technologies —

Part 4:
Dynamic range control

AMENDMENT 2: Loudness leveling

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This document was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 29, *Coding of audio, picture, multimedia, and hypermedia*.

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Information technology — MPEG audio technologies —

Part 4:
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Introduction

Replace the fourth sentence in the second paragraph with the following:

The DRC tool includes dedicated sections for clipping prevention, ducking/leveling, and for generating a fade-in and fade-out to supplement the main dynamic range compression functionality.

6.1.1

Add, before the sentence starting with "For ISO/IEC 14496-12, configuration extension", the following:

An extension payload of type UNIDRCCONFEXT_V1 shall precede an extension payload of type UNIDRCCONFEXT_LEVELING in the bitstream if both payloads are present.

6.1.2.4

Replace last three sentences of the first paragraph with:

If the bit for the "Duck other" or the "Duck/Level self" *drcSetEffect* is set, the DRC set is applied before any downmix specified by the downmix ID, i.e. the DRC set is always applied to the base layout and the downmix is generated thereafter. The *downmixId* 0x7F is not permitted for a DRC set with "Duck other" or "Duck/Level self" effect. In all other cases, the DRC set is applied to the channel configuration indicated by the *downmixId*.

Replace the last sentence in the next-to-last paragraph with:

Similarly, if *duckingScalingPresent* == 1, the scaling factor shall be applied to the associated ducking/leveling gain sequence for that channel group.

6.3.1

Replace the fourth and fifth paragraph with the following:

DRC sets with only a "Fade", "Duck other" or "Duck/Level self" effect are automatically selected by the decoder without using the three-stage selection process. DRC sets with other features can be requested by using DRC decoder settings as described below.

The pool of DRC sets that is subject to the three-stage selection process comprises not only the DRC sets defined in the bitstream (except for DRC sets with "Fade", "Duck other" or a "Duck/Level self" effect) but also virtual DRC sets generated in the DRC tool. The virtual DRC sets are placeholders for the cases where no compression is applied to the audio signal, hence their *drcSetEffect* bits are zero and they correspond to the DRC effect request "None".

6.3.2.1

Replace the first paragraph with the following:

The pre-selection selects all DRC sets that fulfil all requirements listed in Table 10. All available DRC sets are analysed in the given order of steps. If no DRC set is selected, no DRC can be applied except for DRC sets with "Fade", "Duck other" or "Duck/Level self" effect.

Replace Entry #4 of Table 10 with the following:

4	The DRC set does not only have a "Fade", "Duck other" or "Duck/Level self" effect enabled.	Always.	DRC sets with "Fade", "Duck other" or "Duck/Level self" effect are selected automatically. They are not subject to this selection process.

Replace NOTE of Table 10 with the following:

NOTE Pre-selection steps #8 and #9 are interpreted as pre-selection steps #7 and #8 in the first edition of this document (ISO/IEC 23003-4:2015). Pre-selection step #7 related to EQ support is first available with the second edition of this document (ISO/IEC 23003-4:2020).

6.3.2.2.1

Replace the last sentence of the second paragraph, starting with "If no matching downmix IDs can be found..." with the following:

If no matching downmix IDs can be found, no DRC set can be applied except for DRC sets with "Fade", "Duck other" or a "Duck/Level self" effect.

6.3.4

Replace the first paragraph with the following:

This clause uses the term "multiple DRC sets" for DRC sets that are independent of each other and do not include DRC sets with "Fade", "Duck other" or a "Duck/Level self" effect.

6.3.5

Replace 6.3.5 with the following:

6.3.5 Applying multiple DRC sets

In the following cases, multiple DRC sets are applied simultaneously. First, if the DRC set selected in 6.3.4 carries a non-zero entry in the *dependsOnDrcSet* field, the depending DRC set is applied together with the selected one. Second, if a DRC set with "Fade", "Duck other" or "Duck/Level self" effect was automatically selected, it is applied simultaneously with the DRC set selected in 6.3.4 Thus, if the DRC set selected in 6.3.4 has a non-zero *dependsOnDrcSet* value, a total of three DRC sets are applied, which is the maximum number permitted. If all three DRC sets are applied to the same layout (*downmixId*), the DRC set referenced in the *dependsOnDrcSet* field shall be applied first, the DRC set selected in 6.3.4 shall be applied thereafter, and the DRC set with "Fade", "Duck other" or "Duck/Level self" effect shall be applied last. If none of the applied DRC sets is a parametric DRC (see 6.6), the DRC set with "Fade", "Duck

other" or "Duck/Level self" effect can alternatively be processed first. If only two DRC sets are applied to the same layout (*downmixId*), the same order applies. If a DRC set with "Fade" effect and another DRC set with "Duck other" or "Duck/Level self" effect were both automatically selected, the DRC set with "Fade" effect is ignored. A DRC set with "Fade" effect shall be applied after the downmix, if present, if any of the applied DRC sets is a parametric DRC.

6.3.6

Replace second paragraph of 6.3.6 with the following:

In album mode, any DRC set with "Fade" effect is not applied. If not in album mode, if an applicable DRC set with "Fade" effect exists, it shall be applied. The DRC set with "Fade" effect can be applied simultaneously with any other DRC except for DRC sets with a *drcSetEffect* equal to "Duck other" or "Duck/Level self".

6.3.7

Replace 6.3.7 with the following:

6.3.7 Ducking and Loudness Leveling

The base layout and each specific downmix with a unique *downmixId* can have a maximum of one applicable DRC set with a *drcSetEffect* equal to "Ducking other" or "Ducking/Leveling self". During configuration, the decoder scans all available DRC sets for the active downmix to identify the applicable DRC set with a *drcSetEffect* equal to "Ducking other" or "Ducking/Leveling self" if present. If DRC sets with a *drcSetEffect* equal to "Ducking other" or "Ducking/Leveling self" are defined for both the base layout and the active downmix, the one that exactly matches the active downmix is selected.

If Loudness Leveling is switched off as defined in B.3.7.3, selected DRC sets with a *drcSetEffect* equal to "Ducking/Leveling self" and *levelingPresent* equal to 1 are discarded from the selection. If *duckingOnlyDrcSetPresent* is equal to 1, the "Ducking only" DRC set is selected instead.

If a DRC set with a *drcSetEffect* equal to "Ducking other" or "Ducking/Leveling self" is selected and the associated overlaid audio signal is active, the ducking/leveling gain sequence is automatically applied to all channels except those that are members of the channel group associated with the "Duck other" DRC set (*drcSetEffect* equal to "Ducking other") or alternatively to all channels that are members of the channel group associated with the "Duck/Level self" DRC set (*drcSetEffect* equal to "Ducking/Leveling self"). The overlaid audio is defined to be active if at least one non-zero downmix coefficient is applied to it.

DRC sets with a *drcSetEffect* equal to "Ducking other" or "Ducking/Leveling self" are always applied before any downmix, i.e to the base layout. Hence, the DRC channel groups for the ducking/leveling process refer to the base layout. The *downmixId* of the corresponding drcInstructionsUniDrc() indicates how to generate the downmix after the DRC set with a *drcSetEffect* equal to "Ducking other" or "Ducking/Leveling self" was applied.

A DRC set with a *drcSetEffect* equal to "Ducking other" or "Ducking/Leveling self" with *downmixId* equal to 0x0 (baseLayout) is automatically applied independent of the requested *downmixId*. It is therefore recommended to define DRC sets with a *drcSetEffect* equal to "Ducking other" or "Ducking/Leveling self" with *downmixId* equal to 0x0 only for specific use cases, where the DRC set with a *drcSetEffect* equal to "Ducking other" or "Ducking/Leveling self" should be always applied when DRC processing is enabled.

Table 15

Replace the third line with the following:

if ((drcSetEffect & (3<<10)) != 0) {   /* Ducking other, Ducking/Leveling self */

6.4.6

Replace last three sentences of second paragraph, starting with" When ducking is active..." with the following:

When ducking/leveling is active, the ducking/leveling gains in dB are scaled by the factor *duckingScaling,* if present. The *duckingScaling* factors are conveyed in the drcInstructionsUniDrc() payload for the channel they are applied to, which is in contrast to the *bsGainSetIndex* channel assignment for the "Duck other" effect. User-supplied compression and boost factors shall be applied to all DRC sets except DRC sets with a *drcSetEffect* equal to "Clipping", "Fade", "Ducking other" or "Ducking/Leveling self".

Table 17

Replace the fifth line with the following:

    EFFECT_BITS_DUCKING = 0x0400 | 0x0800;   /* drcSetEffect 11 or 12 (Ducking other, Ducking/ Leveling self) */

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Table 35

Replace the 61st line with the following:

    EFFECT_BITS_DUCKING = 0x0400 | 0x0800;   /* drcSetEffect 11 or 12 (Ducking other, Ducking/ Leveling self) */

6.8.4

Replace fourth sentence of first paragraph with the following:

DRCs that are automatically applied, such as for ducking/leveling or fading, are not affected by the EQ selection.

6.9.2

Replace fifth parameter with the following:

$L_{C,\text{DRC},3}$ represents the complexity level of a DRC set with a *drcSetEffect* of "Fade", "Ducking other" or "Ducking/Leveling self", if present. Otherwise, it is 0.

6.10.3

After 6.10.2, add the following subclause:

6.10.3 Loudness Leveling

Loudness Leveling shall be applied if it is switched on as described in B.3.7.3 (default is on). If a DRC set with a "Duck/Level self" effect exists and is selected according to 6.3.7, it is applied according to 6.3.5. If Loudness Leveling is turned off as described in B.3.7.3, the DRC set selection process for DRC sets with a "Duck/Level self" effect is based on the metadata received in the applicable part of the *uniDrcConfigExtension()*-structure (see case UNIDRCCONFEXT_LEVELING in Table 75).

7.3

Replace Table 75 with:

Table 75 — Syntax of uniDrcConfigExtension() payload

Syntax	No. of bits	Mnemonic
uniDrcConfigExtension()		
{		
while (**uniDrcConfigExtType !**= UNIDRCCONFEXT_TERM) {	**4**	**uimsbf**
extSizeBits = **bitSizeLen** + 4;	**4**	**uimsbf**
extBitSize = **bitSize** + 1;	**extSizeBits**	**uimsbf**
switch (uniDrcConfigExtType) {		
case UNIDRCCONFEXT_PARAM_DRC:		
drcCoefficientsParametricDrc();		
parametricDrcInstructionsCount;	**4**	**uimsbf**
for (i=0; i<parametricDrcInstructionsCount; i++) {		
parametricDrcInstructions ();		
}		
break;		
case UNIDRCCONFEXT_V1:		
downmixInstructionsV1Present;	**1**	**bslbf**
if (downmixInstructionsV1Present==1) {		
downmixInstructionsV1Count;	**7**	**uimsbf**
for (i=0; i<downmixInstructionsV1Count; i++) {		
downmixInstructionsV1();		
}		
}		
drcCoeffsAndInstructionsUniDrcV1Present;	**1**	**bslbf**
if (drcCoeffsAndInstructionsUniDrcV1Present==1) {		
drcCoefficientsUniDrcV1Count;	**3**	**uimsbf**
for (i=0; i<drcCoefficientsUniDrcV1Count; i++) {		
drcCoefficientsUniDrcV1();		
}		
drcInstructionsUniDrcV1Count;	**6**	**uimsbf**
for (i=0; i<drcInstructionsUniDrcV1Count; i++) {		
drcInstructionsUniDrcV1();		
}		
}		
loudEqInstructionsPresent;	**1**	**bslbf**
if (loudEqInstructionsPresent==1) {		
loudEqInstructionsCount;	**4**	**uimsbf**

Table 75 *(continued)*

Syntax	No. of bits	Mnemonic
for (i=0; i<loudEqInstructionsCount; i++) {		
loudEqInstructions();		
}		
}		
eqPresent;	**1**	**bslbf**
if (eqPresent==1) {		
eqCoefficients();		
eqInstructionsCount;	**4**	**uimsbf**
for (i=0; i<eqInstructionsCount; i++) {		
eqInstructions();		
}		
}		
break;		
case UNIDRCCONFEXT_LEVELING:		
levelingInstructions();		
break;		
/* add future extensions here */		
default:		
for (i=0; i<extBitSize; i++) {		
otherBit;	**1**	**bslbf**
}		
}		
}		
}		

After Table 90, add:

Table XX — Syntax of levelingInstructions() payload

Syntax	No. of bits	Mnemonic
levelingInstructions()		
{		
for (i=0; i<drcInstructionsUniDrcCount; i++) {		
dse = drcInstructionsUniDrc[i].drcSetEffect;		
if ((dse & (1<<11)) != 0) { /* if Ducking/Leveling self */		
levelingPresent;	**1**	**bslbf**
/* drcInstructionsUniDrc[i].levelingPresent */		
if (levelingPresent==1) {		
duckingOnlyDrcSetPresent;	**1**	**bslbf**
/* drcInstructionsUniDrc[i].duckingOnlyDrcSetPresent */		
if (duckingOnlyDrcSetPresent ==1) {		
/* "Ducking only" DRC set */		
drcInstructionsUniDrc();		
}		

Table XX *(continued)*

Syntax	No. of bits	Mnemonic
}		
}		
}		
for (i=0; i<drcInstructionsUniDrcV1Count; i++) {		
dse = drcInstructionsUniDrcV1[i].drcSetEffect;		
if ((dse & (1<<11)) != 0) { /* if Ducking/Leveling self */		
levelingPresent;	1	bslbf
/* drcInstructionsUniDrcV1[i].levelingPresent */		
if (levelingPresent==1) {		
duckingOnlyDrcSetPresent;	1	bslbf
/* drcInstructionsUniDrcV1[i].duckingOnlyDrcSetPresent */		
if (duckingOnlyDrcSetPresent ==1) {		
/* "Ducking only" DRC set */		
drcInstructionsUniDrcV1();		
}		
}		
}		
}		
}		

8.1.1

Replace the link in the second sentence with the following link:

https://standards.iso.org/iso-iec/23003/-4/ed-2/en/amd/2/

Delete the last sentence.

9.2.1

Replace the link in the first sentence with the following link:

https://standards.iso.org/iso-iec/23003/-4/ed-2/en/amd/2/

9.2.2

Replace second row of Table 94 with the following:

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9.2.2, Table 96

Replace row 13 of Table 96 with the following:

Ducking/Leveling and Fading test condition	Df