



HEAAC Decoder

Test Report

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Ittiam Systems Confidential

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Revision History

Version	Date	Changes
1.0	October 12, 2006	Original
1.1	March 2, 2007	Updated for improved precision and the Multichannel library results.
1.2	September 23, 2008	Made it generic for all packages.
1.3	October 1, 2008	Updated the results for all builds

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1. Introduction

1.1 Motivation

AAC is a popular audio coding technique recommended by MPEG committee. The codec handles audio signals sampled in the range of 8 kHz to 96 kHz. It operates on a frame of 1024 samples. The bit-rates supported are in the range of 8 kbps to 576 kbps per channel.

SBR and PS are the tools used in combination with the AAC general audio codec. This results in HEAAC v2 (also known as Enhanced aacPlus). Usage of Enhanced aacPlus results in significant increase of coding gain. In SBR, the high-band, i.e. the high frequency part of the spectrum is replicated using the low-band. In PS, channel redundancy is exploited and parameters are extracted from a down-mixed channel. The bit-rate is by far below the bit-rate required when using conventional AAC coding. This translates into better quality at lower bit-rates.

1.2 Scope

This document describes the test procedure and results for the AAC / HE-AAC / HE-AAC v2 Decoder, applicable as per the component licensed.

1.3 Glossary

Term	Explanation
MPEG	Motion Pictures Expert Group
AAC	Advanced Audio Coding
SBR	Spectral Bandwidth Replication
PS	Parametric Stereo
ADTS	Audio Data Transport Stream
ADIF	Audio Data Interchange Format
LOAS	Low Overhead Audio Stream
LC	Low Complexity
CRC	Cyclic Redundancy Check

HQ	High Quality (SBR decoder)
LP	Low Power (SBR decoder)
IS	Intensity Stereo
MS	Mid-side Stereo
TNS	Temporal Noise Shaping
PNS	Perceptual Noise Substitution
ISO	International Standards Organization.
IEC	International Electro-technical Commission.
3GPP	Third Generation Partnership Project
PEAQ	Perceptual Evaluation of Audio Quality
ODG	Objective Differential Grade

2. Test Description

2.1 Test Objective

The following tests have been carried out to test HEAAC v2 Decoder.

- **MPEG Conformance Test:** This is to test the conformance of HEAAC v2 Decoder with a conformance tool of MPEG. This tests the AAC conformance, PNS conformance, SBR conformance and PS conformance
- **3GPP Conformance Test:** This is to test the conformance of HEAAC v2 Decoder with a conformance tool of 3GPP. This tests the PS conformance.

2.2 Test Criteria

The following are the criteria for the decoder to be compliant.

2.2.1 AAC Conformance test

The AAC decoder conformance defined in ISO/IEC 14496-4:2003 [2]. It mentions the maximum allowed RMS and absolute maximum difference w.r.t. to the reference decoded output. The tool used to test this is `ssnr_cd`.

2.2.2 PNS Conformance test

In addition to the above AAC conformance test to call a decoder MPEG4 AAC conformant, it has to pass the PNS conformance test as defined in ISO/IEC 14496-4:2003 [2].

2.2.3 SBR Conformance test

The SBR decoder conformance is defined in ISO/IEC 14496-4-AMD8 [3]. It mentions the maximum allowed RMS and absolute maximum difference for QMF and SBR parts. SBR conformance is isolated from AAC conformance, for which the conformance tool and test vectors are specially designed. The first part of the test cases have only AAC output and a second part have the AAC plus SBR output. The conformance tool uses the only AAC part output of the Decoder Under Test (DUT) and feeds it to its internal reference SBR decoder and compares this with SBR output of DUT. To call a decoder HEAAC conformant it has to pass both AAC and SBR conformance.

2.2.4 PS Conformance test

The PS decoder conformance is defined in ISO/IEC 14496-4-AMD11 [4]. It mentions allowed RMS and absolute maximum difference for QMF and SBR + PS parts. This test is similar to the SBR test as in the initial part of the test vector is mono and the second part is PS. The MPEG conformance tool has specified the criteria for two PS test cases.

2.2.5 3GPP PS Conformance test

Other than the MPEG conformance tests the 3GPP specifies additional PS conformance for decoders in [5]. This test compares the decoder under test decoded output with 3GPP Floating point decoder output psycho-acoustically using the ITU BS 1387 PEAQ tool. The criteria is defined as not having a ODG deviation of more than $\text{abs}(0.25)$. For the PEAQ comparison the EAQUAL tool is used.

2.2.6 Erroneous stream tests

A set of erroneous test vectors is used to verify the robustness of Ittiam HE-AAC v2 Decoder. These include actual erroneous files and files which have features which are not supported by Ittiam decoder.

2.3 Test Resources

Test vectors, reference decoder and testing tools have to be obtained by the MPEG and 3GPP resources.

2.3.1 Test Utilities/Test vectors

1. MPEG4 AAC Conformance
 - Utility used is `ssnr_cd`. Refer [6] for the utility and reference decoder
 - Testvectors available with [2]
2. MPEG4 PNS conformance
 - Utility used is `pnsConformance`. Refer [6] for the utility and reference decoder
 - Testvectors available with [2]
3. MPEG4 SBR High Quality conformance
 - Utility used is `sbrConfToolHQ`. Refer [6] for the utility
 - Testvectors available with [3]
4. MPEG4 SBR Low Power conformance
 - Utility used is `sbrConfToolLP`. Refer [6] for the utility

- Testvectors available with [3]
 - 5. MPEG4 Parametric Stereo conformance
 - Utility used is `sbrConfToolPS`. Refer [6] for the utility
 - Testvectors available with [4]
 - 6. 3GPP PS conformance.
 - ODG Utility used is `EAQUAL`. Refer [5] for the reference decoder
 - Testvectors available with [5]
 - 7. Erroneous stream test.
 - Erroneous streams created by introducing errors in bit-stream format
- MPEG testvectors of other profiles available in [2]

3. Test Results

3.1 Results

The results are categorized into six sections. One out of this is applicable based on the AAC profile licensed.

3.1.1 HEAAC v2 Stereo Decoder results

3.1.1.1 AAC Conformance Test

Following table summarizes the AAC conformance test results for HEAAC v2 Decoder. The worst case conformance results in each category of the test cases is given below. A 15 bit conformance is required for 16 bit output for AL00 cases to consider the decoder an MPEG AAC conformant. AL14 test cases have DRC, these cases have been compared with reference decoder without applying DRC as Ittiam AAC implementation doesn't support DRC. Core AAC Decoder has passed all the PNS conformance cases.

Input File	Compliance
AL00 - *.adts	15 bits
AL01 - *.adts	15 bits
AL02 - *.adts	15 bits
AL03 - *.adts	15 bits
AL04 - *.adts	15 bits
AL05 - *.adts	15 bits
AL14 - *.adts	11 bits
AL17 - *.adts	15 bits
AL18 - *.adts	PASS
AL19 - *.adts	PASS

Table 3-1 AAC Conformance results (HEAAC v2 Stereo Decoder results).

3.1.1.2 SBR conformance test

Following table summarizes the SBR conformance results for HEAAC v2 Decoder.

Input File	Compliance			
	QMF-Max	QMF-RMS	SBR-Max	SBR-RMS
al_sbr_qmf_32_1.adts	3.015 (5.000)	0.648 (1.400)	Not Tested	Not Tested
al_sbr_e_32_1.adts	2.343 (90.000)	0.417 (2.000)	21.597 (90.000)	0.944 (2.000)
al_sbr_gh_32_1.adts	2.605 (51.000)	0.427 (1.500)	10.712 (51.000)	0.700 (1.500)
al_sbr_i_32_1.adts	2.482 (36.000)	0.420 (3.400)	12.169 (36.000)	1.273 (3.400)
al_sbr_s_32_1.adts	2.501 (120.000)	0.411 (1.900)	2.824 (120.000)	0.556 (1.900)
al_sbr_e_32_2.adts	3.208 (90.000)	0.658 (2.000)	33.423 (90.000)	1.300 (2.000)
al_sbr_gh_32_2.adts	3.195 (51.000)	0.647 (1.500)	17.729 (51.000)	1.014 (1.500)
al_sbr_i_32_2.adts	3.844 (36.000)	0.650 (3.400)	4.499 (36.000)	0.960 (3.400)
al_sbr_s_32_2.adts	3.837 (120.000)	0.642 (1.900)	32.249 (120.000)	1.045 (1.900)
al_sbr_qmf_44_1.adts	3.179 (5.000)	0.651 (1.400)	Not Tested	Not Tested
al_sbr_e_44_1.adts	2.340 (90.000)	0.417 (2.000)	10.332 (90.000)	0.697 (2.000)
al_sbr_gh_44_1.adts	2.619 (51.000)	0.424 (1.500)	8.809 (51.000)	0.640 (1.500)
al_sbr_i_44_1.adts	2.377 (36.000)	0.420 (3.400)	15.944 (36.000)	2.325 (3.400)
al_sbr_s_44_1.adts	2.314 (120.000)	0.412 (1.900)	2.259 (120.000)	0.523 (1.900)
al_sbr_e_44_2.adts	3.762 (90.000)	0.650 (2.000)	21.169 (90.000)	1.077 (2.000)
al_sbr_gh_44_2.adts	3.881 (51.000)	0.651 (1.500)	25.183 (51.000)	0.967 (1.500)
al_sbr_i_44_2.adts	4.054 (36.000)	0.651 (3.400)	5.550 (36.000)	0.979 (3.400)
al_sbr_s_44_2.adts	3.967 (120.000)	0.643 (1.900)	27.184 (120.000)	0.979 (1.900)
al_sbr_qmf_48_1.adts	3.316 (5.000)	0.657 (1.400)	Not Tested	Not Tested

al_sbr_e_48_1.adts	2.399 (90.000)	0.430 (2.000)	12.074 (90.000)	0.691 (2.000)
al_sbr_gh_48_1.adts	2.629 (51.000)	0.426 (1.500)	8.237 (51.000)	0.652 (1.500)
al_sbr_i_48_1.adts	2.374 (36.000)	0.420 (3.400)	14.504 (36.000)	2.127 (3.400)
al_sbr_s_48_1.adts	2.301 (120.000)	0.411 (1.900)	2.171 (120.000)	0.518 (1.900)
al_sbr_e_48_2.adts	3.817 (90.000)	0.643 (2.000)	21.491 (90.000)	1.076 (2.000)
al_sbr_gh_48_2.adts	3.942 (51.000)	0.651 (1.500)	12.023 (51.000)	0.934 (1.500)
al_sbr_i_48_2.adts	3.825 (36.000)	0.649 (3.400)	4.947 (36.000)	0.976 (3.400)
al_sbr_s_48_2.adts	4.024 (120.000)	0.643 (1.900)	13.541 (120.000)	0.936 (1.900)

Table 3-2 SBR conformance results (HEAAC v2 Stereo Decoder results).

Note al_sbr_sig_* are signaling test cases and are decoded correctly by the Ittiam HEAAC Decoder.

al_sbr_sr_* and sbr_cm_* series of test cases are designated “listening” test cases. They are not to be used for testing with the provided conformance tools.

al_sbr_cm_48_4, al_sbr_cm_48_5.1, al_sbr_cm_48_5 and al_sbr_cm_96_5 are not supported as they are of 4, 5.1, 5 and 5 channel configuration respectively.

For test files al_sbr_sr_64_2_fsaac32, al_sbr_sr_88_2_fsaac44, al_sbr_sr_96_2_fsaac48 the decoder operates on down-sampled synthesis as its a Level 3 Decoder

3.1.1.3 PS conformance test

Following table summarizes the PS conformance results for HE-AAC v2 Decoder.

Input File	Compliance			
	QMF-Max	QMF-RMS	SBR+PS-Max	SBR+PS-RMS
al_sbr_ps_00.adts	2.609 (8.000)	0.408 (1.700)	2.497 (8.000)	0.555 (1.700)
al_sbr_ps_01.adts	2.609 (12.000)	0.407 (1.800)	7.823 (12.000)	1.036 (1.800)
al_sbr_ps_02.adts	2.609	0.408	10.714	1.822
al_sbr_ps_03.adts	2.609	0.408	16.703	2.365
al_sbr_ps_04.adts	2.609	0.408	2.497	0.555
al_sbr_ps_05.adts	2.609	0.408	12.620	1.958
al_sbr_ps_06.adts	2.193	0.402	12.527	1.950

Table 3-3 PS conformance results (HEAAC v2 Stereo Decoder results).

3.1.1.4 3GPP PS conformance test

Following table summarizes the 3GPP PS conformance results for HEAAC v2 Stereo Decoder. The criteria for these files is that the ODG deviation cannot be more than abs(0.25)

Input File	ODG
m_cl_x_2_16s.wav	0.01
m_cl_x_2_21s.wav	0.03
m_cl_x_2_28s.wav	0.01
m_ot_x_1_16s.wav	0.02
m_ot_x_1_21s.wav	0.04
m_ot_x_1_28s.wav	0.01
m_p_x_1_16s.wav	0.02
m_p_x_1_21s.wav	0.04
m_p_x_1_28s.wav	0.02
m_si_x_1_16s.wav	-0.03
m_si_x_1_21s.wav	0.02
m_si_x_1_28s.wav	-0.1
s_cl_2t_1_16s.wav	0.02
s_cl_2t_1_21s.wav	0.04
s_cl_2t_1_28s.wav	0.02
s_cl_2t_2_16s.wav	-0.1
s_cl_2t_2_21s.wav	0.04
s_cl_2t_2_28s.wav	0.01
s_cl_mt_1_16s.wav	0.02

s_cl_mt_1_21s.wav	0.04
s_cl_mt_1_28s.wav	0.01
s_no_ft_2_16s.wav	0.01
s_no_ft_2_21s.wav	0.04
s_no_ft_2_28s.wav	0.01
sbm_sm_x_1_16s.wav	0.02
sbm_sm_x_1_21s.wav	0.04
sbm_sm_x_1_28s.wav	0.01
sbm_sm_x_2_16s.wav	0.02
sbm_sm_x_2_21s.wav	0.01
sbm_sm_x_2_28s.wav	-0.01
som_fi_x_2_16s.wav	0.02
som_fi_x_2_21s.wav	0.04
som_fi_x_2_28s.wav	0.02
som_ot_x_1_16s.wav	0.01
som_ot_x_1_21s.wav	0.03
som_ot_x_1_28s.wav	0.02

Table 3-4 3GPP PS conformance test results (HEAAC v2 Stereo Decoder results).

3.1.1.5 Erroneous Test Cases

Following table summarizes the erroneous test cases results with the error code returned. The reference for these error codes can be found in the codec API document or the error handling function implemented in the sample application released.

Input File	Error code returned
Multichannel AAC files: al06_*.adts, al15_*.adts, al16_*.adts, al17_*.adts	No. of channels in stream greater than max channels defined (0xFFFF9002)
Multichannel SBR files: al_sbr_cm_48_4.adts, al_sbr_cm_48_5.1.adts, al_sbr_cm_48_5.adts, al_sbr_cm_96_5.adts	No. of channels in stream greater than max channels defined (0xFFFF9002)
Handcreated files with change in element instance tag with frames	Element instance tag mismatch, because of new channel mode (0xFFFF980A)
All other profiles AAC conformance files in MP4 format: am*.mp4, as*.mp4, ap*.mp4	AAC Decoder initialization failed (0xFFFF9000)

Main profile AAC conformance files in ADTS format with header forced to be LC: am*_*.adts	LTP data found, not supported (0xFFFF9802) Or No. of channels in stream greater than max channels defined (0xFFFF9002)
LTP profile AAC conformance files in ADTS format with header forced to be LC: ap*_*.adts	Error in AAC decoding (0xFFFF9800)
LTP profile AAC conformance files in raw format: ap*_*.raw	No. of channels in stream greater than max channels defined (0xFFFF9002) Or LTP data found, not supported (0xFFFF9802)
SSR profile AAC conformance files in raw format: as*_*.raw	No. of channels in stream greater than max channels defined (0xFFFF9002) Or Element instance tag mismatch, because of new channel mode (0xFFFF980A) Or Channel coupling not supported (0xFFFF9803)

Table 3-5 Erroneous test cases results (HEAAC v2 Stereo Decoder results)

3.1.2 HEAAC v2 Multichannel Decoder results

3.1.2.1 AAC Conformance Test

Following table summarizes the AAC conformance test results for HEAAC v2 Multichannel Decoder. The worst case conformance results in each category of the test cases is given below. A 15 bit conformance is required for 16 bit output for AL00 cases to consider the decoder an MPEG AAC conformant. AL14, AL15, AL16 test cases have DRC, these cases have been compared with reference decoder without applying DRC as Ittiam AAC implementation doesn't support DRC. Core AAC Decoder has passed all the PNS conformance cases.

Input File	Compliance
AL00 - *.adts	15 bits
AL01 - *.adts	15 bits
AL02 - *.adts	15 bits
AL03 - *.adts	15 bits
AL04 - *.adts	15 bits
AL05 - *.adts	14 bits
AL06 - *.adts	15 bits
AL14 - *.adts	11 bits
AL15 - *.adts	14 bits
AL16 - *.adts	14 bits
AL17 - *.adts	15 bits
AL18 - *.adts	PASS
AL19 - *.adts	PASS

Table 3-6 AAC Conformance results (HEAAC v2 Multichannel Decoder results).

3.1.2.2 SBR conformance test

Following table summarizes the SBR conformance results for HEAAC v2 Multichannel Decoder.

Input File	Compliance			
	QMF-Max	QMF-RMS	SBR-Max	SBR-RMS
al_sbr_qmf_32_1.adts	3.015 (5.000)	0.648 (1.400)	Not Tested	Not Tested
al_sbr_e_32_1.adts	2.343 (90.000)	0.417 (2.000)	21.597 (90.000)	0.944 (2.000)
al_sbr_gh_32_1.adts	2.605 (51.000)	0.427 (1.500)	10.712 (51.000)	0.700 (1.500)

al_sbr_i_32_1.adts	2.482 (36.000)	0.420 (3.400)	12.169 (36.000)	1.273 (3.400)
al_sbr_s_32_1.adts	2.501 (120.000)	0.411 (1.900)	2.824 (120.000)	0.556 (1.900)
al_sbr_e_32_2.adts	3.208 (90.000)	0.658 (2.000)	33.423 (90.000)	1.300 (2.000)
al_sbr_gh_32_2.adts	3.195 (51.000)	0.647 (1.500)	17.729 (51.000)	1.014 (1.500)
al_sbr_i_32_2.adts	3.844 (36.000)	0.650 (3.400)	4.499 (36.000)	0.960 (3.400)
al_sbr_s_32_2.adts	3.837 (120.000)	0.642 (1.900)	32.249 (120.000)	1.045 (1.900)
al_sbr_qmf_44_1.adts	3.179 (5.000)	0.651 (1.400)	Not Tested	Not Tested
al_sbr_e_44_1.adts	2.340 (90.000)	0.417 (2.000)	10.332 (90.000)	0.697 (2.000)
al_sbr_gh_44_1.adts	2.619 (51.000)	0.424 (1.500)	8.809 (51.000)	0.640 (1.500)
al_sbr_i_44_1.adts	2.377 (36.000)	0.420 (3.400)	15.944 (36.000)	2.325 (3.400)
al_sbr_s_44_1.adts	2.314 (120.000)	0.412 (1.900)	2.259 (120.000)	0.523 (1.900)
al_sbr_e_44_2.adts	3.762 (90.000)	0.650 (2.000)	21.169 (90.000)	1.077 (2.000)
al_sbr_gh_44_2.adts	3.881 (51.000)	0.651 (1.500)	25.183 (51.000)	0.967 (1.500)
al_sbr_i_44_2.adts	4.054 (36.000)	0.651 (3.400)	5.550 (36.000)	0.979 (3.400)
al_sbr_s_44_2.adts	3.967 (120.000)	0.643 (1.900)	27.184 (120.000)	0.979 (1.900)
al_sbr_qmf_48_1.adts	3.316 (5.000)	0.657 (1.400)	Not Tested	Not Tested
al_sbr_e_48_1.adts	2.399 (90.000)	0.430 (2.000)	12.074 (90.000)	0.691 (2.000)
al_sbr_gh_48_1.adts	2.629 (51.000)	0.426 (1.500)	8.237 (51.000)	0.652 (1.500)
al_sbr_i_48_1.adts	2.374 (36.000)	0.420 (3.400)	14.504 (36.000)	2.127 (3.400)
al_sbr_s_48_1.adts	2.301 (120.000)	0.411 (1.900)	2.171 (120.000)	0.518 (1.900)
al_sbr_e_48_2.adts	3.817 (90.000)	0.643 (2.000)	21.491 (90.000)	1.076 (2.000)
al_sbr_gh_48_2.adts	3.942 (51.000)	0.651 (1.500)	12.023 (51.000)	0.934 (1.500)
al_sbr_i_48_2.adts	3.825 (36.000)	0.649 (3.400)	4.947 (36.000)	0.976 (3.400)

3.1.2.3 PS conformance test

Following table summarizes the PS conformance results for HEAAC v2 Multichannel Decoder.

Input File	Compliance			
	QMF-Max	QMF-RMS	SBR+PS-Max	SBR+PS-RMS
al_sbr_ps_00.adts	2.609 (8.000)	0.408 (1.700)	2.497 (8.000)	0.555 (1.700)
al_sbr_ps_01.adts	2.609 (12.000)	0.407 (1.800)	7.823 (12.000)	1.036 (1.800)
al_sbr_ps_02.adts	2.609	0.408	10.714	1.822
al_sbr_ps_03.adts	2.609	0.408	16.703	2.365
al_sbr_ps_04.adts	2.609	0.408	2.497	0.555
al_sbr_ps_05.adts	2.609	0.408	12.620	1.958
al_sbr_ps_06.adts	2.193	0.402	12.527	1.950

Table 3-8 PS conformance results (HEAAC v2 Multichannel Decoder results).

3.1.2.4 3GPP PS conformance test

Following table summarizes the 3GPP PS conformance results for HEAAC v2 Multichannel Decoder. The criteria for these files is that the ODG deviation cannot be more than abs(0.25)

Input File	ODG
m_cl_x_2_16s.wav	0.01
m_cl_x_2_21s.wav	0.03
m_cl_x_2_28s.wav	0.01
m_ot_x_1_16s.wav	0.02
m_ot_x_1_21s.wav	0.04
m_ot_x_1_28s.wav	0.01
m_p_x_1_16s.wav	0.02
m_p_x_1_21s.wav	0.04
m_p_x_1_28s.wav	0.02
m_si_x_1_16s.wav	-0.03
m_si_x_1_21s.wav	0.02
m_si_x_1_28s.wav	-0.1
s_cl_2t_1_16s.wav	0.02
s_cl_2t_1_21s.wav	0.04
s_cl_2t_1_28s.wav	0.02
s_cl_2t_2_16s.wav	-0.1
s_cl_2t_2_21s.wav	0.04
s_cl_2t_2_28s.wav	0.01

s_cl_mt_1_16s.wav	0.02
s_cl_mt_1_21s.wav	0.04
s_cl_mt_1_28s.wav	0.01
s_no_ft_2_16s.wav	0.01
s_no_ft_2_21s.wav	0.04
s_no_ft_2_28s.wav	0.01
sbm_sm_x_1_16s.wav	0.02
sbm_sm_x_1_21s.wav	0.04
sbm_sm_x_1_28s.wav	0.01
sbm_sm_x_2_16s.wav	0.02
sbm_sm_x_2_21s.wav	0.01
sbm_sm_x_2_28s.wav	-0.01
som_fi_x_2_16s.wav	0.02
som_fi_x_2_21s.wav	0.04
som_fi_x_2_28s.wav	0.02
som_ot_x_1_16s.wav	0.01
som_ot_x_1_21s.wav	0.03
som_ot_x_1_28s.wav	0.02

Table 3-9 3GPP PS conformance test results (HEAAC v2 Multichannel Decoder results).

3.1.2.5 Erroneous Test Cases

Following table summarizes the erroneous test cases results with the error code returned. The reference for these error codes can be found in the codec API document or the error handling function implemented in the sample application released.

Input File	Error code returned
Handcreated files with change in element instance tag with frames	Element instance tag mismatch, because of new channel mode (0xFFFF980A)
All other profiles AAC conformance files in MP4 format: am*.mp4, as*.mp4, ap*.mp4	AAC Decoder initialization failed (0xFFFF9000)
Main profile AAC conformance files in ADTS format with header forced to be LC: am*_*.adts	LTP data found, not supported (0xFFFF9802) Or No. of channels in stream greater than max channels defined (0xFFFF9002)

LTP profile AAC conformance files in ADTS format with header forced to be LC: ap*_*.adts	Error in AAC decoding (0xFFFF9800)
LTP profile AAC conformance files in raw format: ap*_*.raw	No. of channels in stream greater than max channels defined (0xFFFF9002) Or LTP data found, not supported (0xFFFF9802)
SSR profile AAC conformance files in raw format: as*_*.raw	No. of channels in stream greater than max channels defined (0xFFFF9002) Or Element instance tag mismatch, because of new channel mode (0xFFFF980A) Or Channel coupling not supported (0xFFFF9803)

Table 3-10 Erroneous test cases results (HEAAC v2 Multichannel Decoder results)

3.1.3 aacPlus Stereo Decoder results

3.1.3.1 AAC Conformance Test

Following table summarizes the AAC conformance test results for aacPlus Decoder. The worst case conformance results in each category of the test cases is given below. A 15 bit conformance is required for 16 bit output for AL00 cases to consider the decoder an MPEG AAC conformant. AL14 test cases have DRC, these cases have been compared with reference decoder without applying DRC as Ittiam AAC implementation doesn't support DRC. Core AAC Decoder has passed all the PNS conformance cases.

Input File	Compliance
AL00 - *.adts	15 bits
AL01 - *.adts	15 bits

Input File	Compliance
AL02 - *.adts	15 bits
AL03 - *.adts	15 bits
AL04 - *.adts	15 bits
AL05 - *.adts	15 bits
AL14 - *.adts	11 bits
AL17 - *.adts	15 bits
AL18 - *.adts	PASS
AL19 - *.adts	PASS

Table 3-11 AAC Conformance results (aacPlus Stereo Decoder results).

3.1.3.2 SBR conformance test

Following table summarizes the SBR conformance results for aacPlus Decoder.

Input File	Compliance			
	QMF-Max	QMF-RMS	SBR-Max	SBR-RMS
al_sbr_qmf_32_1.adts	3.697 (5.000)	0.812 (1.400)	Not Tested	Not Tested
al_sbr_e_32_1.adts	3.683 (90.000)	0.655 (2.000)	22.931 (90.000)	1.222 (2.000)
al_sbr_gh_32_1.adts	3.918 (51.000)	0.651 (1.500)	10.870 (51.000)	0.961 (1.500)
al_sbr_i_32_1.adts	3.897 (36.000)	0.649 (3.400)	5.899 (36.000)	1.011 (3.400)
al_sbr_s_32_1.adts	3.518 (120.000)	0.641 (1.900)	4.425 (120.000)	0.908 (1.900)
al_sbr_e_32_2.adts	3.208 (90.000)	0.658 (2.000)	33.423 (90.000)	1.300 (2.000)
al_sbr_gh_32_2.adts	3.195 (51.000)	0.647 (1.500)	17.729 (51.000)	1.014 (1.500)
al_sbr_i_32_2.adts	3.844 (36.000)	0.650 (3.400)	4.499 (36.000)	0.960 (3.400)
al_sbr_s_32_2.adts	3.837 (120.000)	0.642 (1.900)	32.249 (120.000)	1.045 (1.900)
al_sbr_qmf_44_1.adts	3.733 (5.000)	0.814 (1.400)	Not Tested	Not Tested
al_sbr_e_44_1.adts	3.462 (90.000)	0.650 (2.000)	15.163 (90.000)	0.975 (2.000)
al_sbr_gh_44_1.adts	3.97 (51.000)	0.650 (1.500)	14.698 (51.000)	0.913 (1.500)
al_sbr_i_44_1.adts	3.844 (36.000)	0.649 (3.400)	5.730 (36.000)	1.014 (3.400)

al_sbr_s_44_1.adts	3.891 (120.000)	0.642 (1.900)	4.425 (120.000)	0.880 (1.900)
al_sbr_e_44_2.adts	3.762 (90.000)	0.650 (2.000)	21.169 (90.000)	1.077 (2.000)
al_sbr_gh_44_2.adts	3.881 (51.000)	0.651 (1.500)	25.183 (51.000)	0.967 (1.500)
al_sbr_i_44_2.adts	4.054 (36.000)	0.651 (3.400)	5.550 (36.000)	0.979 (3.400)
al_sbr_s_44_2.adts	3.967 (120.000)	0.643 (1.900)	27.184 (120.000)	0.979 (1.900)
al_sbr_qmf_48_1.adts	3.48 (5.000)	0.818 (1.400)	Not Tested	Not Tested
al_sbr_e_48_1.adts	3.256 (90.000)	0.642 (2.000)	10.574 (90.000)	0.940 (2.000)
al_sbr_gh_48_1.adts	3.857 (51.000)	0.649 (1.500)	11.017 (51.000)	0.907 (1.500)
al_sbr_i_48_1.adts	3.73 (36.000)	0.650 (3.400)	7.300 (36.000)	1.075 (3.400)
al_sbr_s_48_1.adts	3.729 (120.000)	0.643 (1.900)	52.868 (120.000)	1.249 (1.900)
al_sbr_e_48_2.adts	3.817 (90.000)	0.643 (2.000)	21.491 (90.000)	1.076 (2.000)
al_sbr_gh_48_2.adts	3.942 (51.000)	0.651 (1.500)	12.023 (51.000)	0.934 (1.500)
al_sbr_i_48_2.adts	3.825 (36.000)	0.649 (3.400)	4.947 (36.000)	0.976 (3.400)
al_sbr_s_48_2.adts	4.024 (120.000)	0.643 (1.900)	13.541 (120.000)	0.936 (1.900)

Table 3-12 SBR conformance results (aacPlus Stereo Decoder results).

Note al_sbr_sig_* is signaling test cases and are decoded correctly by the Ittiam HEAAC Decoder.

al_sbr_sr_* and sbr_cm_* series of test cases are designated “listening” test cases. They are not be used for testing with the provided conformance tools.

al_sbr_cm_48_4, al_sbr_cm_48_5.1, al_sbr_cm_48_5 and al_sbr_cm_96_5 are not supported as they are of 4, 5.1, 5 and 5 channel configuration respectively.

For test files al_sbr_sr_64_2_fsaac32, al_sbr_sr_88_2_fsaac44, al_sbr_sr_96_2_fsaac48 the decoder operates on down-sampled synthesis as its a Level 3 Decoder

3.1.4 aacPlus Multichannel Decoder results

3.1.4.1 AAC Conformance Test

Following table summarizes the AAC conformance test results for AacPlus Decoder. The worst case conformance results in each category of the test cases is given below. A 15 bit conformance is required for 16 bit output for AL00 cases to consider the decoder an MPEG AAC conformant. AL14, AL15, AL16 test cases have DRC, these cases have been compared with reference decoder without applying DRC as Ittiam AAC implementation doesn't support DRC. Core AAC Decoder has passed all the PNS conformance cases.

Input File	Compliance
AL00 - *.adts	15 bits
AL01 - *.adts	15 bits
AL02 - *.adts	15 bits
AL03 - *.adts	15 bits
AL04 - *.adts	15 bits
AL05 - *.adts	14 bits
AL06 - *.adts	15 bits
AL14 - *.adts	11 bits
AL15 - *.adts	14 bits
AL16 - *.adts	14 bits
AL17 - *.adts	15 bits
AL18 - *.adts	PASS
AL19 - *.adts	PASS

Table 3-13 AAC Conformance results (aacPlus Multichannel Decoder results).

3.1.4.2 SBR conformance test

Following table summarizes the SBR conformance results for aacPlus Decoder.

Input File	Compliance			
	QMF-Max	QMF-RMS	SBR-Max	SBR-RMS
al_sbr_qmf_32_1.adts	3.697 (5.000)	0.812 (1.400)	Not Tested	Not Tested
al_sbr_e_32_1.adts	3.683 (90.000)	0.655 (2.000)	22.931 (90.000)	1.222 (2.000)
al_sbr_gh_32_1.adts	3.918 (51.000)	0.651 (1.500)	10.870 (51.000)	0.961 (1.500)

al_sbr_i_32_1.adts	3.897 (36.000)	0.649 (3.400)	5.899 (36.000)	1.011 (3.400)
al_sbr_s_32_1.adts	3.518 (120.000)	0.641 (1.900)	4.425 (120.000)	0.908 (1.900)
al_sbr_e_32_2.adts	3.208 (90.000)	0.658 (2.000)	33.423 (90.000)	1.300 (2.000)
al_sbr_gh_32_2.adts	3.195 (51.000)	0.647 (1.500)	17.729 (51.000)	1.014 (1.500)
al_sbr_i_32_2.adts	3.844 (36.000)	0.650 (3.400)	4.499 (36.000)	0.960 (3.400)
al_sbr_s_32_2.adts	3.837 (120.000)	0.642 (1.900)	32.249 (120.000)	1.045 (1.900)
al_sbr_qmf_44_1.adts	3.733 (5.000)	0.814 (1.400)	Not Tested	Not Tested
al_sbr_e_44_1.adts	3.462 (90.000)	0.650 (2.000)	15.163 (90.000)	0.975 (2.000)
al_sbr_gh_44_1.adts	3.97 (51.000)	0.650 (1.500)	14.698 (51.000)	0.913 (1.500)
al_sbr_i_44_1.adts	3.844 (36.000)	0.649 (3.400)	5.730 (36.000)	1.014 (3.400)
al_sbr_s_44_1.adts	3.891 (120.000)	0.642 (1.900)	4.425 (120.000)	0.880 (1.900)
al_sbr_e_44_2.adts	3.762 (90.000)	0.650 (2.000)	21.169 (90.000)	1.077 (2.000)
al_sbr_gh_44_2.adts	3.881 (51.000)	0.651 (1.500)	25.183 (51.000)	0.967 (1.500)
al_sbr_i_44_2.adts	4.054 (36.000)	0.651 (3.400)	5.550 (36.000)	0.979 (3.400)
al_sbr_s_44_2.adts	3.967 (120.000)	0.643 (1.900)	27.184 (120.000)	0.979 (1.900)
al_sbr_qmf_48_1.adts	3.48 (5.000)	0.818 (1.400)	Not Tested	Not Tested
al_sbr_e_48_1.adts	3.256 (90.000)	0.642 (2.000)	10.574 (90.000)	0.940 (2.000)
al_sbr_gh_48_1.adts	3.857 (51.000)	0.649 (1.500)	11.017 (51.000)	0.907 (1.500)
al_sbr_i_48_1.adts	3.73 (36.000)	0.650 (3.400)	7.300 (36.000)	1.075 (3.400)
al_sbr_s_48_1.adts	3.729 (120.000)	0.643 (1.900)	52.868 (120.000)	1.249 (1.900)
al_sbr_e_48_2.adts	3.817 (90.000)	0.643 (2.000)	21.491 (90.000)	1.076 (2.000)
al_sbr_gh_48_2.adts	3.942 (51.000)	0.651 (1.500)	12.023 (51.000)	0.934 (1.500)

3.1.5 AAC Stereo Decoder results

3.1.5.1 AAC Conformance Test

Following table summarizes the AAC conformance test results for AAC Decoder. The worst case conformance results in each category of the test cases is given below. A 15 bit conformance is required for 16 bit output for AL00 cases to consider the decoder an MPEG AAC conformant. AL14, AL15, AL16 test cases have DRC, these cases have been compared with reference decoder without applying DRC as Ittiam AAC implementation doesn't support DRC. Core AAC Decoder has passed all the PNS conformance cases.

Input File	Compliance
AL00 - *.adts	15 bits
AL01 - *.adts	15 bits
AL02 - *.adts	15 bits
AL03 - *.adts	15 bits
AL04 - *.adts	15 bits
AL05 - *.adts	15 bits
AL14 - *.adts	11 bits
AL17 - *.adts	15 bits
AL18 - *.adts	PASS
AL19 - *.adts	PASS

Table 3-15 AAC Conformance results (AAC Stereo Decoder results).

3.1.6 AAC Multichannel Decoder results

3.1.6.1 AAC Conformance Test

Following table summarizes the AAC conformance test results for AAC Decoder. The worst case conformance results in each category of the test cases is given below. A 15 bit conformance is required for 16 bit output for AL00 cases to consider the decoder an MPEG AAC conformant. AL14, AL15, AL16 test cases have DRC, these cases have been compared with reference decoder without applying DRC as Ittiam AAC implementation doesn't support DRC. Core AAC Decoder has passed all the PNS conformance cases.

Input File	Compliance
AL00 - *.adts	15 bits
AL01 - *.adts	15 bits
AL02 - *.adts	15 bits
AL03 - *.adts	15 bits
AL04 - *.adts	15 bits
AL05 - *.adts	15 bits
AL06 - *.adts	15 bits
AL14 - *.adts	11 bits
AL15 - *.adts	14 bits
AL16 - *.adts	14 bits
AL17 - *.adts	15 bits
AL18 - *.adts	PASS
AL19 - *.adts	PASS

Table 3-16 AAC Conformance results (AAC Multichannel Decoder results).

4. Conclusion

The results in **Section 3.1** shows that HEAAC v2 Decoder, aacPlus Decoder and AAC Decoder is fully conformant to MPEG and 3GPP criteria

5. References

- [1] *Text of ISO/IEC 14496-3:2001/AMD1, Bandwidth Extension (MPEG-4)*
- [2] *ISO/IEC 14496-4, AAC conformance (MPEG-4)*
- [3] *ISO/IEC 14496-4:AMD8, HE-AAC, Audio BIFS and SA Conformance (MPEG-4)*
- [4] *ISO/IEC 14496-4:AMD11, Parametric stereo conformance (MPEG-4)*
- [5] *3GPP TS 26.406 v6.3.0, Enhanced aacPlus general audio codec:Conformance testing & package*
- [6] *ISO/IEC 14496-5:AMD6, Reference Software*