

N/HD-NET

(High Definition on Networks)

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EBU HDTV Project Groups

P/HDTP **High Definition in Television Production**

B/TQE **Television Quality Evolution**

Looking at HDTV production and emission respectively.

N/HD-NET **High Definition on Networks**

Looking at the underlying requirements to move HDTV around & between.

WBU-ISOG

World Broadcasting Unions International Satellite Operations Group

HDTV MPEG2 encoders/decoders interoperability tests

Telesat, Ottawa

- **First round- March 2005**
- **Second round- July 2005**
- **WBU-ISOG/manufacturers meeting, Washington-
October 2005**

WBU-ISOG/Telesat tests – First round

MPEG2, 4:2:2 coders &/or decoders from 9 manufacturers
Source material was critical sport sequences

Video

Assessment- subjective, on large plasma displays (except 720p/50)

- 1080i/59.94
- 720p/59.94
- 1080i/50
- (720p/50, only two encoders and three decoders)

40 & 60 Mb/s

4 formats, 2 bit-rates = 8 tests per encoder/decoder pair

8 encoders, 6 decoders = 48 combinations

48 x 8 = 384 tests

210 tests worked correctly

70% success after allowance for lack of 720p/50 capability

WBU-ISOG/Telesat tests – First round

Audio

Assessment- tone measured, source material subjective

- Uncompressed two channel PCM, AES/EBU (2.048 Mb/s)
- Dual channel MPEG Layer II (384 kb/s)
- Two dual channels of MPEG Layer II (2 x 384 kb/s)
- 8 channel Dolby-E. (2.44 Mb/s)

Only at 1080i/59.94 video, 40Mb/s

8 encoders, 6 decoders, 4 formats = 192

124 worked well

74% success after allowance

(some equipment not supporting certain formats)

WBU-ISOG/Telesat tests – First round

Video/audio delay (Lip Sync)

Mostly reasonable except for Dolby-E

Latency

Not tested

WBU-ISOG/Telesat tests – Second round

To retest parameters that had failed in the first round

Still MPEG2, 4:2:2

Most of the original manufacturers, some new ones

Same source material + EBU/SVT material

Video

Same monitoring (this time 720p/50 on a monitor)

- 1080i/59.94
- 720p/59.94
- (720p/50 - 3 encoders, 2 decoders)

Again, 40 & 60 Mb/s

All combinations worked

WBU-ISOG/Telesat tests – Second round

Audio

Assessment- just subjective (OK / not OK)

- Uncompressed two channel PCM, AES/EBU
- Two dual channels of MPEG Layer II
- 8 channel Dolby-E

Only at 1080i/59.94 video, 40Mb/s.

Most combinations worked

WBU-ISOG/Telesat tests – Second round

Via Satellite

1080i/59.94 video, 4-channel MPEG audio, 40 Mb/s
for all combinations of encoder-decoder

Included simulated rain-fade for one minute (10 dB attenuation in the up-link)

No difference from back-to-back tests

Latency

1080i/59.94 video, 40 Mbit/s, all combinations of coders/decoders.

Measured 321ms to 886ms.

(1800ms if including one particular encoder which apparently had been optimised for distribution use)

So could be >1 second if via satellite

WBU-ISOG/Telesat tests – Second round

Lip Sync

Only with 4-channel MPEG audio

Short-term-

Errors rather high (up to 60 ms)

One encoder gave significantly different readings after the ASI connection was interrupted then re-connected.

Long-term-

Measured before and after 12 hours of connection, then again after a disconnect/reconnect of the ASI input.

Some encoder-decoder combinations showed considerable drift over the 12 hours (up to 200 ms), The increased errors of the drifters was cured by disconnecting and reconnecting the ASI input.

WBU-ISOG/Telesat tests

Interoperability tests summary

- Video almost 100%, audio about 80%
- Still significant lip sync errors with some encoder-decoder combinations
Long-term drift is also a problem in some cases.
- Dolby-E now interoperates well as far as decoding, but in some combinations the lip sync error can be high.
- Bit-rate for contribution- 60 Mb/s shows no obvious improvement over 40 Mb/s even on critical sequences, although not proper quality assessment environment.

WBU-ISOG/manufacturers meeting, Washington

- Discussed results of two rounds of tests – still not perfect but the manufacturers now understood the reasons for the failures, so felt sure that remaining problems could be solved.
- Discussion concerning the possibility of "self testing", whereby manufacturers should provide each other with Transport Streams for checking interoperability.
Unlikely as some manufacturers were not prepared to so provide.
Concerns about reverse engineering revealing secrets about their encoder design, especially in the case of MPEG-4 encoders.

Compression

1.5 Gb/s for HD-SDI 720p/50 or 1080i/50. 3 Gb/s for 1080p/50

BBC mezzanine compression scheme, effectively lossless

2.2-2.5 to 1. Enables 1080p/50 over 1.5 Gb/s links

Satellite- 36 MHz or 72 MHz transponders

Bit-rate depends on modulation scheme

36 MHz allows order of 40-45 Mb/s with DVB S

Maybe 60 Mb/s with DVB S2

HD contribution quality reasonable at about 40 Mb/s (MPEG2) if no further significant processing

If subsequent conversion likely, higher bit-rate needed

Eurovision aiming to carry WFC 1080i/50 at 60 Mb/s in 36MHz

MPEG4 AVC

- More effective at lower bit rates so good for distribution
- Not good for contribution yet as high latency & no 4:2:2
- MPEG4 4:2:2 not currently high priority for manufacturers
- For near future, stay with MPEG2 for contribution
- MPEG4 - 25% saving over MPEG2? So eventually, probably

Cascading/concatenating MPEG2 & MPEG4

- Example- BBC/Snell & Wilcox 'MOLE' technology
 - Decoders forward the previous encoding decisions on in the digital signal so subsequent encoders can utilise

Conversion

- Of scale; between interlace/progressive; of frame rate
- Signal compressed/de-compressed during contribution
Convert before compression or after de-compression?
(Different answer if MPEG4 contribution?)
- For least degradation, same I-frame issue as for cascading

More WBU-ISOG

- Default encoder/decoder PID settings
- ATIS (Automatic Transmitter Identification System)