

RECOMMENDATION ITU-R BR.1384<sup>\*, \*\*</sup>**Parameters for international exchange of multi-channel sound recordings<sup>\*\*\*</sup>**

(Question ITU-R 215/10)

(1998)

The ITU Radiocommunication Assembly,

*considering*

- a) that one multi-channel stereophonic sound system has been defined in Recommendation ITU-R BS.775;
- b) that Recommendation ITU-R BS.775 recommends the use of five reference recording 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, with an additional low frequency effects (LFE) channel;
- c) that several consumer packaged media formats such as LaserDisc and DVD-V are being used to deliver multi-channel sound to consumers;
- d) that some regions are beginning television services which include multi-channel sound;
- e) that the recording of multi-channel sound programmes within the production area for both SDTV and HDTV is now well advanced and that their international exchange for research, test, demonstration and broadcast purposes is increasing;
- f) that the exchange of such material has already taken place within ISO/IEC JTC 1/SC 29/WG 11 (MPEG), and within various international projects;
- g) that one set of technical parameters such as assignment of audio signals to tracks, level conditions, etc. is needed in order to avoid operational problems,

*recommends*

- 1** that for the recording of multi-channel stereophonic sound programme material, the track assignment, recording characteristics and level alignment be in accordance with Annex 1.

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\* Radiocommunication Study Group 6 made editorial amendments to this Recommendation in 2001 in accordance with Resolution ITU-R 44.

\*\* This Recommendation should be brought to the attention of the International Electrotechnical Commission (IEC).

\*\*\* International programme exchange is defined as the transmission of television or sound programme material (or components thereof) among professional parties in different countries. It should be based on internationally agreed and widely employed technical standards or operating practices, except by prior bilateral agreement among the parties involved.

## ANNEX 1

**1 Signal definitions**

The audio signals to be recorded are designated according to Recommendation ITU-R BS.775:

**2/0 format** (two channel stereophony)

**A** left channel/signal

**B** right channel/signal

**3/2 format** (preferred format for multi-channel sound, also usable for 3/1 or 2/2)

**L** left channel/signal

**C** centre channel/signal

**R** right channel/signal

**LS** left surround channel/signal (see Note 1)

**RS** right surround channel/signal (see Note 1)

**LFE** additional low frequency effects channel/signal (see Note 2)

**MS** monophonic surround channel/signal (see Note 3)

**F** freely usable

NOTE 1 – In film sound practice, the level calibration of stereo surround channels differs from that of the frontal channels by 3 dB. That is, the LS and RS channels in the cinema monitor system have an output level –3 dB with respect to that of the frontal channels and the level on a recording has the LS and RS channels at a level of +3 dB with respect to the frontal channels. The level of the LS and RS channels should be corrected when a transfer is done between the recording format employed in film sound to the recording format described in this annex.

NOTE 2 – Inclusion of the LFE channel is optional. If the channel is included, its reproduction by the listener is also optional. Therefore this channel should not contain low frequency content which is essential to the programme content.

NOTE 3 – The monophonic surround channel (**MS**) is often referred to as the **S** channel.

**2 Track assignment**

The track assignment should be noted on the tape.

A basic 4 track sound recording format for recording a 3/1 multi-channel sound programme should have the following assignment of sound tracks; see Table 1.

TABLE 1

**Channel assignments for a 4-channel recording**

Track	Channel
1	L
2	R
3	C
4	MS

A basic 8 track sound recording format (valid for sound recording on a separate carrier as well as on a future VTR with 8 or more main sound tracks) should have the following assignment of sound tracks (see Table 2). For media with six tracks, the assignments for tracks 1-6 shall be followed. 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 multi-channel programmes 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  
Channel assignments for an 8-channel recording<sup>\*, \*\*</sup>

Track	Channel
1	L
2	R
3	C
4	LFE
5	LS <sup>(1)</sup>
6	RS <sup>(1)</sup>
7	A
8	B

\* Other channel assignment practices which apply to specific countries and in specific circumstances can be found in Appendix 1.

\*\* Unused tracks should not carry any other signals. They should be left silent. This is to eliminate the possibility of operational error.

(1) In the case of programmes using the 3/1 multi-channel sound format, the MS (–3 dB) monophonic surround signal should be placed on both tracks 5 and 6. This allows a programme with a single surround channel to be treated as a programme 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.

### 3 Recording characteristics

#### 3.1 Sampling frequency

In accordance with Recommendation ITU-R BS.646, the sampling frequency shall be 48 kHz.

#### 3.2 Emphasis

The recording should be made without any emphasis.

### 4 Level calibration

With the exception of the LFE channel, all audio channels belonging to a common programme are recorded on the storage media at levels appropriate for reproduction over a set of loudspeaker

channels which produce the same acoustic sound pressure level for a common stimulus. This means that the programme would play correctly over a reproduction system in which each of the individual speaker channels in the 3/2 configuration (L, C, R, LS, RS) has the same relative acoustic output when presented with equal level signals from the media.

The LFE channel is recorded with a level offset of  $-10$  dB. This offset is compensated for in the reproduction system, where the LFE loudspeaker has an acoustic output (within its low frequency passband) of  $+10$  dB with respect to the other channels.

## 5 Alignment level

The alignment level shall be noted on the tape label. A tone signal (e.g. 1 kHz sinusoid) at the alignment level should be recorded on all tracks at the beginning of the recording.

Note that different regions employ slightly different alignment levels.

In regions which follow EBU guidelines, and where the recording format is a digital format with a linear resolution of 16 bits or more, the level alignment rules given in EBU Technical Recommendation R64 – 1993 “Exchange of sound programmes as digital tape recordings” and EBU technical Recommendation R68 – 1992 “Alignment level in digital audio production equipment and in digital audio recorders” are used, considering the level definitions in Recommendation ITU-R BS.645:

- permitted maximum signal level       $-9$  dB rel<sup>1</sup>;
- alignment signal level                       $-18$  dB rel<sup>1</sup>.

In regions which follow SMPTE guidelines, and where the recording format is a digital format with a linear resolution of 16 bits or more, the level alignment rules given in SMPTE recommended practice RP155 – 1995 “Audio levels for digital audio records on digital television tape recorders” are used.

- alignment signal level                       $-20$  dB rel digital clipping.

## 6 Pink noise test signals

Pink noise test signals, if present, shall be at equal levels on all channels. Excepting the LFE channel, if each channel of pink noise is reproduced at the same acoustic sound pressure level at the central listening position, then the relative balance of the programme audio channels should be correctly reproduced.

In the case of the LFE channel, the pink noise test signal is intended to be reproduced at an acoustic sound pressure level (within the LFE channel  $<120$  Hz passband) of  $+10$  dB relative to any of the other individual. Note that due to the limited bandwidth of the LFE channel, if the acoustic level produced by the LFE pink noise is measured with a wideband sound pressure level meter, the reading will not measure  $+10$  dB with respect to the other channels. The acoustic level of the LFE channel should measure  $+10$  dB within its  $<120$  Hz bandwidth when measured with a frequency selective meter.

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<sup>1</sup> Relative to the digital clipping level, indicated with an IEC quasi-peak programme level meter.

## APPENDIX 1

## TO ANNEX 1

In some areas, slightly different track assignments are in use. Care should be taken to always examine the tape label to determine the exact assignment which is used. The following examples are known.

In Japan, the following track assignments for 8-track recordings are sometimes used in order to facilitate compatibility with 4-track recordings.

**Channel assignments for an 8-channel recording\***

Track	Channel
1	L
2	R
3	C
4	MS
5	LS <sup>(1)</sup>
6	RS <sup>(1)</sup>
7	A
8	B

\* This assignment may be used when there is no LFE channel.

- (1) In the case of programmes with a monophonic surround channel, the MS (–3 dB) monophonic surround signal can be placed on both tracks 5 and 6. This allows a programme with a single surround channel to be treated as a programme 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.

In the United States, the following channel assignment may sometimes be used when the recording does not carry a 2-channel stereo compatible signal.

**Channel assignments for an 8-channel recording**

<b>Track</b>	<b>Channel</b>
1	L
2	R
3	C
4	LFE
5	LS <sup>(1)</sup>
6	RS <sup>(1)</sup>
7	F
8	F

- <sup>(1)</sup> In the case of programmes using the 3/1 multi-channel sound format, the MS (–3 dB) monophonic surround signal should be placed on both tracks 5 and 6. This allows a programme with a single surround channel to be treated as a programme 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.
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