

**WBU-ISOG
MPEG-4 (H.264) CONTRIBUTION
HD CODEC
INTEROPERABILITY PROGRAM
AND
TEST RESULTS**

WBU-ISOG
Geneva, Switzerland
November 30-December 1, 2009
Tom Gibbon for NHK
Chair
MPEG-4 HD CODEC
INTEROPERABILITY PROGRAM

BASIC ELEMENTS OF WBU-ISOG MPEG-4 HD CODEC INTEROPERABILITY PROGRAM

1. Sponsorship by WBU-ISOG
2. Formal Participation Agreements Signed by Vendors
3. Payment of Test Fees By Vendor to Test Contractor - \$8,000
4. Appointment of Telesat as Test Contractor
5. Test Tapes and Transport Stream parameters provided by WBU-ISOG

BASIC ELEMENTS OF WBU-ISOG MPEG-4 HD CODEC INTEROPERABILITY PROGRAM (cont.)

6. Transport Streams created by Vendors and uploaded to Telesat server
7. Transport Streams downloaded by Vendors for informal tests by Vendors
8. Formal Tests conducted by Telesat
9. Publish Results of Tests on WBU-ISOG website

HISTORY

October 22-23, 2007 – WBU-ISOG decides at its semi-annual meeting in Dubrovnik to sponsor MPEG-4 Interoperability Tests. Tom Gibbon for NHK appointed as Chair.

February, 2008 – Broadcasting Planning Group Formed.

March, 2008 – Telesat Appointed as Test Contractor. Communications Research Centre (CRC) agrees to assist.

March – April, 2008 – Test Parameters specified.

June, 2008 – Invitations and Participation Agreements sent to Vendors.

HISTORY (cont.)

October, 2008 – Minimum Number of Vendors Return Signed Participation Agreements.

December, 2008 – Test Tapes Provided to Vendors

February, 2009 – June, 2009 – Informal Testing by Vendors

June, 2009 – Formal Tests At Telesat

October, 2009 – Formal Test Results Published by WBU-ISOG.

MPEG-4 PARTICIPATING VENDORS

12 Vendors

10 Encoder Vendors

9 Decoder Vendors

1. ADTEC (Encoder Only)
2. ATEME (Encoder Only)
3. Cisco
4. Comtech TV
5. Evertz Microsystems Inc.
6. Fujitsu
7. Harmonic, Inc. (Encoder Only)
8. International Datacasting (Decoder Only)
9. NTT Electronics Corporation
10. Sencore (Decoder Only)
11. Tandberg Television
12. Thomson Grass Valley

TEST PARAMETERS SUMMARY

1. Tests were conducted only for high definition formats.
2. Tests were conducted using bit rates at 38 Mbps high quality contribution (e.g., major events, potential concatenation), at 20 Mbps medium quality contribution and 10.3 Mbps SNG.
3. Tests at 4:2:2 and 4:2:0
4. Tests with four Video Formats:
 - 1080i/59.94
 - 1080i/50
 - 720p/59.9
 - 720p/50

TEST PARAMETERS (cont.)

5. Tests with Four Audio Formats:

- 4 Ch. Audio MPEG-2 (MPEG 1 Layer 2)
- Dolby E 20 bit mode 8 channels (SMPTE 302 M 2002)
- PCM (SMPTE 302 M 2002)
- AAC

6. Latency was tested. If Latency is too extreme for a particular vendor decoder, the decoder may not be interoperable because it cannot effectively be used.

DETAILS OF TEST PARAMETERS

- Video Formats:
 - 1080i/59.94
 - 1080i/50
 - 720p/59.9
 - 720p/50
- Bit Rates:
 - High Quality: 38 Mbps
 - Medium Quality: 20 Mbps
 - SNG: 10.3 Mbps
- Chroma:
 - High Quality: 4:2:2 (Hi 422 @L4 (10 bit if supported, otherwise 8 bit))
 - Medium Quality: 4:2:2 (Hi 422@L4 (10 bit if supported, otherwise 8 bit))
 - SNG: 4:2:0 ((HiP@L4 8 bit)
- or if 4:2:2 not supported:
 - High Quality: 4:2:0 (H:P @ L4 8 bit)
 - Medium Quality: 4:2:0 (H:P @ L4 8 bit)

DETAILS OF TEST PARAMETERS (cont.)

- Coding Structure:
 - IBBP
- GOP:
 - GOP 15 and 16
- Audio Format:
 - 4 Ch. Audio MPEG-2 (MPEG 1 Layer 2)
 - Dolby E 20 bit mode 8 channels (SMPTE 302 M 2002)
 - PCM (SMPTE 302 M 2002)
 - AAC
- Lip Sync:
 - Test all audio formats

DETAILS OF TEST PARAMETERS (cont.)

- Latency:
 - High – Standard latency
 - Medium – Standard latency
 - SNG - Low Latency
- Resolution:
 - All tests will be done at full resolution:
 - 1920 (1800 line) h pixels
 - 1280 (720 line) h pixels

TRANSPORT STREAMS AND TESTS

- 28 Transport Streams To Be Provided by Each Vendor
- 10 Encoders
- 280 Potential Transport Streams To Be Tested
- 9 Decoders

TEST PROCEDURES

1. Video Tests

- Uploaded ASI streams used for tests
(onsite encoders used only if technical problems arise)
- Pass/fail
(previous tests required expert viewers and ratings)
- TS sent to all 10 decoders simultaneously
- Decoder stations have 24" HD 1920x1080
(60Hz/50Hz monitors)
- Pass/fail assessment done directly at decoder station
- If video present (pass) but impairment is visible, impairment reported and video patched for larger 24" display for closer scrutiny

TEST PROCEDURES (cont.)

2. Audio Tests

- Uploaded ASI streams used for tests
(onsite encoders used only if technical problems arise)
- Pass/fail
- TS sent to all 10 decoders simultaneously
- Assessments done at central audio station or at decoder site
- Tests performed with one representative TS in each available audio encoded format (MPEG-2, AAC, PCM, Dolby E)

TEST PROCEDURES (cont.)

3. Latency Test

- Live test using on-site encoder
- Performed only at 1080i/59.94
- Tests at 38 Mbps (high quality) with standard latency setting and 10.3 Mbps (SNG quality) with low latency setting
- Tests at 20 Mbps (medium quality) with standard latency only if vendor does not support 38 Mbps

TEST PROCEDURES (cont.)

4. Short Term Lip Sync

- Uploaded ASI streams used for tests
(onsite encoders to be used only if technical problems arise)
- Maximum 5 minute duration using 30 second Vistek loop
- 5 minutes reduced if tests show no significant drift
- Tests at 1080i/50Hz MPEG 2 and 1080i/60Hz PCM, AAC, Dolby E with representative TS
- With time as problem, lip sync done by Telesat following week without vendor support

WBU-ISOG – VIDEO AND AUDIO TEST SETUP

- **Video Testing**

- Each vendors video was evaluated at the decoder stations on 24” LCD displays;
- Rating Pass / Fail with comment;
- Decoder HDSDI output patched to 42” monitors for critical evaluation.

- **Audio Testing**

- Each decoder under test has its audio patched to the test facility for evaluation and pass/fail audio testing

- **Lip Sync Testing**

- Vistek Valid8 signal
- Lip sync monitored over a 5 minute period using a looping 30 second transport stream from the vendor under test.

INTEROPERABILITY RESULTS

UNSUPPORTED PARAMETERS

- 6 encoder vendors did not support 38 Mbps
- 3 decoder vendors did not support 38 Mbps
- 7 encoder vendors did not support 4:2:2
- 8 decoder vendors did not support 4:2:2

In fact there was only 1 successful test for 38 Mbps at 4:2:2.

For 38 Mbps at 4:2:0, there were 27 successful tests.

INTEROPERABILITY RESULTS

UNSUPPORTED PARAMETERS (cont.)

- 3 encoder vendors did not support Dolby E
- 2 decoder vendors did not support Dolby E
- 3 encoder vendors did not support PCM
- 4 decoder vendors did not support PCM
- 3 decoder vendors did not support AAC
- 2 decoder vendors did not support 720p/50
- 2 decoder vendors did not support 1080i/50

INTEROPERABILITY VIDEO RESULTS

- 1024 Tests
- 848 Unconditional Pass
- 83% Unconditional Pass Rate

- Typical examples
 - 38 Mbps 1080i/59.94 4:2:2 3 tests – 1 pass (33 %)
 - 20 Mbps 1080i/59.94 4:2:0 57 tests – 49 pass (86%)
 - 10.3 Mbps 1080i/59.94 4:2:0 90 tests – 78 pass (87%)
 - 10.3 Mbps 720p/59.94 4:2:0 81 tests – 70 pass (86%)

VIDEO COMMENTS EXAMPLES

- FREEZE FRAMES, BREAKUPS AND BLOCKING
- NO USABLE PICTURE
- OK ON FIRST PASS,
 - INCREASING ARTIFACTS WITH EACH LOOP.
 - THEN REQUIRES RESET.
 - TEMPORARY ERRORS AT LOOP POINT
- FLASHBACKS TO COLOUR BARS
- VERY LONG DELAY (40SEC) BEFORE RESYNCING AFTER COLOUR BAR
- PROBLEM SYNCHRONIZING TO TS
- SINGLE JUDDER EVENT (FRAME FREEZE/JUMP)

VIDEO INTEROPERABILITY SUMMARY OF RESULTS

- GENERALLY A GOOD INTEROPERABILITY RATE OVERALL WITH A 16% COMMENT RATE.
- 1080I59.94 AND 720P59.94 AT 10.3MBPS WERE THE BEST SUPPORTED FORMATS FOR THE ENCODER VENDORS.
- THE 38MBPS CBR TS RATE AND 4:2:2 CHROMA HAD THE LEAST SUPPORT FROM ENCODER VENDORS.
- STANDARD MPEG4 4:2:2 CHROMA DECODING WAS SUPPORTED BY ONE VENDOR. ONE VENDOR HAD A PROPRIETARY 4:2:2 IMPLEMENTATION.
- 1080I50 HAD THE HIGHEST NUMBER OF COMMENTS AS A % OF THE TOTAL COMMENTS.

INTEROPERABILITY AUDIO TEST RESULTS

- MPEG-2
 - 90 tests
 - 82 pass
 - 8 failures with single decoder
 - 91%
- Dolby E
 - 49 tests
 - 38 pass
 - 78%
- PCM
 - 35 tests
 - 29 pass
 - 83%
- AAC
 - 56 tests
 - 49 pass
 - 88%

AUDIO COMMENTS EXAMPLES

- NO AUDIO
- VIDEO ISSUES AT DECODER, AUDIO OK
- DOLBY CRC ERRORS AT TESTING CENTER
- INTERMITTENT DECODE
- DECODES BUT HAS CONSISTENT BREAKUP

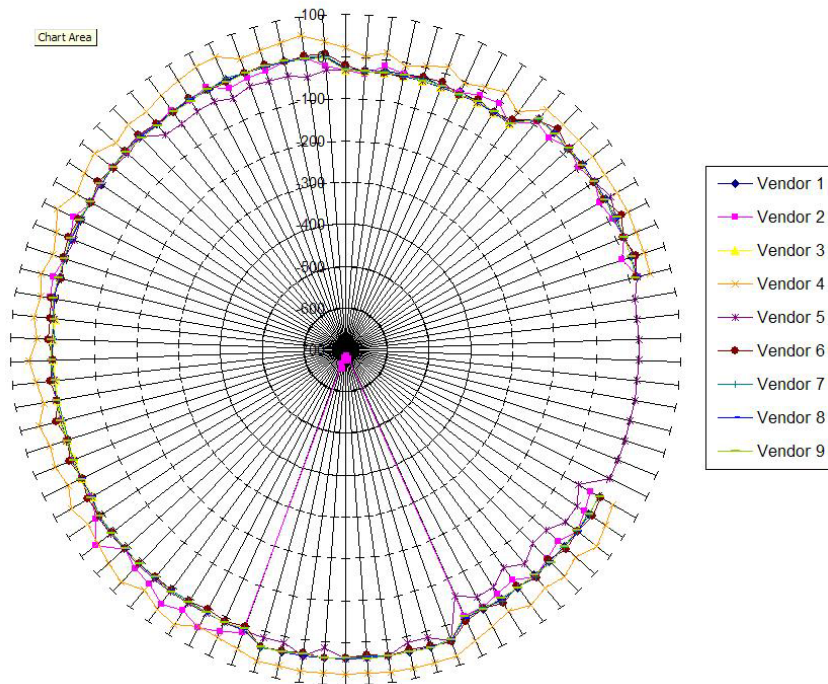
INTEROPERABILITY LIP SYNC RESULTS

- 150 Total Measurement on 4 different audio formats.
- Generally acceptable
- One decoder unacceptable, but it has indicated new firmware has been released to address problem.
- Long term Lip Sync – One 6 hour test – no appreciable difference on recorders.

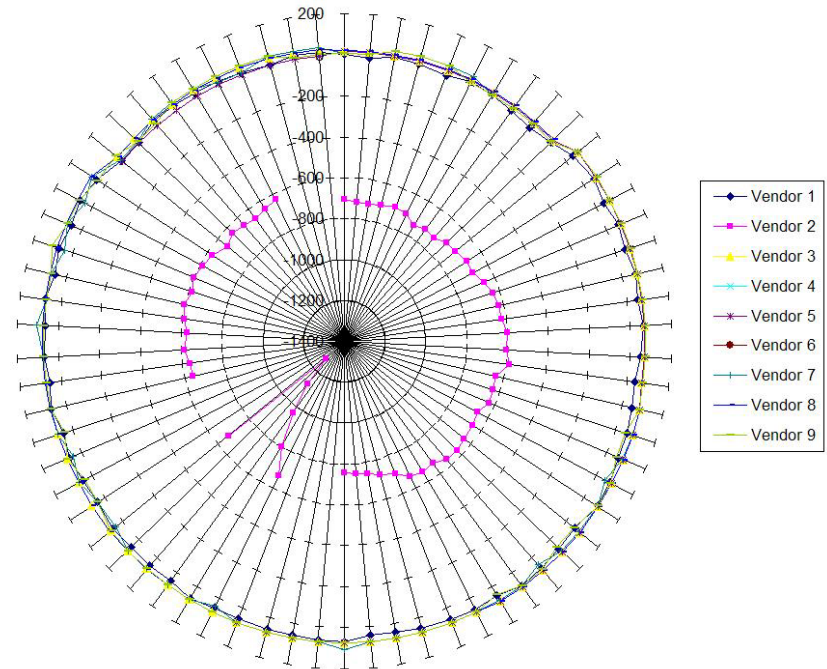
SHORT TERM LIP SYNC

- Results generally good with vendors typically within a similar range.
- One decoder vendor at slightly greater delta from the broadcast decoder norm with MPEG2.
- One decoder vendor with large deltas.

MPEG2 Audio Lip Sync (milliseconds)



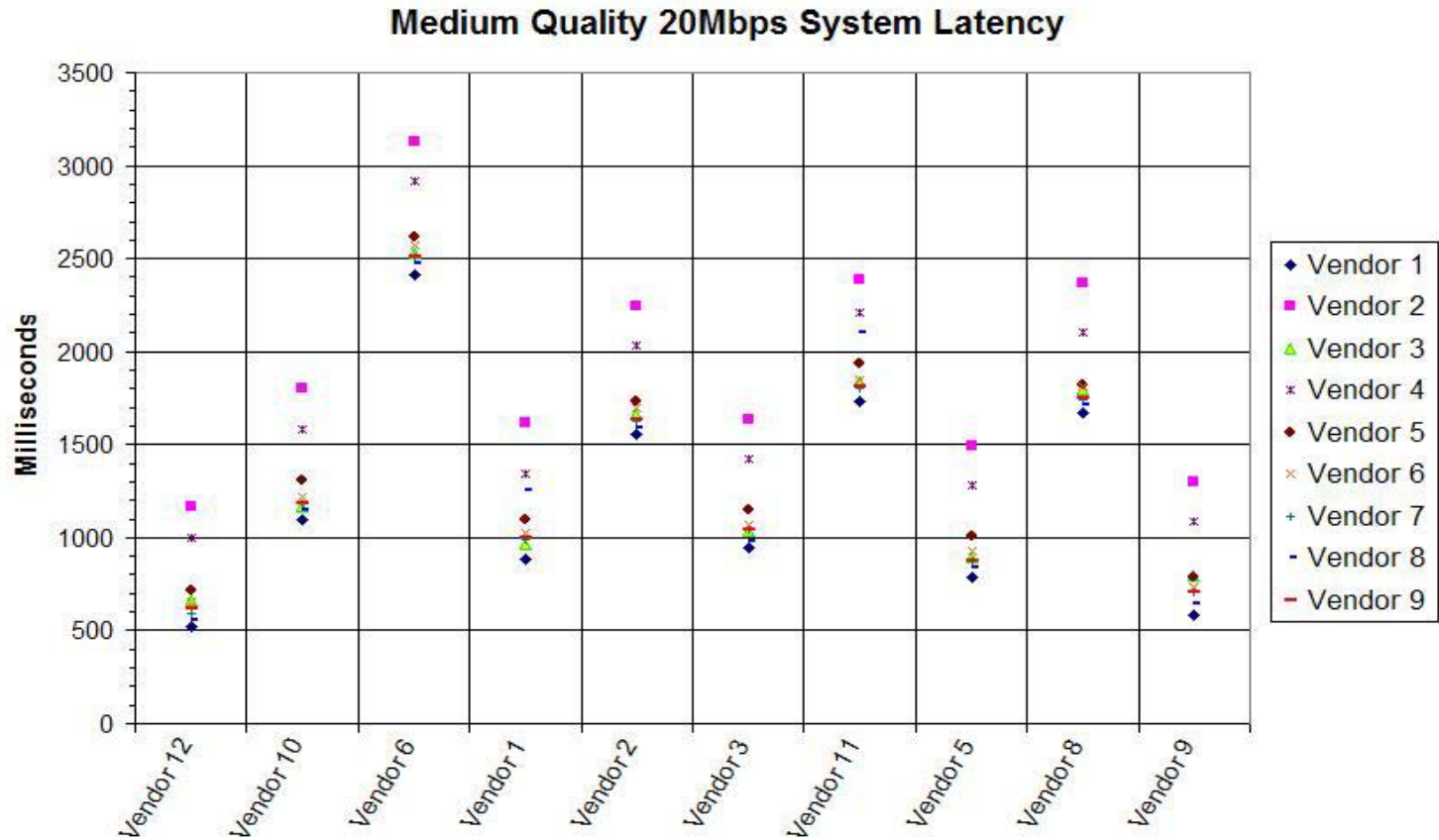
Dolby-E Audio Lip Sync (milliseconds)



INTEROPERABILITY LATENCY RESULTS

- NO PASS FAIL
- CLEAR THAT SOME ENCODERS PRESENTED CONSISTENTLY LONGER LATENCY PERIODS
- CLEAR THAT SOME DECODERS PRESENTED CONSISTENTLY LONGER LATENCY PERIODS

SYSTEM LATENCY



- Results were similar between Quality:
 - High
 - Medium
 - SNG
- Transport Stream Provider

RESULTS ON WBU-ISOG WEBSITE

[http://www.nabanet.com/wbuarea/library/
documents.asp#sub_interoperability](http://www.nabanet.com/wbuarea/library/documents.asp#sub_interoperability)