



Recommendation ITU-R BS.775-3
(08/2012)

**Multichannel stereophonic sound system
with and without accompanying picture**

BS Series
Broadcasting service (sound)



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Foreword

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Series of ITU-R Recommendations

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Series	Title
BO	Satellite delivery
BR	Recording for production, archival and play-out; film for television
BS	Broadcasting service (sound)
BT	Broadcasting service (television)
F	Fixed service
M	Mobile, radiodetermination, amateur and related satellite services
P	Radiowave propagation
RA	Radio astronomy
RS	Remote sensing systems
S	Fixed-satellite service
SA	Space applications and meteorology
SF	Frequency sharing and coordination between fixed-satellite and fixed service systems
SM	Spectrum management
SNG	Satellite news gathering
TF	Time signals and frequency standards emissions
V	Vocabulary and related subjects

Note: This ITU-R Recommendation was approved in English under the procedure detailed in Resolution ITU-R 1.

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RECOMMENDATION ITU-R BS.775-3*, **

**Multichannel stereophonic sound system with
and without accompanying picture**

(1992-1994-2006-2012)

Scope

Digital TV has rapidly gained ground around the world. Several digital television broadcasting services have already been introduced in the terrestrial and in the satellite bands. As part of these digital broadcasting services, multichannel audio services are used or have been specified to enhance the directional stability of the frontal sound image and the sensation of spatial reality (ambience).

Recommendation ITU-R BS.775 recommends one universal multichannel stereophonic sound system with three front channels and two rear/side channels together with an optional low frequency effects (LFE) channel.

The ITU Radiocommunication Assembly,

considering

- a) that it is widely recognized that a two-channel sound system has serious limitations and improved presentation is necessary;
- b) that the requirements of cinema presentation differ from those that apply in the home, particularly with respect to room and screen size and distribution of listeners, but that the same programmes may be reproduced in either the cinema or the home;
- c) that broadcast HDTV signals, and those delivered by other media, should be capable of giving appropriate sound quality with a wide range of domestic loudspeaker configurations, including compatibility with two-channel stereophonic and monophonic listening;
- d) that for multichannel sound it is desirable to separate the requirements of production, delivery and domestic presentation, though these are mutually interacting;
- e) that investigations about multichannel sound transmission and reproduction associated and not associated with accompanying picture are being carried out with the basic requirements;
- f) that one universal multichannel sound system applicable to both sound and television broadcasting would be beneficial to the listener;
- g) that compromises may be necessary to ensure that the system is as universal and as practical as possible;
- h) that a hierarchy of compatible sound systems for broadcasting, cinema and recordings is useful for programme exchange and up- and down-mixing depending on the programme material;

* This Recommendation should be brought to the attention of the International Electrotechnical Commission (IEC) and the Society of Motion Picture and Television Engineers (SMPTE).

** Radiocommunication Study Group 6 made editorial amendments to this Recommendation in November 2009 in accordance with Resolution ITU-R 1.

- j) that ancillary services such as those for the visually impaired and hearing impaired are desirable;
- k) that advances in digital audio coding currently allow the delivery of multiple audio channels in an efficient manner,

recommends

1 the universal multichannel stereophonic sound system, with or without accompanying picture, within a hierarchy given in Annex 1;

2 the following reference loudspeaker arrangement (see Fig. 1):

- three front loudspeakers combined with two rear/side loudspeakers (Note 1);
- the left and right frontal loudspeakers are placed at the extremities of an arc subtending 60° at the reference listening point (Notes 2 and 3).

Where for reasons of available space, it is preferred to place the frontal loudspeakers on a straight line base, then it may be necessary to introduce compensating time delays in the signal feed of the centre loudspeaker;

- both side/rear loudspeakers should be placed within the sectors from 100° to 120° from the centre front reference. Precise location is not necessary. Side/rear loudspeakers should be no closer to the listener than the frontal loudspeakers, unless compensating time delay is introduced (Notes 4 and 5);
- the acoustic centre of frontal loudspeakers should ideally be at a height approximately equal to that of the listener's ears. This implies an acoustically transparent screen. Where a non-acoustically transparent screen is used, the centre loudspeaker should be placed immediately above or below the picture. The height of side/rear loudspeakers is less critical;

3 the use of five reference recording/transmission signals for left (L), right (R), centre (C), channels for the front, and left surround (LS) and right surround (RS) channels for the side/rear. Additionally the system may include a low frequency effects signal for a low frequency effects (LFE) channel any use of which should take into account the information provided in Annex 7 and Appendix 1 of Annex 7.

In circumstances where transmission capacity or other constraints apply, the LS and RS signals can be combined with one (mono surround, MS) or zero rear/side signals. In the case of mono surround, the MS signal is fed to both LS and RS loudspeakers (see Fig. 1);

4 that in the international exchange of audio or television programmes that use an audio format which offers a low-frequency effects (LFE) channel, the LFE channel should be band-limited to its nominal frequency band (up to 120 Hz);

5 that broadcast of any television programme that contains an LFE channel should not transmit any information on that channel above the nominal 120 Hz cutoff frequency;

6 compatibility, if required, with existing and low cost receivers by using one of the methods given in Annex 3;

7 down-mixing capability, if required, for reduction of the number of channels, either prior to transmission or at the receiver, by employing the down-mixing equations given in Table 2;

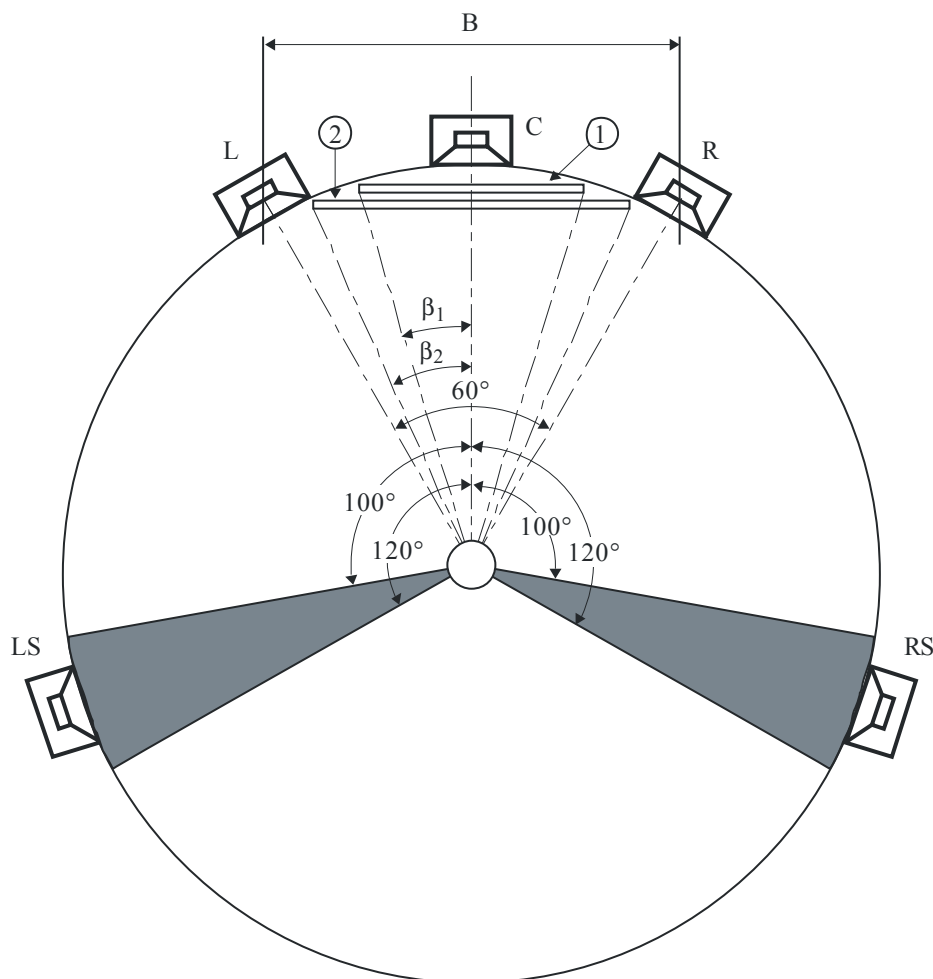
8 upward conversion where an increase in the number of channels is desired, either prior to transmission or at the receiver, by employing upwards-conversion techniques described in Annex 5;

9 overall quality to the requirements of Annex 2;

- 10** provision (but see also § 11 below) for the following if necessary:
- alternate multiple language principal services;
 - one or more independent channels carrying descriptive information for the visually impaired;
 - one or more independent channels for the purpose of supplying improved intelligibility to the hearing impaired;
- 11** additional data transmitted with the audio to enable the flexible use of the data capacity allocatable to audio signals (see Annex 6).

FIGURE 1

**Reference loudspeaker arrangement with
loudspeakers L/C/R and LS/RS**



$$\text{Screen 1 HDTV – Reference distance} = 3 H (2\beta_1 = 33^\circ)$$

$$\text{Screen 2} = 2 H (2\beta_2 = 48^\circ)$$

H: height of screen

B: loudspeaker base width

Loudspeaker	Horizontal angle from centre (degrees)	Height (m)	Inclination (degrees)
C	0	1.2	0
L, R	30	1.2	0
LS, RS	100 ... 120	≥ 1.2	0 ... 15 down

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NOTE 1 – Optionally, there may be an even number of more than two rear/side loudspeakers which may provide a larger optimum listening area and greater envelopment.

NOTE 2 – Optimum sound reproduction requires use of wide angular spacing between the left and right loudspeakers of two or three front loudspeaker channel stereophonic systems (see Fig. 1). It is recognized that the television pictures accompanying stereophonic sound having such an angular width cannot, with current techniques, be displayed to the same wide angles, but are often restricted to 33° horizontal subtended angle at the reference distance, although cinema images may be displayed at such angles (see Fig. 1). The

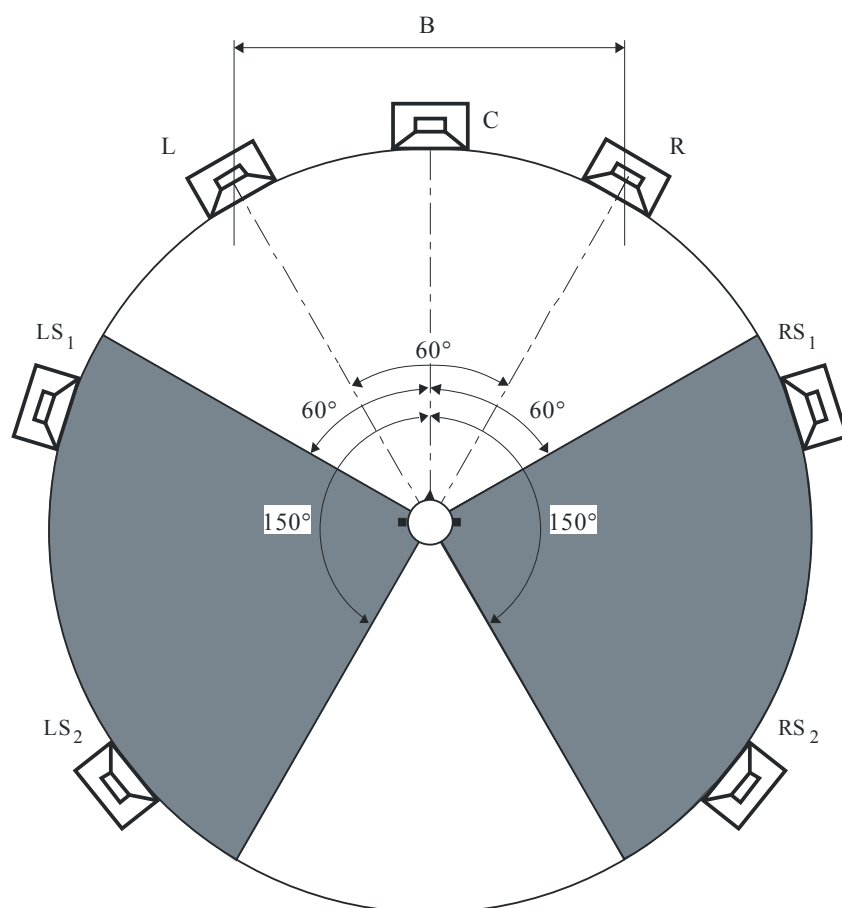
resulting mismatch between picture and sound image width leads to differences in mixing technique for cinema and television. It is expected that larger television displays will lead to better compatibility of mixes for cinema and television display.

NOTE 3 – The size of the loudspeaker basewidth, B (see Fig. 1), is defined for reference listening test conditions in Recommendation ITU-R BS.1116 – Methods for the subjective assessment of small impairments in audio systems including multichannel sound systems.

NOTE 4 – If more than two rear/side loudspeakers are used, then the loudspeakers should be disposed symmetrically and at equal intervals on the arc which measures from 60° to 150° from the centre front reference (see Fig. 2).

NOTE 5 – If more than two rear/side loudspeakers are used, the LS signal should be fed to each of the side/rear loudspeakers on the left side of the room and the RS signal should be fed to each of the side/rear loudspeakers on the right side of the room. In doing so, it will be necessary to reduce the signal gain such that the total power emitted by the loudspeakers carrying the LS (or RS) signal is the same as if that signal had been reproduced over a single loudspeaker. For large room reproduction, it may also be necessary to delay, or otherwise de-correlate, the feeds to some or all of the side/rear loudspeakers. Further studies on such de-correlation is necessary.

FIGURE 2
Optional 3/4 loudspeaker arrangement (3 front and 4 surround)



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Annex 1

Hierarchy of compatible multichannel sound systems for broadcasting and recording

System	Channels	Code	Loudspeaker arrangement
Mono channel system	M	1/0	M
Mono plus mono surround	M/MS	1/1	
Two-channel stereo	L/R	2/0	
Two-channel stereo plus 1 surround	L/R/MS	2/1	
Two-channel stereo plus 2 surround	L/R/LS/RS	2/2	
Three-channel stereo	L/C/R	3/0	
Three-channel stereo plus 1 surround	L/C/R/MS	3/1	
Three-channel stereo plus 2 surround	L/C/R/LS/RS	3/2	

⁽¹⁾ In the case of mono surround the signal feeding LS and RS should preferably be decorrelated.

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