SMPTE ST 2098-2 IMMERSIVE AUDIO BITSTREAM CONSTRAINTS IAB APPLICATION PROFILE 1

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1. ISDCF NOTES AND OVERVIEW

There is a need for a constraining document for the immersive audio bitstream defined in SMPTE ST 2098-2:2019. The full specification is not supported by the current installed base of renderers, and they may take time to be updated. Multiple vendors are making immersive audio renderers or authoring tools and need clear guidance on necessary features for deployment. ISDCF is creating this bitstream constraints document in anticipation of submission to SMPTE and in anticipation of future profiles that incorporate more features of the full ST 2098-2 specification.

This is a bitstream constraint recommended practice. It is intended to guide authoring products to restrict the usage of features that may not be rendered by some equipment in the field. A bitstream would be "qualified" to be an IAB Profile 1 bitstream if it did not exceed the guidance set forth in this profile. This document plus ST 2098-2 can be a fully self-contained guideline for bitstream construction.

Rendering solutions can indicate if they are capable of playing back IAB Profile 1, but this would be guidance to the user, not a definition. Future IAB Profiles (2, 3, etc.) could be supersets of Profile 1.

The document is based on the tests performed during the ISDCF Plugfest held in February 2020, and from information gathered directly by manufacturers. The document has item numbers for use as reference in discussions only. This list includes what is and is not currently supported in IAB bitstream based on current versions of rendering implementations.

It is believed that legacy content (Dolby Atmos) follows the guidelines of IAB Profile 1. None of this legacy content includes the CPL identification information defined in Section 4 below.

2. PURPOSE

SMPTE ST 2098-2 Immersive Audio Bitstream (IAB) defines a bitstream to carry immersive audio. It was designed with many forward-looking features, some of which are not currently supported by renderers in the field. In order to effectively begin the rollout of IAB DCP's to the industry, an agreed set of constraints for the IAB is needed. "IAB Application Profile 1" codifies these requirements and supported features. Profile 1 is based on what is implemented by the immersive audio renderers in theatres as of February 2020. As software develops and more features from ST 2098-2 are added to the renderers in the field, additional profiles may be codified, possibly until the entire feature set of ST 2098-2 is supported across the industry.

3. DCP CONSTRAINTS

3.1. Packaging Format

All compositions carrying a SMPTE ST 2098-2 IAB within an Immersive Audio essence track, as defined in SMPTE ST 429-18, shall comply with the SMPTE packaging constraints as defined by SMPTE ST 429-19.

3.2. Soundfields

Composition shall contain either a 7.1 DS or a 9.1OH soundfield group for the bed, and shall not contain any other bed soundfield group (e.g. 5.1, 11.1, 13.1, 15.1).

4. CPL IDENTIFICATION

4.1. ContentTitleText

The "Audio Type" field of the Digital Cinema Naming Convention for use within the CPL `ContentTitleText` shall be "IAB".

4.2. CompositionMetadataAsset

For CPLs conforming to this Application Profile document, the following `ExtensionMetadata` shall be present within the `CompositionMetaDataAsset`:

```
<cpl-meta:ExtensionMetadata scope="http://isdcf.com/ns/cplmd/app">
  <cpl-meta:Name>Application</cpl-meta:Name>
  <cpl-meta:PropertyList>
    <cpl-meta:Property>
      <cpl-meta:Name>IAB Profile</cpl-meta:Name>
      <cpl-meta:Value>SMPTE-ST-2098-2:2019-P1</cpl-meta:Value>
    </cpl-meta:Property>
  </cpl-meta:PropertyList>
</cpl-meta:ExtensionMetadata>
```

4.3. Legacy Content

If no `ExtensionMetadata` is present or "IAB" is not present in the CPL `ContentTitleText` as defined in 4.1 and 4.2 above, it is assumed the IAB is Profile 1 "Legacy" Content, which still conforms to this document's guidelines and constraints.

5. BITSTREAM CONSTRAINTS

5.1. General Constraints

1. Sample Rate shall be 48 kHz.
2. Frame/edit rate shall be 24/1, 25/1, 30/1, 48/1, 50/1, or 60/1.
3. Number of channels, objects, and MaxRendered constraints:
   a. The maximum number of bed channels shall be 10.
   b. The maximum number of objects shall be 118.
   c. The MaxRendered field (which is the sum of objects and bed channels) of the IAFrame shall have a value of 128 or less.
4. A maximum of one bed per frame shall be in the bitstream.

5.2. Channel Beds

ITEM #	ITEM	BITSTREAM CONSTRAINT	ST 2098-2 SECTION
B1	General Bed Parameters	- SubElementCount of BedDefinition shall be set to "0"	9.2
B2	Channel Beds	- Only the following channels (and associated ChannelIDs) or any subset of them shall be used: 0x0 CHANNEL_SCREEN_LEFT 0x2 CHANNEL_SCREEN_CENTER 0x4 CHANNEL_SCREEN_RIGHT 0x5 CHANNEL_LEFT_SIDE_SURROUND 0x7 CHANNEL_LEFT_REAR_SURROUND 0x8 CHANNEL_RIGHT_REAR_SURROUND 0x9 CHANNEL_RIGHT_SIDE_SURROUND 0xB CHANNEL_LEFT_TOP_SURROUND 0xC CHANNEL_RIGHT_TOP_SURROUND 0xD CHANNEL_LFE	10.3.5
B3	Bed Gain	- ChannelGainPrefix field shall be set to "0" - Bitstream shall not contain the ChannelGain element	9.2, 10.3.7, 10.3.8
B4	Conditional Beds	- The ConditionalBed field shall be set to "0" OR - The ConditionalBed field shall be set to "1", AND the associated BedUseCase field shall be set to 0xFF	5.3, 9.2, 10.3.2, 10.3.3
B5	Bed Remap	- Bitstream shall not contain BedRemap	10.4.1, 10.4.5, 10.4.6
B6	Channel Decorrelation	- ChannelDecorInfoExists field shall be set to "0" - Bitstream shall not contain the ChannelDecorCoefPrefix element - Bitstream shall not contain the ChannelDecorCoef element	9.2, 10.3.9, 10.3.10, 10.3.11
B7	Simultaneous Beds	- Bitstream shall not contain simultaneous beds	A.1

5.3.   Objects

ITEM #	ITEM	BITSTREAM CONSTRAINT	ST 2098-2 SECTION
O1	General Object Parameters	- ObjectDefinition MetaID value shall be less than or equal to 118 - SubElementCount of ObjectDefinition shall be set to "0"	9.4, 10.3.1
O2	Snap Tolerance	- When ObjectSnapTolExists field is present, it shall be set to "0" - Bitstream shall not contain the ObjectSnapTolerance element	9.4, 10.5.9, 11.2
O3	Object Zone and Object Zone Gain	- Bitstream shall not contain ObjectZoneDefinition19	Table 3, 10.5.13, 10.5.14, 10.6
O4	ZoneGainPrefix values	- The 9 ZoneGainPrefix fields shall be assigned values only in certain combinations as defined in Section 5.5 below - ZoneGainPrefix shall only have a value of 0x0 or 0x1	9.4, 10.5.11, 10.5.13
O5	Object Gain	- ObjectGainPrefix field shall be set to "0" - Bitstream shall not contain ObjectGain	9.4, 10.5.5, 10.5.6
O6	Object Spread	- ObjectSpreadMode field shall always be set to 0x02 (OBJECT_SPREAD_1D) - Bitstream shall not contain ObjectSpreadX - Bitstream shall not contain ObjectSpreadY - Bitstream shall not contain ObjectSpreadZ	5.4, 10.5.15, 10.5.16, 10.5.17
O7	Simultaneous Objects	- There shall be a maximum 118 simultaneous objects	A.4
O8	Object Decorrelation Coefficient Prefix	- ObjectDecorCoefPrefix shall only have a value of 0x0 or 0x1 - Bitstream shall not contain ObjectDecorCoef	10.5.18, 10.5.19
O9	Conditional Object	- The ConditionalObject field shall be set to "0" OR - The ConditionalObject field shall be set to "1", AND the associated ObjectUseCase field shall be set to 0xFF	9.4,10.5.1, 10.5.2

5.4.   Informational Metadata

ITEM #	ITEM	BITSTREAM CONSTRAINT	ST 2098-2 SECTION
IM1	General informational metadata parameters or Unknown Data	- Bitstream shall not contain any element, data, or value that is not explicitly defined in SMPTE ST 2098-2	
IM2	Authoring Tool Information	- Bitstream shall not contain the AuthoringToolInfo element	9.1, Table 3, 10.1.1
IM3	User Data	- Bitstream shall not contain the UserData element	9.9, 10.1.1
IM4	AudioDataID	- AudioDataID value shall be limited to 0xFFFE prior to Plex(8) encoding and 0xFFFFFE after Plex(8) encoding.	10.3.6, 10.7.1
IM5	MetaID	- All MetaID values shall be limited to 0xFFFE prior to Plex(8) encoding and 0xFFFFFE after Plex(8) encoding.	10.3.1

Deleted: a width of 16 bits (i.e. FF FFFE maximum)

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5.5. ZoneGainPrefix

The below table defines the sets of ZoneGainPrefix values that shall be supported, as noted in item # O4 in Section 5.3 above.

Zone	ZoneGainPrefix Settings										
	Set #1a	Set #1b	Set #2a	Set #2b	Set #3a	Set #3b	Set #4a	Set #4b	Set #5a	Set #5b	Set #6
All Screen Loudspeakers Left of Center	1	1	1	1	0	0	1	1	0	0	1
Screen Center Loudspeakers	1	1	1	1	1	1	1	1	0	0	1
All Screen Loudspeakers Right of Center	1	1	1	1	0	0	1	1	0	0	1
All Loudspeakers on Left Wall	1	1	0	0	0	0	0	0	1	1	1
All Loudspeakers on Right Wall	1	1	0	0	0	0	0	0	1	1	1
All Loudspeakers on Left Half of Rear Wall	0	0	1	1	1	1	0	0	1	1	1
All Loudspeakers on Right Half of Rear Wall	0	0	1	1	1	1	0	0	1	1	1
All Overhead Loudspeakers Left of Center	1	0	1	0	1	0	1	0	1	0	0
All Overhead Loudspeakers Right of Center	1	0	1	0	1	0	1	0	1	0	0

NOTE: The renderer may default to all Zones enabled unless the ZoneGainPrefix fields are assigned values in accordance with one of the sets defined above.