AES standard for
digital audio engineering -
High-resolution multi-channel audio interconnection (HRMAI)

Abstract

HRMAI provides a professional multi-channel audio interconnection with a number of distinctive characteristics:

- Support for a wide range of commonly-used digital audio coding formats
- Low and deterministic latency
- Use of ubiquitous “Category-5” data cable
- Interconnect span up to 100 m
- High-quality full-duplex clocks transmitted in parallel with audio data
- Full-duplex audio interconnection
- 5 Mbit/sec full-duplex auxiliary data connection, compatible with Ethernet networks.

HRMAI is a high-performance point-to-point audio interconnection rather than a network, although the auxiliary data may operate as a true network, independently of the audio.

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Foreword

This foreword is not part of AES50, AES standard for digital audio engineering - High-resolution multi-channel audio interconnection (HRMAI).

This document was developed under project AES-X140: High-resolution multi-channel audio interconnection (HRMAI). It was developed by task group SC-02-02-H from an initial draft by M Page.

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Foreword to the second edition, 2011

This new edition revises AES50-2005 and contains amendments resulting from a real-world implementation of the standard.

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Chair, SC-02-02 Working Group on Digital Input/Output Interfacing
2011-05-04

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”.

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AES standard for digital audio engineering - High-resolution multi-channel audio interconnection (HRMAI)

Introduction

HRMAI provides a professional multi-channel audio interconnection with a number of distinctive characteristics:

- Support for a wide range of commonly-used digital audio coding formats, including "high-resolution" formats such as high sample-rate linear PCM, and one-bit delta-sigma modulated formats.
- Low and deterministic latency (< 100 $\mu$s)
- Use of ubiquitous "Category-5" data cable
- Interconnect span up to 100 m
- High-quality full-duplex clocks transmitted in parallel with audio data
- Full-duplex audio interconnection
- 5 Mbit/sec full-duplex auxiliary data connection, compatible with Ethernet networks.

HRMAI is a high-performance point-to-point audio interconnection, rather than a network (although the auxiliary data may operate as a true network, independently of the audio). It is thus an alternative to AES10 (MADI). AES10 lacks many of the features listed above, which are enabled by developments in underlying technology in the thirteen years since AES10 was introduced. However, for applications which do not need these additional facilities, AES10 will continue to be appropriate.

It is recommended that this standard be read in conjunction with the accompanying AESSC Technical Report, AES-R6, Guidelines for AES standard for digital audio engineering - High-resolution multi-channel audio interconnection (HRMAI), AES50. This provides additional background, rationale and implementation advice. In particular, the first section of AES-R6 is an overview of the technology, providing context which may aid understanding of the normative clauses of this standard.
0 Preamble

0.1 Patents
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0.2 Documentation conventions
Following ISO convention, decimal points are conventionally shown as commas (,).

Non-decimal numbers are shown by a subscript suffix indicating the number base. For example, 10₁₆ is a hexadecimal number.

To identify the bits within an octet, 0 = LSB, 7 = MSB

1 Scope
This document specifies a means to carry multiple channels of digital audio in AES3 or bit-stream formats, plus system synchronisation information, over a structured data cable using the IEEE Std 802.3 physical layer. It includes a means to convey arbitrary packet-based data over the link, in addition to the specified audio interconnection.

2 Normative references
The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

AES3-2009 AES recommended practice for digital audio engineering – Serial transmission format for two-channel linearly represented digital audio data, Parts 1 to 4. Audio Engineering Society, New York, NY., US.

Note: adopted by ISO/IEC from: IEEE Std 802.3, 2000 edition, *Carrier sense multiple access with collision detection (CSMA/CD) access method and physical layer specifications*. New York, NY, US: Institution of Electrical and Electronics Engineers. At time of writing, the most recent version of this specification (if more than six months old) is available for free download from the IEEE website under their “Get IEEE802” programme: http://standards.ieee.org/getieee802/

**ANSI X3.263-1995** *Fibre Distributed Data Interface (FDDI) – Token Ring Twisted Pair Physical Layer Medium Dependent (TP-PMD)* American National Standards Institute, New York, NY, US.

**IEEE Std 802.1Q-2003** *IEEE Standards for Local and Metropolitan Area Networks: Virtual Bridged Local Area Networks*. Institution of Electrical and Electronics Engineers, New York, NY, US.