SMPTE ST 2098-2 IMMERSIVE AUDIO BITSTREAM RENDERER IMPLEMENTATION ISDCF IAB APPLICATION “PROFILE 1”

PURPOSE:

SMPTE ST 2098-2 Immersive Audio Bitstream 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 requirements and supported features for Immersive Audio Renderers is needed. “IAB Application Profile 1” codifies these requirements and supported features. Profile 1 is based on what is currently supported by the immersive audio renderers in theatres, using information from ISDCF Plugfests and manufacturers. As software develops and more features from ST 2098-2 are added to the renderers in the field, additional profiles may be codified until the entire feature set of ST 2098-2 is supported across the industry.

CPL IDENTIFICATION:

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

```
<cpl-meta:ExtensionMetadata scope=" http://www.smpte-ra.org/schemas/429-16/2014/Ext-Meta#scope">
  <cpl-meta:Name>SMPTE</cpl-meta:Name>
  <cpl-meta:PropertyList>
    <cpl-meta:Property>
      <cpl-meta:Name>IAB Profile</cpl-meta:Name>
      <cpl-meta:Value>SMPTE-IAB2098-2-P1</cpl-meta:Value>
    </cpl-meta:Property>
  </cpl-meta:PropertyList>
</cpl-meta:ExtensionMetadata>
```

OVERALL REQUIREMENTS:

1. The supported Sample Rate is 48 kHz
2. Supported frame rates are 24 FPS, 48 FPS and 60 FPS
3. The maximum supported number of bed channels is 10 and the maximum number of objects supported is 118. Thus, in the IAB bitstream, MaxRendered is 10 bed channels and 118 objects maximum
4. Only one bed shall be used

SUPPORTED FEATURES

ITEM NUMBER	ITEM	DESCRIPTION	REQUIRED MINIMUM IMPLEMENTATION	ST 2098-2 REFERENCE SECTION	DOLBY IAB GUIDLINES	COMMENTS
CHANNEL BED SUPPORT ITEMS						
	General Bed Parameters				SubElementCount of BedDefinition shall exist and shall be set to “0” in the IAB	
B1	*Channel Routing*			*10.3.5*		
B1a	5.1*		Must route correctly*		Only 9.1 OH Channels and associated Channel ID’s may be used in the IAB	*This did not get a full pass at the February Plugfest, but seems like it’s a basic requirement
B1b	7.1DS	Routing	Must route correctly		Only 9.1 OH Channels and associated Channel ID’s may be used in the IAB*	*Though not specified in the guidelines, 7.1 soundfield group works correctly per the Plugfest. This is likely due to the fact that the 7.1 channels are also in the 9.1OH soundfield group
B1c	9.1OH	Routing	Must route correctly		Only 9.1 OH Channels and associated Channel ID’s may be used in the IAB	
OBJECT SUPPORT ITEMS						
	General object parameters				ObjectMetaID shall start from 1 and increase sequentially up to the number of objects in a frame	
O2	*Object Snap*	*Snap to closest loudspeaker*		*10.5.8, 10.5.9, 10.5.10*		
O2a	Snap off	Object does not snap	With the snap value set to off, object must not snap to any speaker			

ITEM NUMBER	ITEM	DESCRIPTION	REQUIRED MINIMUM IMPLEMENTATION	ST 2098-2 REFERENCE SECTION	DOLBY IAB GUIDLINES	COMMENTS
O3	*Object Zone and Object Zone Gain*	*A defined zone where an object can be included or excluded. The zone gain determines the objects' inclusion amount*		*Table 3, 10.5.13, 10.5.14, 10.6*	*ZoneGainPrefix shall only have a value of 0x0 or 0x1- which implies that the ZoneGain field would never be present* *The bitstream shall not contain ObjectZoneDefinition19*	
03c	Object Zone Gains that are supported		The particular zones and zone gain combinations noted in Dolby's IAB guideline are supported		*The 9 ZoneGainPrefix fields shall be assigned values only in certain combinations. The renderer will default to all Zones enabled unless ZoneGainPrefix fields are assigned values in accordance with the sets defined in the Dolby IAB Guidline #11*	
O4	*Object Spread*	*Object becomes bigger or smaller, spreading in a defined way*		*5.4, 10.5.15, 10.5.16, 10.5.17*	*ObjectSpreadMode field shall always be set to 0x02 (OBJECT_SPREAD_ID)*	
O4a	Object Spread-1D	Object spreads equally in all dimensions with 12 bit coding	With the Object Spread set to 1D, object must respond to a range from 0 (no spread) to 1 (full spread)			
O5	Object Panning	Object pans in response to pan metadata	Object must pan correctly per metadata value	9.4		
O6	Pan Sub Blocks	Sub divisions within an IA frame that can contain different panning metadata	Pan Sub Blocks must be supported	10.5.3, 10.5.4, Table 23		
O7	Simultaneous Objects	Number of objects that can be played simultaneously	Must be able to correctly play 18 simultaneous objects , with or without the presence of a bed	A.4		Using greater than 18 simultaneous objects may cause unexpected results

ITEM NUMBER	ITEM	DESCRIPTION	REQUIRED MINIMUM IMPLEMENTATION	ST 2098-2 REFERENCE SECTION	DOLBY IAB GUIDLINES	COMMENTS
O9	Object Zones	A defined zone where an object can be included or excluded	Only particular combinations of Object Zones are supported		See table in	
INFORMATIONAL METADATA AND EFFECT ON PLAYBACK						
	General informational metadata parameters				The bitstream shall not contain any element or value that is not explicitly defined in SMPTE ST 2098-2	
IM1	*Authoring Tool Information*			*9.1, Table 3, 10.1.1*	*The bitstream shall not contain the AuthoringToolInfo element*	
IM1b	Placed at the end of IAFrame: ChildElements	IAElement ID Syntax: IAFrame	The presence of Authoring Tool Information at the end of IAFrame:ChildElements will not cause playback issues			Though the Dolby guidelines forbid AuthoringToolInfo it did not cause a problem if placed at the end of IAFrame: ChildElements in the Plugfest **Should we take out this requirement?**
IM2	*Unknown Data*				*The bitstream shall not contain any element or value that is not explicitly defined in SMPTE ST 2098-2*	*Called Unknown Element in the Plugfest document*
IM2b	Placed at the end of IAFrame	IAElement ID Syntax: IAFrame	The presence of UnknownData at the end of IAFrame:ChildElements will not cause playback issues			Though the Dolby guidelines forbid UnknownData, it did not cause a problem if placed at the end of IAFrame in the Plugfest **Should we take out this requirement?**
IM3	*User Data*			*9.9, 10.1.1*	*The bitstream shall not contain the UserData element*	

ITEM NUMBER	ITEM	DESCRIPTION	REQUIRED MINIMUM IMPLEMENTATION	ST 2098-2 REFERENCE SECTION	DOLBY IAB GUIDLINES	COMMENTS
IM3b	Placed at the end of IAFrame: ChildElements		The presence of User Data at the end of IAFrame:ChildElements will not cause playback issues			Though the Dolby guidelines forbid UserData, it did not cause a problem if placed at the end of IAFrame: ChildElements in the Plugfest **Should we take out this requirement?**
IM4	Audio Description		The presence of an Audio Description code will not cause playback issues	10.3.12		

NON-SUPPORTED FEATURES

ITEM NUMBER	ITEM	DESCRIPTION	NOT REQUIRED IMPLEMENTATION	ST 2098-2 REFERENCE SECTION	DOLBY IAB GUIDLINES	COMMENTS
CHANNEL BED SUPPORT ITEMS						
	General Bed Parameters				SubElementCount of BedDefinition shall exist and shall be set to “0” in the IAB Only one bed shall be used	
B1	*Channel Routing*			*10.3.5*		
B1a	5.1		Not required to correctly route a 5.1 bed		Only 9.1 OH Channels and associated Channel ID’s may be used in the IAB	This is here based on 5.1 not passing all implementations at the February Plugfest, but if seems it should really be a requirement
B1d	Greater than 9.1OH (e.g. 11.1, 13.1, 15.1)		Not required to support bed soundfield groups greater than 9.1OH. For example, 11.1, 13.1 and 15.1 are not required to be supported		Only 9.1 OH Channels and associated Channel ID’s may be used in the IAB	Using beds with soundfield groups greater than 9.1OH may cause unexpected results

ITEM NUMBER	ITEM	DESCRIPTION	NOT REQUIRED IMPLEMENTATION	ST 2098-2 REFERENCE SECTION	DOLBY IAB GUIDLINES	COMMENTS
B2	Bed Gain		Not required to respond to Bed Gain	9.2, 10.3.7, 10.3.8	ChannelGainPrefix field shall exist and shall be set to "0" in the IAB The bitstream shall not contain the ChannelGain element	
B3	*Target Environment*		*Not required to respond to Target Environment*	*5.3*		*Using Target Environment may cause unexpected results*
B3a	Channel Decorrelation		Not required to respond to channel Decorrelation	9.2, 10.3.9, 10.3.10, 10.3.11	ChannelDecorInfoExists field shall exist and shall be set to "0" in the IAB The bitstream shall not contain the ChannelDecorCoefPrefix element The bitstream shall not contain the ChannelDecorCoef element	
B3b	Conditional Beds		Not required to play conditional beds	9.2, 10.3.2	The ConditionalBed field shall be set to "0", or the ConditionalBed field shall be set to "1," and the associated BedUseCase field set to 0xFF (i.e. 8 bits of all ones"). This is "always use" in ST 2098-2 Table 1	Using Conditional Beds may cause unexpected results
B3c	Bed Remap		Not required to respond to Bed Remap Coefficients	10.4.1, 10405, 10.4.6	The bitstream shall not contain BedRemap	Using Bed Remap Coefficients may cause unexpected results
B4	Simultaneous Beds		Not required to play simultaneous beds			Using Simultaneous Beds may cause unexpected results
OBJECT SUPPORT ITEMS						
	General object parameters				SubElementCount of ObjectDefinition shall exist and shall be set to "0" in the IAB	

ITEM NUMBER	ITEM	DESCRIPTION	NOT REQUIRED IMPLEMENTATION	ST 2098-2 REFERENCE SECTION	DOLBY IAB GUIDLINES	COMMENTS
O1	Object Gain			9.4, 10.5.5, 10.5.6	ObjectGainPrefix field shall exist and shall be set to “0” in the IAB The bitstream shall not contain the ObjectGain element.	
O2	*Object Snap*	*Snap to closest loudspeaker*		*10.5.8, 10.5.9, 10.5.10*		
O2b	Snap On		Not required to respond to Snap On			Using snap on may cause unexpected results
O2c	Snap Tolerance		Not required to respond to Snap Tolerance	11.2	ObjectSnapTolExists field shall exist and shall be set to “0” in the IAB The bitstream shall not contain the ObjectSnapTolerance element	Using snap tolerance may cause unexpected results
O3	*Object Zone and Object Zone Gain*	*A defined zone where an object can be included or excluded. The zone gain determines the objects’ inclusion amount*		*Table 3, 10.5.13, 10.5.14, 10.6*	*ZoneGainPrefix shall only have a value of 0x0 or 0x1-which implies that the ZoneGain field would never be present* *The bitstream shall not contain ObjectZoneDefinition19*	
O3a	Object Zone Gain 0 or 1		Not required to respond to Zone Gain other than the predefined zone combinations. All zones are otherwise considered always on			Using Zone Gain outside of the predefined zone combinations may cause unexpected results
O3b	Object Zone Gain-range		Not required to respond to Zone Gain other than the predefined zone combinations. All zones are otherwise considered always on			Using Zone Gain outside of the predefined zone combinations may cause unexpected results
O4	*Object spread*	*Object becomes bigger or smaller, spreading in a defined way*		*5.4, 10.5.15, 10.5.16, 10.5.17*		
O4b	Object Spread-Low Rez	Object spreads equally in all dimensions with 8 bit coding	Not required to respond to spread values in Low Rez mode			

ITEM NUMBER	ITEM	DESCRIPTION	NOT REQUIRED IMPLEMENTATION	ST 2098-2 REFERENCE SECTION	DOLBY IAB GUIDLINES	COMMENTS
O4c	Object Spread-3D	Object spreads with specific spreading in each dimension	Not required to respond to spread values in 3D mode		The bitstream shall not contain the ObjectSpreadX, ObjectSpreadY or ObjectSpreadZ elements	Using Object Spread-3D may cause unexpected results
O5	Object Decorrelation	Degree of decorrelation desired between multiple output signals derived from a single audio waveform	Not required to respond to object decorrelation parameters	10.5.18, 10.5.19	ObjectDecorCoefPrefix shall only have a value of 0x0 or 0x1- which implies that the ObjectDecorCoef field would never be present	Using Object Decorrelation may cause unexpected results
O8	Conditional Object	Object that plays when certain conditions are met	Not required to support conditional objects	9.4,10.5.1, 10.5.2	The ConditionalObject field shall be set to "0", or the ConditionalObject field shall be set to "1," and the associated ObjectUseCase field set to 0xFF (i.e. 8 bits of all ones"). This is "always use" in ST 2098-2 Table 1 The bitstream shall not contain the ObjectUseCase element	
INFORMATIONAL METADATA AND EFFECT ON PLAYBACK						
	General informational metadata parameters				The bitstream shall not contain any element or value that is not explicitly defined in SMPTE ST 2098-2	
IM1	*Authoring Tool Information*			*9.1, Table 3, 10.1.1*	*The bitstream shall not contain the AuthoringToolInfo element*	
IM1a	At the beginning of IAFrame: ChildElements	IAElement Syntax: IAFrame	Not required to support playback when Authoring Tool Information is at the beginning of IAFrame:ChildElements			**Should this be a more general requirement that AuthoringToolInfo is simply not supported?**
IM2	*Unknown Data*				*The bitstream shall not contain any element or value that is not explicitly defined in SMPTE ST 2098-2*	*Called "Unknown Element" in the Plugfest document*

ITEM NUMBER	ITEM	DESCRIPTION	NOT REQUIRED IMPLEMENTATION	ST 2098-2 REFERENCE SECTION	DOLBY IAB GUIDLINES	COMMENTS
IM2a	Placed at the beginning of IAFrame	IAElement Syntax: IAFrame	Not required to support playback when UnknownData is at the beginning of IAFrame			**Should this be a more general requirement that UnknownData is simply not supported?**
IM3	*User Data*			*9.9, 10.1.1*	*The bitstream shall not contain the UserData element*	
IM3a	At the beginning of IAFrame: ChildElements	IAElement Syntax: IAFrame	Not required to support playback when User Data is at the beginning of IAFrame:ChildElements			**Should this be a more general requirement that UserData is simply not supported?**