

EBU Technical Recommendation R68-2000

Alignment level in digital audio production equipment and in digital audio recorders

<i>EBU Committee</i>	<i>First issued</i>	<i>Revised</i>	<i>Re-issued</i>
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The EBU has studied the needs of audio signal levels in digital equipment and recorders used in broadcasting. It is of the opinion that recordings should be made with linear coding using no pre-emphasis and with a resolution of at least 16¹ bits in accordance with ITU-R Recommendation BS.646 [1]. The EBU considers that it is desirable to recommend a signal coding level so that signals can easily be exchanged between equipment.

The EBU has considered various ways of specifying an audio level in digital form and has taken into account:

- that the only reliable method to specify a level in a digital signal is by reference to the maximum digital codes allowed by the number of bits in use;
- that an audio signal level can be defined in terms of an alignment signal that is a sine wave signal which has a level (the alignment level) which is 9 dB (or 8 dB in some organizations) below the permitted maximum level of the audio programme (the terms "alignment level" and "permitted maximum level" are defined in ITU-R Recommendation BS.645 [2]);
- that an alignment signal can be specified relative to the maximum sine-wave signal that can be coded by the digital coding levels;
- that, due to the characteristics of quasi-peak programme meters used by broadcasters, the true programme peaks can be 3 dB greater than those indicated; When operator errors are taken into account the true peaks may occasionally be 6 dB greater than indicated or 15 dB above alignment level;
- that the signal to noise ratio in a digital audio system is directly related to the number of bits used and the alignment level chosen;
- that it is desirable in practical operations to have all equipment and recorders aligned to the same level.

The EBU *recommends*

that, in digital audio equipment, its Members should use coding levels for digital audio signals which correspond to an alignment level which is 18 dB² below the maximum possible coding level of the digital system, irrespective of the total number of bits available. The digital codes for maximum coding levels and alignment levels for 16, 18, 20 and 24-bit audio systems are shown in *Table 1*.

Table 1 - Digital codes for maximum levels and alignment levels

Number of bits	Maximum coding level		Audio alignment level	
	negative peaks	positive peaks	negative peaks	positive peaks
16 ¹	8000	7FFF	F000	0FFF
18	20000	1FFFF	3C000	03FFF
20	80000	7FFFF	F0000	0FFFF
24	800000	7FFFFFF	F00000	0FFFFFF

¹. 16-bit recordings may not meet the requirements of some organizations regarding the signal-to-noise in production equipment, depending on the performance of the A/D and D/A converters.

². corresponding to a ratio of 1:8 (18.06 dB)

Bibliography

- [1] ITU-R Recommendation BS.646-1: **Source encoding for digital sound signals in broadcasting studios.**
 - [2] ITU-R Recommendation BS.645-2: **Test signals and metering to be used on international sound-programme connections.**
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