STANDARDS AND INFORMATION DOCUMENTS

AES75-2023
(Rev. AES75-2022)

STANDARDS

AES standard for acoustics - Measuring loudspeaker maximum linear sound levels using noise

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AES standard for acoustics – Measuring loudspeaker maximum linear sound levels using noise

Published by
Audio Engineering Society, Inc.

Abstract

This standard details a procedure for measuring maximum linear sound levels of a loudspeaker system or driver using a test signal called Music-Noise. In order to measure maximum linear sound levels meaningfully and repeatably, a signal is required whose RMS and peak levels as functions of frequency have been shown to be representative of program material. Various existing standards define noise-based test signals which, like Music-Noise, have incorporated the knowledge that typical program material has a diminishing RMS level with increasing frequency, but Music-Noise uniquely also features a relatively constant peak level as a function of frequency, so that the crest factor (peak level – RMS level) increases with frequency, which an analysis on a large variety of music and other content has revealed is an important additional characteristic of typical program material. The specified procedure determines a loudspeaker's maximum linear sound levels by incrementally increasing the Playback Level of Music-Noise until a stop condition is met: either an unacceptable change in the transfer function's magnitude or an unacceptable change in the coherence of the transfer function.

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2022-04-16 printing

Contents

Foreword

This foreword is not part of the AES75 *AES standard for acoustics – Measuring loudspeaker maximum linear sound levels using noise*.

This document was developed in project AES-X250, in the SC-04-03-A task group on measurement of maximum linear sound levels using noise, under the leadership of Merlijn van Veen and Roger Schwenke.

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Steve Hutt
Chair, working group SC-04-03
2021-11-02

Foreword to 2023 revision

This foreword is not part of the AES75 *AES standard for acoustics – Measuring loudspeaker maximum linear sound levels using noise*.

This edition of the standard revised the test signal name. The signal is now called Music-Noise to emphasize that its spectrum and frequency-dependent crest factor were engineered to emulate those characteristics of music. This is an editorial change, all technical aspects of the standard remain unchanged.

The EULA in the 2022 edition licensed the M-Noise trademark. Since the trademark is no longer used the EULA has been removed from this edition.

Geoff Hill
Chair, working group SC-04-03
2023-04-16

Note on normative language

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

AES standard for acoustics – Measuring loudspeaker maximum linear sound levels using noise

0 Introduction

0.1 General

This standard specifies a method for measuring the maximum linear sound levels of a loudspeaker system or driver. It uses a mathematically derived test signal called Music-Noise that effectively emulates the dynamic characteristics of music. It measures loudspeaker maximum linear sound levels in a repeatable manner which closely represents the values determined in practice with typical program material.

In order to measure maximum linear sound levels meaningfully and repeatably, a signal is required whose RMS and peak levels as functions of frequency have been shown to represent program material. Previous standards have incorporated the idea that typical content has a diminishing RMS level with increasing frequency. In research leading to this standard, a large variety of music has been analyzed, and it has additionally been found that peak levels do not reduce, but rather are relatively constant with frequency. The Music-Noise test signal features a relatively constant peak level as a function of frequency, but a diminishing RMS level with increasing frequency.

The maximum sound levels of a loudspeaker are determined by incrementally increasing the Playback Level of Music-Noise until a stop condition is met: either an unacceptable change in the transfer function’s magnitude, or an unacceptable change in the coherence of the transfer function.

To help clarify the relationship between the terms peak level and RMS level it is useful to consider a period of silence interrupted by a drum strike followed by more silence. The peak sound level of this signal can be measured. Now imagine the same drum being hit with exactly the same strength over and over again at an increasing rate. The peak sound level of this signal is the same as the single drum hit. However, the RMS sound level increases as the rate of the drum hits increases.

Observations like this led to the development of the Music-Noise test signal used in this standard as a more appropriate signal than the commonly used pink noise signal. Even if a filter, such as the ANSI/CTA-426-B filter, is applied to a pink noise signal to shape its magnitude to more closely match the magnitude of typical music content, the resulting crest factor versus frequency will not match that of typical music like Music-Noise will. The RMS magnitude spectra for Music-Noise and other signals are shown in figure 0. The magnitude is shown as signal power per 1/n octave-based frequency bands. Pink noise would be a horizontal line at 0 dB.