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SMPTE 323M-2004
Revision of
SMPTE 323M-1999

SMPTE STANDARD

for Motion-Picture Film — Channel Assignments and Levels on Multichannel Audio Media

1 Introduction

This standard provides specifications for the placing of a 5.1 channel audio program onto multitrack audio media. The multichannel audio system consists of left, center, right, left surround, right surround, and subwoofer (SW) channels. This standard specifies a mapping between the audio signals intended to feed loudspeakers, and a sequence of audio tracks on multitrack audio storage media. This standard also specifies the relative levels of the audio signals. Media prepared according to this standard will play properly on a loudspeaker system calibrated according to the theatrical exhibition standard, SMPTE RP 200.

In theatrical exhibition systems, the SW channel is always reproduced. Domestic consumer multichannel audio employs a low-frequency effects (LFE) channel which can carry the information included on the cinema SW channel. However, in consumer audio systems, the LFE channel is considered optional in reproduction, and is intended to carry extreme high-level and low-frequency effects. When an audio program originally produced as a feature film for theatrical release is transferred to consumer media, the LFE channel is often derived from the dedicated theatrical subwoofer channel. When transferring programs originally produced for the theatrical reproduction over to media intended for domestic consumer reproduction, it may be necessary to remix some of the content of the subwoofer channel into the main full bandwidth channels so as to maintain the artistic integrity of the program content in case the LFE channel is not reproduced.

2 Scope

This standard specifies the audio channel assignment, and the relative levels of the audio channels, for recordings of audio programs containing six audio channels, onto storage media for film sound. Programs which are placed on media according to this standard are intended for reproduction in the cinema where the SW channel is always reproduced. This standard is not intended for application in the area of sound intended for reproduction in the domestic consumer environment.

3 Normative references

The following standards contain provisions which, 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 standard are encouraged to investigate the possibility of applying the most recent edition of the standards indicated below.

SMPTE RP 127-1999, Specifications for Type U Audio Level and Multifrequency Test Film for 35-mm Studio Audio Reproducers, Magnetic Full-Coat Type

SMPTE RP 155-2004, Motion Pictures and Television — Reference Level for Digital Audio Systems

SMPTE RP 200-2002, Relative and Absolute Sound Pressure Levels for Motion-Picture Multichannel Sound Systems — Applicable for Analog Photographic Film Audio, Digital Photographic Film Audio and D-Cinema

Approved
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4 Channel assignments

4.1 Signal definitions

Table 1 specifies the nomenclature used to identify audio channels. The Lt,Rt terms refer to a two-channel matrix surround encoded program.

Table 1 – Audio channel abbreviations

Audio channel	Abbreviation
Left	L
Center	C
Right	R
Left surround	LS
Right surround	RS
Subwoofer	SW
Mono surround	MS
Mono surround at a –3 dB level	MS (–3 dB)
Left total	Lt
Right total	Rt
Unassigned/unused	U

4.2 Track assignments

Table 2 indicates three allowed track assignments denoted A, B, and C. Eight tracks are shown. For media with six tracks, the assignments for tracks 1-6 apply. Some media have more than eight tracks or a multiple of eight tracks. Media with more than eight tracks shall follow the assignment in table 2 for the first group of eight tracks. When relevant (i.e., additional multichannel programs are carried), it is recommended that other groupings of 8 tracks (i.e., tracks 9-16 or 17-24 on a 24-track media) also follow the channel assignments shown in table 2.

Table 2 – Track assignments for media with 6 or more channels

Track	Standard assignment A			Standard assignment B			Standard assignment C		
1	L			L			L		
2	R			LS (see note)			C		
3	C			C			R		
4	SW			RS (see note)			LS		
5	LS (see note)			R			RS		
6	RS (see note)			SW			SW		
7	Lt	or	U	Lt	or	U	Lt	or	U
8	Rt		U	Rt		U	Rt		U

Note – In the case of programs with a monophonic surround channel, the MS (–3 dB) monophonic surround signal can be placed on both tracks 5 and 6. This allows a program with a single surround channel to be treated as a program with two surround channels. The MS (–3 dB) signal will be reproduced out of both the LS and RS loudspeakers, with a relative level of –3 dB with respect to the front channels. The combined power into the room will be the correct relative level of 0 dB.

5 Digital signal characteristics

5.1 Channel assignments and levels

Digital media conforming to this standard shall employ a nominal sampling frequency of 48 kHz.

NOTE – There is some limited usage of digital audio with a sampling frequency of 1000/1001 or 1001/1000 relative to the 48-kHz value. These applications are considered within the scope of this standard. Storage media labeled as conforming to this standard shall be playable at the 48-kHz sample rate. These storage media may also be playable at the off-speed rates, where appropriate, in order to remain in sync with a corresponding source of pictures.

5.2 Emphasis

The audio signals carried by digital media which conform to this standard shall not contain any frequency emphasis.

6 Level alignment

6.1 Level calibration

The audio channels are recorded onto storage media with levels relative to the intended acoustic level for reproduction as indicated in table 3.

Table 3 – Relative levels of recorded channels

Channel	Relative level
L	0 dB
R	0 dB
C	0 dB
SW	–10 dB
LS	+3 dB
RS	+3 dB

The three front channels are recorded at equal level. The surround channels are recorded at a level offset of +3 dB, which is suitable for reproduction in a cinema which has left and right surround speaker systems, each of which has an acoustic output of –3 dB relative to the frontal channels (given a common stimulus).

The SW channel is stored with a level offset of –10 dB. This offset is compensated for in the reproduction system, where the subwoofer channel has an acoustic output (within its low-frequency passband) of +10 dB with respect to an individual front (L, C, or R) channel.

6.2 Level calibration test signals

6.2.1 Tones

Level calibration tones are the subject of SMPTE RP 127 and SMPTE RP 155.

6.2.2 Pink noise

Pink noise test signals, if present, shall be at equal levels on all channels.

7 Media labeling

Media which conform to this standard shall have a label that clearly documents the contents of each individual track, and any test or alignment signals that are present. The preferred form of the label is a standardized electronic label. At the time of issuance of this standard, a standardized method of electronic labeling is not available.

For recorded media, the preferred form of labeling is to store the label in electronic form on the media along with the audio information. For transmission media, the electronic label should be included in the transmission.

For removable media, until a standardized form of electronic label is available, and for those removable media which cannot carry an electronic label, a human readable textual label shall be closely associated with the media.

The label shall indicate compliance with either the A, B, or C columns in table 2 by using the notation: SMPTE 323M-A, SMPTE 323M-B, or SMPTE 323MC.

Examples of labeling are shown in annex A.

Annex A (informative)
Tape label

Examples of a tape label for an eight-channel tape recorded according to this standard are shown in table A.1.

Tape number: 123

Title: An Example Film

Program details: A set of examples to illustrate labeling and usage of this standard.

Tone alignment level: –20 dBFS

Pink noise alignment level: –30 dBFS rms

Table A.1 – Example of tape label

	(Example 1)	(Example 2)	(Example 3)	(Example 4)
Track	SMPTE 323M-A	SMPTE 323M-A	SMPTE 323M-B	SMPTE 323M-C
1	L	L	L	L
2	R	R	LS	C
3	C	C	C	R
4	SW	SW	RS	LS
5	LS	LS	R	RS
6	RS	RS	SW	SW
7	Lt	U	Lt	Lt
8	Rt	U	Rt	Rt

Annex B (informative)
Bibliography

SMPTE 320M-1999, Television — Channel Assignments and Levels on Multichannel Audio Media

ITU-R BS.775-1 (07/94), Multichannel Stereophonic Sound System With and Without Accompanying Picture