AES standard for digital audio — Digital input-output interfacing — Serial transmission format for two-channel linearly-represented digital audio data — Part 1: Audio Content

Published by
Audio Engineering Society, Inc.
Copyright ©2009 by the Audio Engineering Society

Abstract

AES3 provides for the serial digital transmission of two channels of periodically sampled and uniformly quantized audio signals on various media.

This Part specifies the semantics of the audio data, including the "validity" flag. It also specifies the sampling frequency by reference to AES5, *AES recommended practice for professional digital audio — Preferred sampling frequencies for applications employing pulse-code modulation*.

An AES standard implies a consensus of those directly and materially affected by its scope and provisions and is intended as a guide to aid the manufacturer, the consumer, and the general public. The existence of an AES standard does not in any respect preclude anyone, whether or not he or she has approved the document, from manufacturing, marketing, purchasing, or using products, processes, or procedures not in agreement with the standard. Prior to approval, all parties were provided opportunities to comment or object to any provision. Attention is drawn to the possibility that some of the elements of this AES standard or information document may be the subject of patent rights. AES shall not be held responsible for identifying any or all such patents. Approval does not assume any liability to any patent owner, nor does it assume any obligation whatever to parties adopting the standards document. This document is subject to periodic review and users are cautioned to obtain the latest edition. Recipients of this document are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

Document preview:
for full document, go to
www.aes.org/publications/standards

2010-01-11 printing

Preview only
www.aes.org/standards

Contents

1 Scope **4**

2 Normative references **4**

3 Definitions and abbreviations **5**

4 Audio Content **5**
4.1 Audio content coding 5
4.2 PCM polarity 5
4.3 Coding precision options 5
4.4 Intermediate coding precision 5
4.5 Non-audio content 6
4.6 DC content 6

5 Sampling Frequency **6**
5.1 Channel interdependency 6
5.2 Choice of sampling frequency 6

6 Validity bit **6**
6.1 Channel validity usage 6
6.2 Independent channel validity 6

7 Pre-emphasis **6**
7.1 Pre-emphasis characteristic 6
7.2 Pre-emphasis indication 6

Annex A (informative) Informative references **7**

Preview only
www.aes.org/standards

Document preview:
for full document, go to
www.aes.org/publications/standards

Foreword

This foreword is not part of the *AES3-1-2009, AES standard for digital audio — Digital input-output interfacing — Serial transmission format for two-channel linearly represented digital audio data, Part 1: Audio Content*.

AES3 has been under constant review since the standard was first issued in 1985, and the present edition reflects the collective experience and opinions of many users, manufacturers, and organizations familiar with equipment or systems employing AES3.

This document was adapted by R. Caine from the 2003 edition as amended by Amendments 5 and 6, and its technical content is believed to be identical to the relevant parts of that version. Other members of the writing group that developed this document in draft included: C. Travis, C. Langen, H. Jahne, J. Grant, J. Woodgate, M. Natter, M. Poimboeuf, R. Cabot, S. Heinzmann, M. Werwein, and M. Yonge.

J Grant, chair
SC-02-02 Working Group on Digital Input-Output Interfacing
May 2009

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”.

Preview only
www.aes.org/standards

Document preview:
for full document, go to
www.aes.org/publications/standards

AES standard for digital audio — Digital input-output interfacing — Serial transmission format for two-channel linearly-represented digital audio data — Part 1: Audio Content

1 Scope

These four documents specify an interface for the serial digital transmission of two channels of periodically sampled and linearly represented digital audio data from one transmitter to one receiver. This Part 1 defines the format for coding audio used for the audio content.

It is expected that the audio data will have been sampled at any of the sampling frequencies recognized by the AES5 *Recommended Practice for Professional Digital Audio Applications Employing Pulse-Code Modulation — Preferred Sampling Frequencies*. Note that conformance with this interface specification does not require equipment to utilise these rates. The capability of the interface to indicate other sample rates does not imply that it is recommended that equipment support these rates. To eliminate doubt, equipment specifications should define supported sampling frequencies.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this document. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this document are encouraged to investigate the possibility of applying the most recent editions of the indicated standards.

AES5-2008, *AES Recommended Practice for Professional Digital Audio Applications Employing Pulse Code Modulation—Preferred Sampling Frequencies*, Audio Engineering Society, New York, NY, USA.

ITU-R BS.450-3, *Transmission standards for FM sound broadcasting at VHF*, International Telecommunication Union, Geneva, Switzerland (was previously CCIR Rec 450-1).

ITU-T J.17, *Pre-emphasis used on sound-program circuits*, International Telecommunication Union, Geneva, Switzerland.

Preview only
www.aes.org/standards

Document preview:
for full document, go to
www.aes.org/publications/standards

AES standard for digital audio — Digital input-output interfacing — Serial transmission format for two-channel linearly-represented digital audio data — Part 2: Metadata and Subcode

Published by
Audio Engineering Society, Inc.
Copyright ©2009 by the Audio Engineering Society

Abstract

AES3 provides for the serial digital transmission of two channels of periodically sampled and uniformly quantized audio signals on various media.

This Part specifies the information transmitted with the audio data: principally the "channel status" but also user data and the use of the auxiliary bits to carry a co-ordination signal.

An AES standard implies a consensus of those directly and materially affected by its scope and provisions and is intended as a guide to aid the manufacturer, the consumer, and the general public. The existence of an AES standard does not in any respect preclude anyone, whether or not he or she has approved the document, from manufacturing, marketing, purchasing, or using products, processes, or procedures not in agreement with the standard. Prior to approval, all parties were provided opportunities to comment or object to any provision. Attention is drawn to the possibility that some of the elements of this AES standard or information document may be the subject of patent rights. AES shall not be held responsible for identifying any or all such patents. Approval does not assume any liability to any patent owner, nor does it assume any obligation whatever to parties adopting the standards document. This document is subject to periodic review and users are cautioned to obtain the latest edition. Recipients of this document are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

Document preview:
for full document, go to
www.aes.org/publications/standards

2010-01-11 printing

Preview only
www.aes.org/standards

Contents

1 Scope **4**

2 Normative references **4**

3 Definitions and abbreviations **5**

4 User data format **5**

5 Channel status format **5**
5.1 Channel status bit 5
5.2 Channel status block 6
5.3 Implementation 6
5.3.1 Implementation levels 6
5.3.1.2 Standard Level 6
5.3.1.3 Enhanced Level 6
5.3.2 Transmitter requirement 6
5.3.3 Receiver requirement 6
5.4 Documentation 6
5.5 Channel status content 7
5.5.0 Byte 0: Basic audio parameters 8
5.5.1 Byte 1: Channel modes, user bits management 8
5.5.2 Byte 2: Auxiliary bits, word length and alignment level 10
5.5.3 Byte 3: Multichannel modes 11
5.5.4 Byte 4: DARS, hidden information, multiple-rate sampling frequencies 12
5.5.5 Byte 5: Reserved 13
5.5.6 Bytes 6 to 9: Alphanumeric channel origin 13
5.5.7 Bytes 10 to 13: Alphanumeric channel destination 13
5.5.8 Bytes 14 to 17: Local sample address code 13
5.5.9 Bytes 18 to 21: Time-of-day sample address code 13
5.5.10 Byte 22: Reserved 14
5.5.11 Byte 23: Channel status data CRCC 14
5.6 Channel Status when non-PCM audio is flagged 14

6. Auxiliary bits **14**
6.1 Availability of auxiliary bits 14
6.2 Use of auxiliary bits 14

Annex A (informative) Informative references **15**

Annex B (informative) Provision of additional, voice-quality channels **16**

Annex C (informative) Generation of CRCC (byte 23) for channel status **17**

Preview only
www.aes.org/standards

Document preview:
for full document, go to
www.aes.org/publications/standards

Foreword

This foreword is not part of the *AES3-2-2009, AES standard for digital audio — Digital input-output interfacing — Serial transmission format for two-channel linearly represented digital audio data, Part 2: Metadata and Subcode*

AES3 has been under constant review since the standard was first issued in 1985, and the present edition reflects the collective experience and opinions of many users, manufacturers, and organizations familiar with equipment or systems employing AES3.

This document was adapted by R. Caine from the 2003 edition as amended by Amendments 5 and 6, and its technical content is believed to be identical to the relevant parts of that version. Other members of the writing group that developed this document in draft included: C. Travis, C. Langen, H. Jahne, J. Grant, J. Woodgate, M. Natter, M. Poimboeuf, R. Cabot, S. Heinzmann, M. Werwein, and M. Yonge.

J Grant, chair
SC-02-02 Working Group on Digital Input-Output Interfacing
May 2009

Preview only
www.aes.org/standards

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”.

Document preview:
for full document, go to
www.aes.org/publications/standards

AES standard for digital audio — Digital input-output interfacing — Serial transmission format for two-channel linearly-represented digital audio data — Part 2: Metadata and Subcode

1 Scope

These four documents specify an interface for the serial digital transmission of two channels of periodically sampled and linearly represented digital audio data from one transmitter to one receiver. This Part 2 defines the format for coding metadata, or subcode, relating to the audio content and carried with it.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this document. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this document are encouraged to investigate the possibility of applying the most recent editions of the indicated standards.

AES18, *AES recommended practice for digital audio engineering—Format for the user data channel of the AES digital audio interface*, Audio Engineering Society, New York, NY, USA.

AES52-2006: *AES standard for digital audio engineering — Insertion of unique identifiers into the AES3 transport stream*, Audio Engineering Society, New York, NY, USA.

IEC 60958-3 *Digital audio interface - Part 3: Consumer applications,* International Electrotechnical Commission, Geneva, Switzerland.

ISO 646, *Information processing—ISO 7-bit coded character set for information interchange*, International Organization for Standardization, Geneva, Switzerland.

ITU-R BS.450 Transmission standards for FM sound broadcasting at VHF International Telecommunication Union, Geneva, Switzerland. (was CCIR Rec 450-1),

ITU-T J.17, *Pre-emphasis used on sound program circuits*, International Telecommunication Union, Geneva, Switzerland..

Preview only
www.aes.org/standards

Document preview:
for full document, go to
www.aes.org/publications/standards

AES standard for digital audio — Digital input-output interfacing — Serial transmission format for two-channel linearly-represented digital audio data — Part 3: Transport

Published by
Audio Engineering Society, Inc.
Copyright ©2009 by the Audio Engineering Society

Abstract

AES3 provides for the serial digital transmission of two channels of periodically sampled and uniformly quantized audio signals on various media.

This Part specifies the framing and channel coding for transmission on a unidirectional point-to-point physical link. The specified format minimizes the direct-current (DC) component on the transmission line, facilitates clock recovery from the data stream, and makes the interface insensitive to the polarity of connections.

An AES standard implies a consensus of those directly and materially affected by its scope and provisions and is intended as a guide to aid the manufacturer, the consumer, and the general public. The existence of an AES standard does not in any respect preclude anyone, whether or not he or she has approved the document, from manufacturing, marketing, purchasing, or using products, processes, or procedures not in agreement with the standard. Prior to approval, all parties were provided opportunities to comment or object to any provision. Attention is drawn to the possibility that some of the elements of this AES standard or information document may be the subject of patent rights. AES shall not be held responsible for identifying any or all such patents. Approval does not assume any liability to any patent owner, nor does it assume any obligation whatever to parties adopting the standards document. This document is subject to periodic review and users are cautioned to obtain the latest edition. Recipients of this document are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

Document preview:
for full document, go to
www.aes.org/publications/standards

2010-01-11 printing

Preview only
www.aes.org/standards

Contents

1 Scope **4**

2 Normative references **4**

3 Definitions and abbreviations **5**

4 Subframe **6**
4.1 Subframe time slots 6
4.2 Preambles 6
4.3 Audio data content 6
4.4 Sample word orientation 6
4.5 MSB position 6
4.6 Validity bit 6
4.7 User data bit 6
4.8 Channel status bit 6
4.9 Parity bit 6

5 Frame **7**

6 Channel coding (line coding) **8**

7. Preambles **8**
7.1 Preamble time slots 8
7.2 First subframe preamble 8
7.3 Second subframe preamble 8
7.4 Preamble codes 9

8. Block **10**

Annex A (informative) Informative references **11**

Preview only
www.aes.org/standards

Document preview:
for full document, go to
www.aes.org/publications/standards

Foreword

This foreword is not part of the *AES3-3-2009, AES standard for digital audio — Digital input-output interfacing — Serial transmission format for two-channel linearly represented digital audio data, Part 3: Transport*.

AES3 has been under constant review since the standard was first issued in 1985, and the present edition reflects the collective experience and opinions of many users, manufacturers, and organizations familiar with equipment or systems employing AES3.

This document was adapted by R. Caine from the 2003 edition as amended by Amendments 5 and 6, and its technical content is believed to be identical to the relevant parts of that version. Other members of the writing group that developed this document in draft included: C. Travis, C. Langen, H. Jahne, J. Grant, J. Woodgate, M. Natter, M. Poimboeuf, R. Cabot, S. Heinzmann, M. Werwein, and M. Yonge.

J Grant, chair
SC-02-02 Working Group on Digital Input-Output Interfacing
May 2009

Preview only
www.aes.org/standards

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”.

Document preview:
for full document, go to
www.aes.org/publications/standards

AES standard for digital audio — Digital input-output interfacing — Serial transmission format for two-channel linearly-represented digital audio data — Part 3: Transport

1 Scope

These four documents specify an interface for the serial digital transmission of two channels of periodically sampled and linearly represented digital audio data from one transmitter to one receiver. This Part 3 defines the format for transport of an AES3 digital audio interface.

Specific synchronization issues are covered in AES11 *AES recommended practice for digital audio engineering -- Synchronization of digital audio equipment in studio operations*. An engineering guideline document to accompany this interface specification has been published as AES-2id *AES information document for digital audio engineering - Guidelines for the use of the AES3 interface*.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this document. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this document are encouraged to investigate the possibility of applying the most recent editions of the indicated standards.

None.

Preview only
www.aes.org/standards

Document preview:
for full document, go to
www.aes.org/publications/standards

AES standard for digital audio — Digital input-output interfacing — Serial transmission format for two-channel linearly-represented digital audio data — Part 4: Physical and electrical

Published by
Audio Engineering Society, Inc.
Copyright ©2009 by the Audio Engineering Society

Preview only
www.aes.org/standards

Abstract

AES3 provides for the serial digital transmission of two channels of periodically sampled and uniformly quantized audio signals on various media.

This Part specifies the physical signals that convey the bit stream specified in Part 3. The current version covers electrical signals on twisted-pair and co-axial cables. Other media, including fibre optic, are under consideration.

An AES standard implies a consensus of those directly and materially affected by its scope and provisions and is intended as a guide to aid the manufacturer, the consumer, and the general public. The existence of an AES standard does not in any respect preclude anyone, whether or not he or she has approved the document, from manufacturing, marketing, purchasing, or using products, processes, or procedures not in agreement with the standard. Prior to approval, all parties were provided opportunities to comment or object to any provision. Attention is drawn to the possibility that some of the elements of this AES standard or information document may be the subject of patent rights. AES shall not be held responsible for identifying any or all such patents. Approval does not assume any liability to any patent owner, nor does it assume any obligation whatever to parties adopting the standards document. This document is subject to periodic review and users are cautioned to obtain the latest edition. Recipients of this document are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

Document preview:
for full document, go to
www.aes.org/publications/standards

Contents

1 Scope **4**

2 Normative references **4**

3 Definitions and abbreviations **5**

4 Common features **5**

5 Jitter **6**
5.1 Output interface jitter 6
5.2 Receiver jitter tolerance 7

Annex A (informative) Informative references **8**

Annex B (informative) Symbol rates and UI **9**

Annex C (normative) Balanced transmission **10**
C.1 General Characteristics 10
C.2 Line driver characteristics 11
C.3 Line receiver characteristics 11
C.4 Connector 13

Annex D (normative) Coaxial transmission **14**
D.1 Line driver characteristics 14
D.2 Coaxial cable characteristics 15
D.3 Line receiver characteristics 15
D.4 Connector 17

Annex E (normative) Optical transmission **18**
E.1 Short haul 18
E.2 Medium haul 18
E.3 Long haul 18

Preview only
www.aes.org/standards

Document preview:
for full document, go to
www.aes.org/publications/standards

Foreword

This foreword is not part of the *AES3-4-2009, AES standard for digital audio — Digital input-output interfacing — Serial transmission format for two-channel linearly represented digital audio data Part 4: Physical and electrical*.

AES3 has been under constant review since the standard was first issued in 1985, and the present edition reflects the collective experience and opinions of many users, manufacturers, and organizations familiar with equipment or systems employing AES3.

This document was adapted by R. Caine from the 2003 edition as amended by Amendments 5 and 6 and from AES-3id-2001, and its technical content is believed to be identical to the relevant parts of those versions. Other members of the writing group that developed this document in draft included: C. Travis, C. Langen, H. Jahne, J. Grant, J. Woodgate, M. Natter, M. Poimboeuf, R. Cabot, S. Heinzmann, M. Werwein, and M. Yonge.

J. Grant, chair
SC-02-02 Working Group on Digital Input-Output Interfacing
May 2009

Preview only
www.aes.org/standards

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”.

Document preview:
for full document, go to
www.aes.org/publications/standards

AES standard for digital audio — Digital input-output interfacing — Serial transmission format for two-channel linearly-represented digital audio data — Part 4: Physical and electrical

1 Scope

These four documents specify an interface for the serial digital transmission of two channels of periodically sampled and linearly represented digital audio data from one transmitter to one receiver. This Part 4 document specifies the physical and electrical parameters for different media.

The transport format defined in Part 3 is intended for use with shielded twisted-pair cable of conventional design over distances of up to 100 m without transmission equalization or any special equalization at the receiver and at frame rates of up to 50 kHz. Longer cable lengths and higher frame rates may be used, but with a rapidly increasing requirement for care in cable selection and possible receiver equalization or the use of active repeaters, or both. Provision is made in this standard for adapting the balanced terminals to use 75 Ohm coaxial cable, and transmission by fibre-optic cable is under consideration.

The document does not cover connection to any common carrier equipment.

In this interface specification, mention is made of an interface for consumer use. The two interfaces are not identical.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this document. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this document are encouraged to investigate the possibility of applying the most recent editions of the indicated standards.

ISO/IEC 11801 *Information technology – Generic cabling for customer premises*, International Organization for Standardization and International Electrotechnical Commission, Geneva, Switzerland.

IEC 60169-8 *Radio frequency connectors Part 8 RF coaxial connectors diameter of outer conductor 6.5mm with bayonet lock – characteristic impedance of 50 Ohms* (Type BNC)

IEC 60268-12, *Sound system equipment, Part 12: Application of connectors for broadcast and similar use*, International Electrotechnical Commission, Geneva, Switzerland.

IEC 60603-7, *Connectors for frequencies below 3 MHz for use with printed boards - Part 7: Detailed specification for connectors, 8-way, including fixed and free connectors with common features*, multi-part, International Electrotechnical Commission, Geneva, Switzerland.

IEC 60958-3, *Digital audio interface - Part 3: Consumer applications*, International Electrotechnical Commission, Geneva, Switzerland.

Document preview:
for full document, go to
www.aes.org/publications/standards