AES recommended practice for professional digital audio — Preferred sampling frequencies for applications employing pulse-code modulation

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Abstract

A sampling frequency of 48 kHz is recommended for the origination, processing, and interchange of audio programs employing pulse-code modulation. Recognition is also given to the use of a 44,1-kHz sampling frequency related to certain consumer digital audio applications, the use of a 32-kHz sampling frequency for transmission-related applications, and the use of a 96-kHz sampling frequency for applications requiring a higher bandwidth or more relaxed anti-alias filtering.

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Foreword

[This Foreword is not a part of the *AES recommended practice for professional digital audio — Preferred sampling frequencies for applications employing pulse-code modulation,* AES5-2008.]

Foreword to the original standard (1984)

This document discusses sampling frequencies for the digital encoding by pulse-code modulation of speech or music program signals to be employed for recording, processing or transmission purposes. The intention is to encourage producers of digital audio equipment to utilize in their products those sampling frequencies which facilitate ease of program interchange to the greatest degree practical. The recommendations given herein are generally consistent with the preferences stated by various international organizations such as the International Radio Consultative Committee of the International Telecommunications Union (CCIR), its Study Group on Television and Sound Transmission (CMTT), the European Broadcast Union (EBU), and the Society of Motion Picture and Television Engineers (SMPTE).

The Audio Engineering Society study of sampling frequencies and other digital audio topics was begun in 1979 November with the formation of the AES Digital Audio Technical Committee under the chairmanship of Bart N. Locanthi. In 1981 November, a Working Group was established to prepare a draft document on sampling frequencies. Although most of the Working Group members expressed a strong desire for a single sampling frequency standard (48 kHz), there were some representing various commercial interests who did not agree. Consequently, a consensus for a single sampling frequency could not be reached.

The Working Group on Sampling Frequencies, responsible for assisting the Technical Committee in drafting this Recommended Practice, had the following membership:

Emil L. Torick, Chairman
K. Davies, T. Doi, J. Gibson, M. Gourgon, A. Heaslett, M. Jones, M. Kosaka, R. Lagadec, H. Ogawa, T. Stockham, N. Takahashi, K. Tanaka, H. Tendeloo, A. Weisser, R. Youngquist.

Foreword to the second revision (1997)

This document is a revision of AES5-1984. The revision was undertaken as project AES5-R by the SC-02-05 Working Group on Synchronization of the SC-02 Subcommittee on Digital Audio. The revision is in response to the report on project AES-X45 by a task group of the SC-02-02 Working Group on Digital Input-Output Interfacing. The task group was headed by J. Dunn, vice-chair of SC-02-02. The project was initiated to consider addition of the 96-kHz sampling frequency to subclause 4.2 of AES5-1984 (now subclause 5.2).

R. Caine, chair, SC-02-05
P. Lidbetter, vice-chair, SC-02-05

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Foreword to the third revision (2003)

This document is a revision of AES5-1997. The revision was undertaken as project AES5-R by the SC-02-05 AESSC Working Group on Synchronisation of the SC-02 Subcommittee on Digital Audio. Developments in working practices in digital audio have given rise to the use of higher sampling frequencies for high-quality audio and this revision quantifies the preferred choices for these practices. Reference is also made to other expedient practices. Contributors included: S. Dimond, R. Foss, J. Grant, S. Harris, B. Klinkradt, S. Lyman, A. Mason, J. Nunn, M. Poimboeuf, S. Scott, Y. Sohma, M. Yonge.

Foreword to the fourth revision (2008)

This document is a revision of AES5-2003. The revision was undertaken as project AES5-R by the SC-02-02 AESSC Working Group on Digital Input/Output Interfacing of the SC-02 Subcommittee on Digital Audio. Further developments in working practices in digital audio have given rise to the use of even higher sampling frequencies and this revision quantifies the preferred choices for these practices. Matters of sampling-frequency precision have been removed from this standard to be handled more appropriately by the associated standard AES11 on *Synchronization of digital audio equipment in studio operations*.

J. Grant, chair, SC-02-02

Note on normative language

In AES standards documents, sentences containing the verb "shall" are requirements for compliance with the standard. Sentences containing the verb "should" are strong suggestions (recommendations). Sentences giving permission use the verb "may." Sentences expressing a possibility use the verb "can."

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1 Scope

This standard covers the use of certain preferred sampling frequencies in applications employing pulse-code modulation where there is a need for interchange of high-fidelity digital audio programs with a minimum of transcoding complexity. Examples of applications where such interchange may occur include, but are not limited to, master tape recordings (audio alone, and audio with video), submaster tape recordings prepared for transfer to a consumer product format, studio signal processing, and the point-to-point transmission of broadcast signals over satellite or terrestrial networks.

This standard is not concerned with sampling frequencies for narrow-band audio applications, such as voice-quality transmission links, or with processing devices in which both the input and the output signals are in an analog format, even if such signals are ultimately used for interchange of program.

2 Normative references

There are no normative references for this standard.

3 Definitions

For the purposes of this document, the following terms and definitions apply.

3.1
aliasing
undesirable phenomenon caused by the sampling of an audio signal at too low a rate, so high-frequency components of the audio signal take on the identity of low-frequency components

3.2
sampling frequency
fixed uniform rate, in samples per second, at which an audio signal being digitally encoded is sampled

3.3
sampling frequency conversion
process by which a digitally encoded audio signal is modified such that the resulting new digital audio signal appears to have been generated from the same source but encoded with a different sampling frequency

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