
**Information technology — MPEG
audio technologies —**

**Part 3:
Unified speech and audio coding**

Technologies de l'information — Technologies audio MPEG —

Partie 3: Codage unifié parole et audio

iTeh Standards
(<https://standards.iteh.ai>)
Document Preview

[ISO/IEC 23003-3:2020](https://standards.iteh.ai/catalog/standards/iso/299f2899-4bfd-41b2-822a-fffd069081e0/iso-iec-23003-3-2020)

<https://standards.iteh.ai/catalog/standards/iso/299f2899-4bfd-41b2-822a-fffd069081e0/iso-iec-23003-3-2020>



iTeh Standards
(<https://standards.iteh.ai>)
Document Preview

ISO/IEC 23003-3:2020

<https://standards.iteh.ai/catalog/standards/iso/299f2899-4bfd-41b2-822a-fffd069081e0/iso-iec-23003-3-2020>



COPYRIGHT PROTECTED DOCUMENT

© ISO/IEC 2020

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Fax: +41 22 749 09 47
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

Foreword.....	vii
Introduction.....	viii
1 Scope.....	1
2 Normative references.....	1
3 Terms, definitions, symbols and abbreviated terms	1
3.1 Terms and definitions	1
3.2 Symbols and abbreviated terms.....	3
4 Technical overview	4
4.1 Decoder block diagram.....	4
4.2 Overview of the decoder tools.....	5
4.3 Combination of USAC with MPEG Surround and SAOC.....	9
4.4 Interface between USAC and systems.....	9
4.4.1 Decoder behaviour	10
4.5 USAC profiles and levels	10
4.5.1 General.....	10
4.5.2 MPEG-4 HE AACv2 compatibility	11
4.5.3 Baseline USAC profile	12
4.5.4 Extended high efficiency AAC profile.....	13
4.6 Combination of USAC with MPEG-D DRC	14
5 Syntax	15
5.1 General.....	15
5.2 Decoder configuration (UsacConfig).....	15
5.3 USAC bitstream payloads	20
5.3.1 Payloads for audio object type USAC	20
5.3.2 Subsidiary payloads.....	23
5.3.3 Payloads for enhanced SBR.....	34
5.3.4 Payloads for MPEG Surround.....	43
5.3.5 Payload of extension elements	53
6 Data structure	53
6.1 USAC configuration.....	53
6.1.1 Definition of elements	53
6.1.2 UsacConfig()	63
6.1.3 Usac Output Sampling Frequency	63
6.1.4 UsacChannelConfig()	63
6.1.5 UsacDecoderConfig()	64
6.1.6 UsacSingleChannelElementConfig().....	64
6.1.7 UsacChannelPairElementConfig()	64
6.1.8 UsacLfeElementConfig()	64
6.1.9 UsacCoreConfig().....	64
6.1.10 SbrConfig()	65
6.1.11 SbrDfltHeader()	65
6.1.12 Mps212Config()	65
6.1.13 UsacExtElementConfig().....	65
6.1.14 UsacConfigExtension()	65
6.1.15 Unique stream identifier (Stream ID)	66
6.2 USAC payload.....	66
6.2.1 Definition of elements	66
6.2.2 UsacFrame().....	68
6.2.3 UsacSingleChannelElement()	69
6.2.4 UsacExtElement().....	69
6.2.5 UsacChannelPairElement()	70
6.2.6 Low frequency enhancement (LFE) channel element, UsacLfeElement()	70
6.2.7 UsacCoreCoderData()	71

6.2.8	StereoCoreToolInfo()	71
6.2.9	fd_channel_stream() and ics_info()	72
6.2.10	lpd_channel_stream()	76
6.2.11	Spectral noiseless coder	79
6.2.12	Enhanced SBR	80
6.2.13	Definition of MPEG Surround 2-1-2 payloads	82
6.2.14	Buffer requirements	84
7	Tool descriptions	85
7.1	Quantization	85
7.1.1	Tool description	85
7.1.2	Definition of elements	85
7.1.3	Decoding process	85
7.2	Noise filling	85
7.2.1	Tool description	85
7.2.2	Definition of elements	86
7.2.3	Decoding process	86
7.2.4	Generation of random signs for spectral noise filling	87
7.3	Scale factors	87
7.4	Spectral noiseless coding	87
7.4.1	Tool description	87
7.4.2	Definition of elements	88
7.4.3	Decoding process	89
7.5	enhanced SBR tool (eSBR)	93
7.5.1	Modifications to SBR tool	93
7.5.2	Additional pre-processing in the MPEG-4 SBR within USAC	108
7.5.3	DFT based harmonic transposer	110
7.5.4	QMF based harmonic transposer	120
7.5.5	4:1 Structure for SBR in USAC	128
7.5.6	Predictive vector coding (PVC) decoding process	138
7.6	Inter-subband-sample temporal envelope shaping (inter-TES)	141
7.6.1	Tool Description	141
7.6.2	Definition of elements	142
7.6.3	Inter-TES	142
7.7	Joint stereo coding	144
7.7.1	M/S stereo	144
7.7.2	Complex stereo prediction	144
7.8	TNS	151
7.8.1	General	151
7.8.2	Definition of elements	151
7.8.3	Decoding process	152
7.8.4	Maximum TNS bandwidth	152
7.9	Filterbank and block switching	153
7.9.1	Tool description	153
7.9.2	Definition of elements	153
7.9.3	Decoding process	153
7.10	Time-warped filterbank and blockswitching	161
7.10.1	Tools description	161
7.10.2	Definition of elements	161
7.10.3	Decoding process	163
7.11	MPEG Surround for mono to stereo upmixing	169
7.11.1	Tool description	169
7.11.2	Decoding process	170
7.12	AVQ decoding	182
7.13	LPC-filter	189
7.13.1	Tool description	189
7.13.2	Definition of elements	189
7.13.3	Number of LPC filters	189
7.13.4	General principle of the inverse quantizer	189
7.13.5	Decoding of the LPC quantization mode	190

7.13.6	First-stage approximation	191
7.13.7	AVQ refinement	191
7.13.8	Reordering of quantized LSFs	193
7.13.9	Conversion into LSP parameters.....	193
7.13.10	Interpolation of LSP parameters.....	194
7.13.11	LSP to LP conversion.....	194
7.13.12	LPC initialization at decoder start-up	195
7.14	ACELP.....	196
7.14.1	General.....	196
7.14.2	Definition of elements.....	196
7.14.3	ACELP initialization at USAC decoder start-up	197
7.14.4	Setting of the ACELP excitation buffer using the past FD synthesis and LPC0.....	197
7.14.5	Decoding of CELP excitation.....	197
7.14.6	Excitation postprocessing.....	203
7.14.7	Synthesis	204
7.14.8	Writing in the output buffer.....	204
7.15	MDCT based TCX.....	205
7.15.1	Tool description	205
7.15.2	Decoding process	205
7.16	Forward aliasing cancellation (FAC) tool.....	209
7.16.1	Tool description	209
7.16.2	Definition of elements.....	209
7.16.3	Decoding process	210
7.16.4	Writing in the output buffer.....	211
7.17	Post-processing of the synthesis signal	212
7.18	Audio pre-roll	214
7.18.1	General.....	214
7.18.2	Semantics	214
7.18.3	Decoding process	215
8	Conformance testing.....	217
8.1	General.....	217
8.2	USAC conformance testing.....	217
8.2.1	Profiles	217
8.2.2	Conformance tools and test procedure.....	218
8.3	USAC bitstreams	222
8.3.1	General.....	222
8.3.2	USAC configuration.....	222
8.3.3	Framework.....	225
8.3.4	Frequency domain coding (FD mode).....	226
8.3.5	Linear predictive domain coding (LPD mode).....	228
8.3.6	Common core coding tools	229
8.3.7	Enhanced spectral band replication (eSBR)	230
8.3.8	eSBR – Predictive vector coding (PVC).....	232
8.3.9	eSBR – Inter temporal envelope shaping (inter-TES).....	233
8.3.10	MPEG Surround 2-1-2	233
8.3.11	Configuration Extensions.....	235
8.3.12	AudioPreRoll.....	235
8.3.13	DRC	236
8.3.14	Restrictions depending on profiles and levels.....	236
8.4	USAC decoders.....	238
8.4.1	General.....	238
8.4.2	FD core mode tests	238
8.4.3	LPD core mode tests.....	245
8.4.4	Combined core coding tests	250
8.4.5	eSBR tests.....	251
8.4.6	MPEG Surround 212 tests	260
8.4.7	Bitstream extensions.....	262
8.5	Decoder settings.....	265
8.5.1	General.....	265

8.5.2	Target loudness [Lou-<x>]	265
8.5.3	DRC effect type request [Eff-<x>]	265
8.6	Decoding of MPEG-4 file format parameters to support exact time alignment in file-to-file coding	265
9	Reference software	266
9.1	Reference software structure	266
9.1.1	General	266
9.1.2	Copyright disclaimer for software modules	266
9.2	Bitstream decoding software	268
9.2.1	General	268
9.2.2	USAC decoding software	268
Annex A (normative)	Tables	269
Annex B (informative)	Encoder tools	274
Annex C (normative)	Tables for arithmetic decoder	314
Annex D (normative)	Tables for predictive vector coding	320
Annex E (informative)	Adaptive time/frequency post-processing	329
Annex F (informative)	Audio/systems interaction	335
Annex G (informative)	Reference software	337
Annex H (normative)	Carriage of MPEG-D USAC in ISO base media file format	338
Bibliography		339

iTech Standards
(<https://standards.iteh.ai>)
Document Preview

[ISO/IEC 23003-3:2020](https://standards.iteh.ai/catalog/standards/iso/299f2899-4bfd-41b2-822a-fffd069081e0/iso-iec-23003-3-2020)
<https://standards.iteh.ai/catalog/standards/iso/299f2899-4bfd-41b2-822a-fffd069081e0/iso-iec-23003-3-2020>

Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents) or the IEC list of patent declarations received (see <http://patents.iec.ch>).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 29, *Coding of audio, picture, multimedia and hypermedia information*.

This second edition cancels and replaces the first edition (ISO/IEC 23003-3:2012), which has been technically revised. It also incorporates ISO/IEC 23003-3:2012/Cor.1:2012, ISO/IEC 23003-3:2012/Cor.2:2013, ISO/IEC 23003-3:2012/Cor.3:2015, ISO/IEC 23003-3:2012/Cor.4:2015, ISO/IEC 23003-3:2012/Amd.1:2014, ISO/IEC 23003-3:2012/Amd.1:2014/Cor.1:2015, ISO/IEC 23003-3:2012/Amd.2:2015, ISO/IEC 23003-3:2012/Amd.2:2015/Cor.1:2015 and ISO/IEC 23003-3:2012/Amd.3:2016.

A list of all parts in the ISO/IEC 23003 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.