

# SMPTE STANDARD



## D-Cinema Immersive Audio Channels and Soundfield Groups

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## Foreword

SMPTE (the Society of Motion Picture and Television Engineers) is an internationally-recognized standards developing organization. Headquartered and incorporated in the United States of America, SMPTE has members in over 80 countries on six continents. SMPTE's Engineering Documents, including Standards, Recommended Practices, and Engineering Guidelines, are prepared by SMPTE's Technology Committees. Participation in these Committees is open to all with a bona fide interest in their work. SMPTE cooperates closely with other standards-developing organizations, including ISO, IEC and ITU.

SMPTE Engineering Documents are drafted in accordance with the rules given in its Standards Operations Manual. This SMPTE Engineering Document was prepared by Technology Committee 21DC.

## Intellectual Property

At the time of publication no notice had been received by SMPTE claiming patent rights essential to the implementation of this Engineering Document. However, attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. SMPTE shall not be held responsible for identifying any or all such patent rights.

## Introduction

This section is entirely informative and does not form an integral part of this Engineering Document.

SMPTE ST 428-12 defines identifiers for channel-based D-Cinema audio essence, and also defines identifiers for channel-based Soundfield Groups. This document extends these concepts to the additional Audio Channels and Soundfield Groups associated with Immersive Audio.

## 1 Scope

This standard defines names and abbreviations for Immersive Audio Channels and Immersive Soundfield Groups associated with D-Cinema Immersive Audio presentation. This standard also provides informative guidance on typical locations of cinema Loudspeakers used for Immersive Audio reproduction.

This standard neither specifies the suitability of Audio Channels and Soundfield Groups for a particular sound track, nor specifies the Loudspeakers to be present in an auditorium.

## 2 Conformance Notation

Normative text is text that describes elements of the design that are indispensable or contains the conformance language keywords: “shall”, “should”, or “may”. Informative text is text that is potentially helpful to the user, but not indispensable, and can be removed, changed, or added editorially without affecting interoperability. Informative text does not contain any conformance keywords.

All text in this document is, by default, normative, except: the Introduction, any section explicitly labeled as “Informative” or individual paragraphs that start with “Note:”

The keywords “shall” and “shall not” indicate requirements strictly to be followed in order to conform to the document and from which no deviation is permitted.

The keywords, “should” and “should not” indicate that, among several possibilities, one is recommended as particularly suitable, without mentioning or excluding others; or that a certain course of action is preferred but not necessarily required; or that (in the negative form) a certain possibility or course of action is deprecated but not prohibited.

The keywords “may” and “need not” indicate courses of action permissible within the limits of the document.

The keyword “reserved” indicates a provision that is not defined at this time, shall not be used, and may be defined in the future. The keyword “forbidden” indicates “reserved” and in addition indicates that the provision will never be defined in the future.

A conformant implementation according to this document is one that includes all mandatory provisions (“shall”) and, if implemented, all recommended provisions (“should”) as described. A conformant implementation need not implement optional provisions (“may”) and need not implement them as described.

Unless otherwise specified, the order of precedence of the types of normative information in this document shall be as follows: Normative prose shall be the authoritative definition; Tables shall be next; followed by formal languages; then figures; and then any other language forms.

## 3 Normative References

The following standards contain provisions that, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this recommended practice are encouraged to investigate the possibility of applying the most recent edition of the standards indicated below.

SMPTE ST 428-12:2013, D-Cinema Distribution Master Common Audio Channels and Soundfield Groups

## 4 Terms and Definitions

All terms from SMPTE ST 428-12 apply with the following additions:

### **Base Layer**

Refers to the nominally horizontal layer of Loudspeakers used in 5.1 and 7.1 Soundfield Configurations.

### **Height Layer**

Refers to the layer of Loudspeakers placed on the walls, above the Base Layer.

### **Top Layer**

Refers to the layer of Loudspeakers placed on the ceiling over the audience.

### **Immersive Audio**

Audio that is created with the intent of being reproduced as Immersive Sound via an Immersive Sound System.

### **Immersive Audio Channel**

Audio Channel that is intended to drive specific Height Layer or Top Layer Loudspeakers. See Table 1.

### **Immersive Sound**

Includes sound that emanates from sources at and beyond the Base Layer.

### **Immersive Sound System**

A sound system capable of producing Immersive Sound.

### **Immersive Soundfield**

The Soundfield created by reproducing Immersive Audio.

### **Immersive Soundfield Configuration**

Defined arrangement or configuration of Base Layer Loudspeakers, plus Height Layer and/or Top Layer Loudspeakers, that conveys the intended Immersive Soundfield.

### **Immersive Soundfield Group**

A Soundfield Group that contains Immersive Audio Channels in addition to common cinema Audio Channels.

## 5 Parameters

This standard associates all parameters defined in SMPTE ST 428-12 with D-Cinema Immersive Audio Channels and Soundfield Groups with the exception of the UL parameter and the Soundfield Group symbol.

## 6 Immersive Audio Channels

Table 1 lists common D-Cinema Immersive Audio Channels. The names and abbreviations in this table shall be used when referencing Immersive Audio Channels in order to ensure consistency.

Many Immersive Audio Channels are meant to drive Loudspeakers defined in Annex B, and are denoted as such. The abbreviation of these Immersive Audio Channels is identical to the abbreviation of the associated Loudspeaker.

**Table 1. Immersive Audio Channels**

<b>Name</b>	<b>Abbreviation</b>	<b>Description</b>
Left Height	Lh	Intended to drive the Left Height Loudspeaker.
Right Height	Rh	Intended to drive the Right Height Loudspeaker.
Center Height	Ch	Intended to drive the Center Height Loudspeaker.
Left Surround Height	Lsh	Intended to drive the Left Surround Height Loudspeaker(s).
Right Surround Height	Rsh	Intended to drive the Right Surround Height Loudspeaker(s).
Left Side Surround Height	Lssh	Intended to drive the Left Side Surround Height Loudspeaker(s).
Right Side Surround Height	Rssh	Intended to drive the Right Side Surround Height Loudspeaker(s).
Left Rear Surround Height	Lrsh	Intended to drive the Left Rear Surround Height Loudspeaker(s).
Right Rear Surround Height	Rrsh	Intended to drive the Right Rear Surround Height Loudspeaker(s).
Left Top Surround	Lts	Intended to drive the Left Top Surround Loudspeaker(s).
Right Top Surround	Rts	Intended to drive the Right Top Surround Loudspeaker(s).
Top Surround	Ts	Intended to drive the Top Surround Loudspeaker(s).

## 7 Immersive Soundfield Groups

Table 2 lists common D-Cinema Immersive Soundfield Groups. Each Immersive Soundfield Group consists of a collection of common cinema Audio Channels plus one or more Immersive Audio Channels from Table 1, meant to be played out simultaneously through a given Immersive Soundfield Configuration. Annex C depicts these Immersive Soundfield Configurations. The names in this table shall be used when referencing Immersive Soundfield Groups in order to ensure consistency.

**Table 2. Immersive Soundfield Groups**

Name	Audio Channels
9.1OH	L, C, R, Lss, Rss, Lrs, Rrs, LFE, Lts, Rts
9.1HT	L, C, R, Ls, Rs, LFE, Lh, Rh, Lsh, Rsh
11.1HT	L, C, R, Ls, Rs, LFE, Lh, Ch, Rh, Lsh, Rsh, Ts
13.1HT	L, C, R, Lss, Rss, Lrs, Rrs, LFE, Lh, Ch, Rh, Lsh, Rsh, Ts
15.1HT	L, C, R, Lss, Rss, Lrs, Rrs, LFE, Lh, Ch, Rh, Lssh, Rssh, Lrsh, Rrsh, Ts

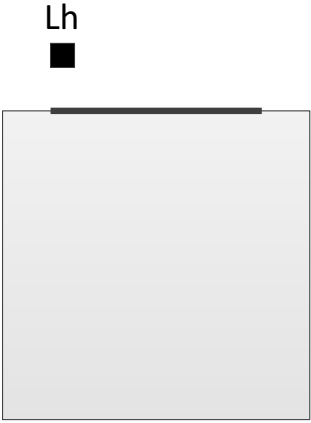
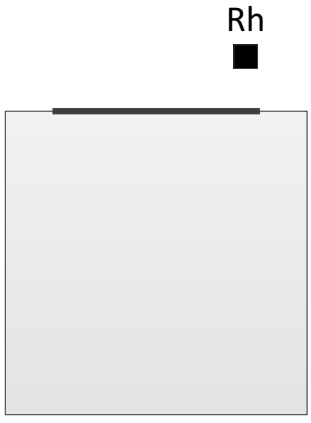
**Annex A**  
**Bibliography (Informative)**

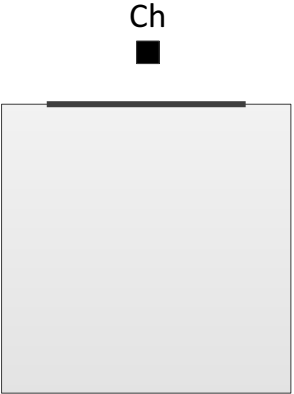
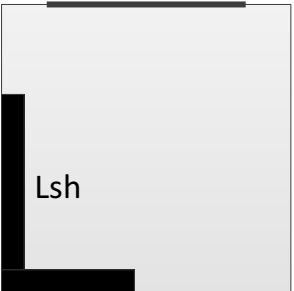
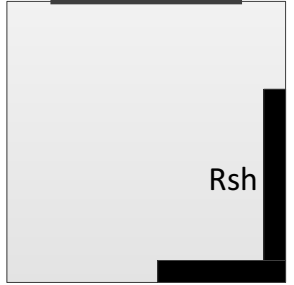

Report of the Study Group on Immersive Audio Systems: Cinema B-Chain and Distribution, 31 March 2014

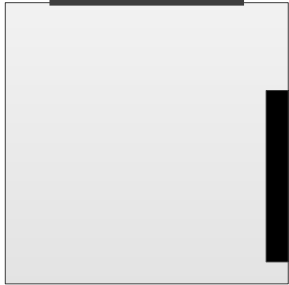
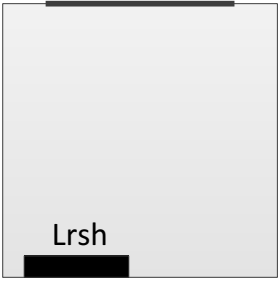
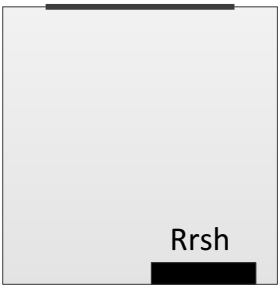
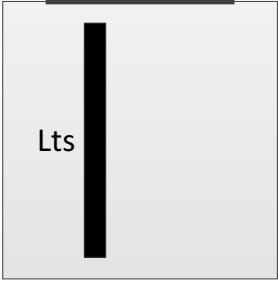
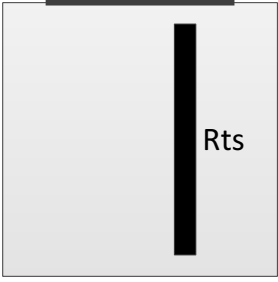
## Annex B Immersive Loudspeakers (Informative)

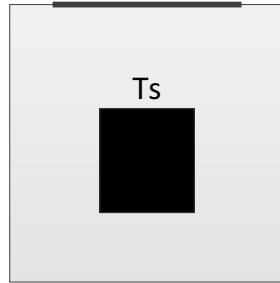
The following table lists common D-Cinema Loudspeakers for Immersive Audio reproduction, including their name, abbreviation (in parentheses) and a description of their typical location. Each Loudspeaker definition is accompanied by a plan view diagram illustrating their general location – the shaded square denotes the boundaries of the auditorium with the screen as a heavy line at the top. Refer to SMPTE ST 428-12 for Loudspeaker positions of Base Layer Loudspeakers.

**Table B1. D-Cinema Loudspeakers for Immersive Audio Reproduction.**

 <p>The diagram shows a shaded square representing the auditorium. A thick horizontal line at the top represents the screen. A small black square representing the loudspeaker is positioned at the top-left corner of the shaded area, directly above the screen line.</p>	<p><b>Lh</b></p> <p><b>Left Height (Lh)</b></p> <p>Positioned behind the screen directly above the Left Loudspeaker, at the left top corner of the screen.</p>
 <p>The diagram shows a shaded square representing the auditorium. A thick horizontal line at the top represents the screen. A small black square representing the loudspeaker is positioned at the top-right corner of the shaded area, directly above the screen line.</p>	<p><b>Rh</b></p> <p><b>Right Height (Rh)</b></p> <p>Positioned behind the screen directly above the Right Loudspeaker, at the right top corner of the screen.</p>

 <p style="text-align: center;">Ch</p>	<p><b>Center Height (Ch)</b></p> <p>Positioned behind the screen directly above the Center Loudspeaker, at the top center of the screen.</p>
 <p style="text-align: center;">Lsh</p>	<p><b>Left Surround Height (Lsh)</b></p> <p>An elevated array of Loudspeakers positioned along the left side and left rear of the room near the ceiling, typically directly above the Ls array, starting approximately 1/3 of the distance from the screen to the rear wall.</p>
 <p style="text-align: center;">Rsh</p>	<p><b>Right Surround Height (Rsh)</b></p> <p>An elevated array of Loudspeakers positioned along the right side and right rear of the room near the ceiling, typically directly above the Rs array, starting approximately 1/3 of the distance from the screen to the rear wall.</p>
 <p style="text-align: center;">Lssh</p>	<p><b>Left Side Surround Height (Lssh)</b></p> <p>An array of Loudspeakers positioned along the left side of the room near the ceiling, typically directly above the Lss array, starting approximately 1/3 of the distance from the screen to the rear wall.</p>

	<p><b>Right Side Surround Height (Rssh)</b></p> <p>An array of Loudspeakers positioned along the right side of the room near the ceiling, typically directly above the Rss array, starting approximately 1/3 of the distance from the screen to the rear wall.</p>
	<p><b>Left Rear Surround Height (Lrsh)</b></p> <p>One or more Loudspeakers typically positioned on the left rear wall of the room near the ceiling, directly above the Lrs Loudspeaker(s).</p>
	<p><b>Right Rear Surround Height (Rrsh)</b></p> <p>One or more Loudspeakers typically positioned on the right rear wall of the room near the ceiling, directly above the Rrs Loudspeaker(s).</p>
	<p><b>Left Top Surround (Lts)</b></p> <p>An array of Loudspeakers mounted on or near the ceiling, typically positioned laterally between the Center screen Loudspeaker and the Left screen Loudspeaker.</p>
	<p><b>Right Top Surround (Rts)</b></p> <p>An array of Loudspeakers mounted on or near the ceiling, typically positioned laterally between the Center screen Loudspeaker and the Right screen Loudspeaker.</p>



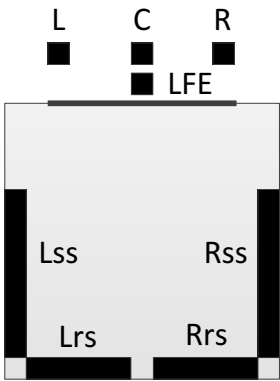
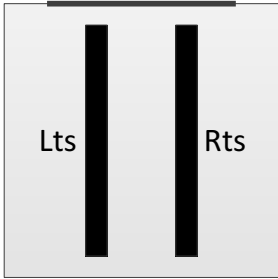
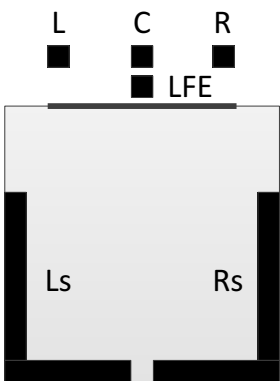
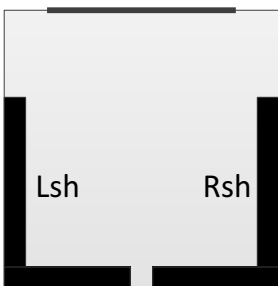
**Top Surround (Ts)**

One or more Loudspeakers typically positioned on the ceiling over the center of the seating area.

## Annex C Immersive Soundfield Configuration Diagrams (Informative)

The following table lists the names of common Immersive Soundfield Configurations along with plan view diagrams showing the relative placement of Loudspeakers in a cinema.

**Table C1. Immersive Soundfield Configurations.**

Name	Base Layer Loudspeakers	Height/Top Layer Loudspeakers
9.1.0H		
9.1.1HT		
11.1.1HT	