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Part 1: MPEG Surround

AMENDMENT 1: Conformance testing

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AMENDEMENT 1: Essai de conformité

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Foreword

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— *Part 1: MPEG Surround*

Information technology — MPEG audio technologies —

Part 1:
MPEG Surround

AMENDMENT 1: Conformance testing

After Clause 7, add a new clause, Conformance testing, as given below:

8 Conformance testing

8.1 Introduction

This clause specifies conformance criteria for both bitstreams and decoders compliant with the MPEG Surround standard as defined in Clauses 1 to 7. This is done to assist implementers and to ensure interoperability.

8.2 Terms and definitions

The terms and definitions as stated in Clause 3 apply. Furthermore, the following terms and definitions will be used throughout this clause.

bitstream – Data encoded according to the MPEG Surround standard.

conformance test bitstream – A bitstream used for testing the conformance of an MPEG Surround decoder.

8.3 MPEG Surround conformance testing

Subclause 4.7 defines the Baseline MPEG Surround profile comprising 6 levels. Some conformance criteria apply to MPEG Surround in general, while others are specific to the Baseline MPEG Surround profile and its levels. Conformance shall be tested for the level of the profile with which a given bitstream or decoder claims to comply.

8.4 Bitstreams

8.4.1 Characteristics

The MPEG Surround AOT can be used in combination with various audio object types.

8.4.2 Test procedure

8.4.2.1 Introduction

An MPEG Surround bitstream shall have the syntax and semantics as specified in Clauses 1 to 7. This subclause defines the conformance criteria that shall be fulfilled by a compliant bitstream. These criteria are specified for the syntactic elements of the bitstream and for some parameters decoded from the MPEG Surround bitstream payload.

8.4.2.2 Configuration header

8.4.2.2.1 SpatialSpecificConfig()

bsSamplingFrequencyIndex Shall be in the range 0x0..0xc or 0xf. For further restrictions, see 8.4.2.5.

bsSamplingFrequency For restrictions, see 8.4.2.5.

bsFrameLength For restrictions, see 8.4.2.5.

bsFreqRes Shall not be encoded with a value of 0.

bsTreeConfig Shall be in the range 0..6. For further restrictions, see 8.4.2.5.

bsQuantMode Shall not be encoded with a value of 3

bsOneIcc No restrictions apply.

bsArbitraryDownmix No restrictions apply.

bsFixedGainsSur Shall be in the range 0..4.

bsFixedGainsLFE Shall be in the range 0..4.

bsFixedGainsDMX No restrictions apply.

bsMatrixMode No restrictions apply.

bsTempShapeConfig Shall not be encoded with a value of 3.

bsDecorrConfig Shall not be encoded with a value of 3.

bs3DaudioMode No restrictions apply.

bsEnvQuantMode Shall be 0.

bs3DaudioHRTFset Shall be 0.

8.4.2.2.2 OttConfig()

bsOttBands Shall not be encoded with a value larger than the value of numBands as given by Table 39.

8.4.2.2.3 TttConfig()

bsTttDualMode No restrictions apply.

bsTttModeLow Shall be in the range 0..5.

bsTttModeHigh Shall be in the range 0..5.

bsTttBandsLow Shall not be encoded with a value larger than the value of numBands as given by Table 39.

8.4.2.2.4 ParamHRTFset()

bsHRTFfreqRes Shall not be encoded with a value of 0.

bsHRTFasymmetric No restrictions apply.

bsHRTFlevelLeft No restrictions apply.

bsHRTFlevelRight No restrictions apply.

bsHRTFphase No restrictions apply.

bsHRTFphaseLR No restrictions apply.

bsHRTFicc No restrictions apply.

bsHRTFiccLR No restrictions apply.

8.4.2.2.5 SpatialExtensionConfig()

bsSacExtType No restrictions apply. Note that in case of values indicated as “reserved” in Table 54, the parsing function SpatialExtensionConfigData(bsSacExtType) shall return the value 0, such that possibly present data is read as bsFillBits (i.e., skipped) and correct parsing of the bitstream can continue.

bsSacExtLen No restrictions apply.

bsSacExtLenAdd No restrictions apply.

bsSacExtLenAddAdd No restrictions apply.

bsFillBits No restrictions apply.

8.4.2.2.6 SpatialExtensionConfigData(0)

The syntactic element SpatialExtensionConfigData(0) shall not be present if the helper variable numSlots has a value that is not listed in Table 55. Furthermore, if this syntactic element is present, the bitstream shall fulfil the requirements outlined in 6.1.13. For further restrictions, see 8.4.2.5.

bsResidualSamplingFrequencyIndex
Shall fulfil the requirements outlined in 6.1.13 and Table 88.

bsResidualFramesPerSpatialFrame
Shall fulfil the requirements outlined in 6.1.13 and Table 87.

8.4.2.2.7 ResidualConfig()

bsResidualPresent No restrictions apply.

bsResidualBands Shall not be encoded with a value larger than the value of **bsOttbands**.

8.4.2.2.8 SpatialExtensionConfigData(1)

The syntactic element SpatialExtensionConfigData(1) shall not be present if bsArbitraryDownmix is encoded with the value of 0 or the helper variable numSlots has a value that is not listed in Table 55. Furthermore, if this syntactic element is present, the bitstream shall fulfil the requirements outlined in 6.1.13.

bsArbitraryDownmixResidualSamplingFrequencyIndex
Shall fulfil the requirements outlined in 6.1.13 and Table 88.

bsArbitraryDownmixResidualFramesPerSpatialFrame
Shall fulfil the requirements outlined in 6.1.13 and Table 87.

bsArbitraryDownmixResidualBands
Shall not be encoded with a value larger than the value of numBands as given by Table 39.

8.4.2.2.9 TreeConfig()

bsOttBoxPresent No restrictions apply.

bsOttDefaultCld No restrictions apply.

bsOttModeLfe No restrictions apply.

bsOttBands Shall not be encoded with a value larger than the value of numBands as given by Table 39.

bsOutputChannelPos Shall be in the range 0..26.

For further restrictions, see 8.4.2.5.

8.4.2.3 Bitstream payload

8.4.2.3.1 SpatialFrame()

bsIndependencyFlag No restrictions apply.

8.4.2.3.2 FramingInfo()

bsFramingType No restrictions apply.

bsNumParamSets For restrictions, see 8.4.2.5.

bsParamSlot[0] Shall be in the range 0..bsFrameLength.

bsDiffParamSlot[ps] Shall be in the range 0..bsFrameLength-bsParamSlot[ps-1]-1.

8.4.2.3.3 OttData()

No restrictions apply.

8.4.2.3.4 TttData()

ICC values of a certain Ttt box shall not be encoded with a value of 0 if (**bsTttModeLow** < 2 || (**bsTttDualMode** == 1 && **bsTttModeHigh** < 2)).

8.4.2.3.5 SmgData()

bsSmoothMode No restrictions apply.

bsSmoothTime No restrictions apply.

bsFreqResStrideSmg No restrictions apply.

bsSmgData No restrictions apply.

8.4.2.3.6 TempShapeData()

bsTempShapeEnable No restrictions apply.

bsTempShapeEnableChannel[ch]
No restrictions apply.

8.4.2.3.7 EnvelopeReshapeHuff()

hcod2D_EnvRes **bsCodeW** shall have a value out of a set of values as defined by column ‘codeword’ of Table A.25, and shall have a length as defined by the corresponding entry in column ‘length’.

8.4.2.3.8 ArbitraryDownmixData()

No restrictions apply.

8.4.2.3.9 EcData()

bsXXXdataMode shall fulfil the requirements outlined in 6.1.13. Shall not be encoded with the value 2 if residual coding is applied.

bsDataPairXXX Shall have the value 0 if setIdx == dataSets-1. No further restrictions apply.

bsQuantCoarseXXX No restrictions apply.

bsFreqResStrideXXX No restrictions apply.

8.4.2.3.10 EcDataPair()

bsPcmCodingXXX No restrictions apply.

bsPilotCodingXXX No restrictions apply.

8.4.2.3.11 GroupedPcmData()

bsPcmWord No restrictions apply.

8.4.2.3.12 DiffHuffData()

hcodPilot_XXX **bsCodeW** shall have a value out of a set of values as defined by column 'codeword' of Tables A.2, A.3 or A.4, respectively, and shall have a length as defined by the corresponding entry in column 'length'.

bsDiffType No restrictions apply.

bsCodingScheme No restrictions apply.

bsPairing No restrictions apply.

bsDiffTimeDirection No restrictions apply.

8.4.2.3.13 HuffData1D()

hcodFirstBand_XXX **bsCodeW** shall have a value out of a set of values as defined by column 'codeword' of Tables A.2, A.3 or A.4, respectively, and shall have a length as defined by the corresponding entry in column 'length'.

hcod1D_XXX_YY **bsCodeW** shall have a value out of a set of values as defined by column 'codeword' of Tables A.5, A.6 or A.7, respectively, and shall have a length as defined by the corresponding entry in column 'length'.

bsSign No restrictions apply.

8.4.2.3.14 HuffData2DFreqPair(), HuffData2DTimePair()

hcodLavIdx **bsCodeW** shall have a value out of a set of values as defined by column 'codeword' of Table A.24, and shall have a length as defined by the corresponding entry in column 'length'.

hcod2D_XXX_YY_ZZ_LL_escape
bsCodeW shall have a value out of a set of values as defined by column 'codeword' of Tables A.8, A.9 or A.10, respectively, and shall have a length as defined by the corresponding entry in column 'length'.

hcod2D_XXX_YY_ZZ_LL
bsCodeW shall have a value out of a set of values as defined by column 'codeword' of the applicable table out of Tables A.11 to A.22, and shall have a length as defined by the corresponding entry in column 'length'.

8.4.2.3.15 SymmetryData()

bsSymBit[i] No restrictions apply.

8.4.2.3.16 LsbData()

bsLsb For restrictions see 8.4.2.3.24.

8.4.2.3.17 SpatialExtensionFrame()

No restrictions apply. Note that in case of bsSacExtType having values indicated as "reserved" in Table 54, the parsing function SpatialExtensionFrameData(bsSacExtType) shall return the value 0, such that possibly present data is read as bsFillBits (i.e., skipped) and correct parsing of the bitstream can continue.

8.4.2.3.18 SpatialExtensionFrameData(0)

For restrictions see 8.4.2.5.

8.4.2.3.19 ResidualData()

bsIccDiffPresent[pi][ps] No restrictions apply.

hcod1D_ICC_Diff **bsCodeW** shall have a value out of a set of values as defined by column 'codeword' of Table A.23, and shall have a length as defined by the corresponding entry in column 'length'.

IccDiff[pi][ps][pb] The value of **IccDiff**[pi][ps][pb] shall not result in an invalid value for **idxICC**[pi][ps][pb].

individual_channel_stream()
Shall fulfil the restrictions outlined for this syntactic element in 5.1 and 5.2 and Tables 77 and 78.

8.4.2.3.20 SpatialExtensionFrameData(1)

No restrictions apply.

8.4.2.3.21 ArbitraryDownmixResidualData()

bsArbitraryDownmixResidualAbs[i]
No restrictions apply.

bsArbitraryDownmixResidualAlphaUpdateSet[i]
No restrictions apply.

individual_channel_stream()
Shall fulfil the restrictions outlined for this syntactic element in 5.1 and 5.2 and Tables 77 and 78.

channel_pair_element() Shall fulfil the restrictions outlined for this syntactic element in 5.1 and 5.2 and Tables 77 and 78. The parameter common_window shall be set to the value of 1.

8.4.2.3.22 SpatialExtensionFrameData(2)

No further restrictions apply.

8.4.2.3.23 ArbitraryTreeData()

No further restrictions apply.

8.4.2.3.24 Restrictions applying to decoded parameters

The following restrictions apply to parameters decoded from the MPEG Surround bitstream.

The helper variable **idxXXX**[pi][ps][pb] shall have values in the ranges as specified in 6.1.2.1 after the corresponding decoding process defined in 6.1.2 was carried out for the present SpatialFrame().

If **bs3DaudioMode** has the value 1, then the absolute value of the determinant of $\mathbf{H}_{\mathrm{Bin}}^{l,k}$ as defined in 6.11.5 shall be larger than or equal to 0.1, i.e.,

$$\left|\det\left(\mathbf{H}_{\mathrm{Bin}}^{l,k}\right)\right| \geq 0.1\,.$$

8.4.2.4 Transport of MPEG Surround data

8.4.2.4.1 Transport in an MPEG environment

8.4.2.4.1.1 Introduction

In case of transport of MPEG Surround data in an MPEG-4 environment, the following restrictions apply.

In case of SpatialSpecificConfig() is conveyed out-of-band, any in-band SpatialSpecificConfig() shall be identical to the out-of-band one.

In case of embedding of MPEG Surround data in MPEG-2/4 AAC payloads, the following restrictions apply. There must be at least one extension_payload() element with extension_type==EXT_SAC_DATA in each AAC frame in order to enable immediate implicit signalling.

In case of embedding of MPEG Surround data in MPEG-1/2 Layer I/II/III bistreams, the following restrictions apply. The first bit of the ancSyncword must be byte-aligned with respect to the first bit of the 0xFFF syncword of the MPEG-1/2 frame header. The AncDataElement() must be completely included in the ancillary data of a single MPEG-1/2 frame. There must be at least one AncDataElement() in the ancillary data of each MPEG-1/2 frame in order to enable immediate implicit signalling.

8.4.2.4.1.2 AncDataElement()

ancSyncword Shall be 0x8E4.

ancType No restrictions apply.

ancStart No restrictions apply.

ancStop No restrictions apply.

ancLenBytes No restrictions apply.

ancLenBytesAdd No restrictions apply.

ancCrcWord Shall have the value as determined by the procedure specified in 7.2.4.

ancDataSegmentByte A data block formed by concatenation of ancDataSegmentByte as specified in 7.2.4 shall, if ancType==0x0 or ancType==0x1, constitute one SacDataFrame() syntax element, padded at the end to obtain an integer number of bytes.

8.4.2.4.1.3 SacDataFrame(sacHeaderFlag)

sacHeaderFlag No restrictions apply.

sacHeaderLen No restrictions apply.

sacHeaderLenAdd No restrictions apply.

bsFillBits No restrictions apply.

sacTimeAlignFlag No restrictions apply.

sacTimeAlign Shall have an absolute value no larger than two times the number of samples in the MPEG Surround PCM frame as defined by **bsFrameLength** and **bsSamplingFrequencyIndex** or **bsSamplingFrequency**.

8.4.2.4.2 Transport over PCM channels

8.4.2.4.2.1 Introduction

In case of transport of MPEG Surround data over PCM channels, the following restrictions apply.

The BuriedData() data shall be embedded in the LSBs of the PCM channels. Typically, 16 bit PCM samples are used. However, also other sample precisions shall be supported, e.g. 20 and 24 bits.

8.4.2.4.2.2 BuriedDataHeader()

bsBDSyncword Shall be 0xAA95.

bsBDChannels Shall have the value of the number of PCM channels in which the MPEG Surround data is embedded.

bsBDFramelength Shall define a PCM buried data frame size which is exactly the same as the MPEG Surround PCM frame size defined by **bsFrameLength** and **bsSamplingFrequencyIndex** or **bsSamplingFrequency.**

bdBDSubframes Shall fulfil the restrictions outlined for this syntactic element in 7.3.3.

bsBDReserved Shall be 0.

bsBDAlloc[channel][subframe]
Shall not exceed the value of n for n bit PCM samples.

bsBDHeaderCrc shall fulfil the restrictions outlined for this syntactic element in 7.3.3.

bsBDHeaderPadding Shall be 0.

8.4.2.4.2.3 BuriedDataFrame()

bsBDFramePadding Shall be 0.

8.4.2.4.2.4 BuriedDataElement()

bsBDType Each BuriedDataFrame() shall at least contain one BuriedDataElement() with **bsBDType** set to the value of 0 or 1. In the case of file based applications, the first frame shall contain a BuriedDataElement() with **bsBDType** set to the value of 1.

bsBDID Shall be set to a value in the range of 0..7, each value shall be used only once in a BuriedDataFrame().

bsBDLengthIdx No restrictions apply.

bsBDLength Shall fulfil the restriction outlined for this syntactic element in 7.3.3.

bsBDBytes Shall contain exactly one SacDataFrame().

bsBDDataCrc Shall fulfil the restrictions outlined for this syntactic element in 7.3.3.

8.4.2.5 Restrictions depending on profiles and levels

8.4.2.5.1 Introduction

Depending on the profile and level associated with the present MPEG Surround bitstream, further restrictions may apply.

8.4.2.5.2 Baseline MPEG Surround profile

For the Baseline MPEG Surround Profile, the following further restrictions apply.

bsSamplingFrequencyIndex
Shall be encoded with a value listed in Table AMD1.1.

bsSamplingFrequency Shall be encoded with a value listed in Table AMD1.1.

bsFrameLength Shall be in the range 3..71.

bsTreeConfig Shall be encoded with a value listed in Table AMD1.1.

Table AMD1.1 — Restrictions for the Baseline MPEG Surround Profile

	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6
bsSamplingFrequencyIndex	0x3..0xc, 0xf	0x3..0xc, 0xf	0x3..0xc, 0xf	0x3..0xc, 0xf	0x3..0xc, 0xf	0x0..0xc, 0xf
bsSamplingFrequency	<= 48000	<= 48000	<= 48000	<= 48000	<= 48000	<= 96000
bsTreeConfig	0..4	0..4	0..4	0..4	0..6	0..6

TreeConfig() After decoding of the syntactic element TreeConfig(), the helper variable numOutChanAT shall have a value not larger than 32.

SpatialExtensionConfigData(0)
This syntactic element shall not be present in case of Level 1 or Level 2.

SpatialExtensionConfigData(1)
This syntactic element shall not be present.

bsNumParamSets Shall have a value not larger than bsFrameLength/4, where the division shall be interpreted as an ANSI C integer division.

8.5 Decoders

8.5.1 Characteristics

8.5.1.1 General

The MPEG Surround decoder can be implemented in two different versions:

- High Quality MPEG Surround
- Low Power MPEG Surround

8.5.1.2 Baseline MPEG Surround profile

- The ability to skip over residual data embedded in the MPEG Surround bitstream payload is mandatory for decoders of level 1 and 2. Decoders of level 3 and higher shall be able to decode and apply a residual bitstream payload.

8.5.2 Test procedure

8.5.2.1 Downmix decoders

An MPEG Surround decoder can be used in combination with a downmix decoder. In this case, the downmix decoder shall fulfil the conformance criteria that are applicable to it. If a downmix decoder other than PCM is used, the MPEG Surround conformance test procedure uses a technique that removes the influence of a potentially inaccurate downmix decoder to the maximum extent possible.