

**WBU-ISOG  
INTEROPERABILITY TESTING  
OF 1080i/720p ENCODERS AND DECODERS**

**TEST PLAN FOR  
SECOND ROUND OF TESTS  
July 18-25, 2005**

This document describes the policy, procedures, test objectives and methods for the technical evaluation that will be applicable to the second round of interoperability tests for 1080i/720p encoders and decoders of various manufacturers. This Test Plan ("Second Round Test Plan") will reference the Test Plan, dated February 16, 2005, which was applicable to the first round of tests ("First Round Test Plan").

**Background**

The first round of tests was held at Telesat Canada in Ottawa during the week of March 7-11 ("First Round Tests") based on First Round Test Plan and on the WBU-ISOG Basic Test Parameters For Existing MPEG-2 1080i/720p Codec Interoperability For Contribution Feeds for Program Exchange (attached as Appendix A to the First Round Test Plan). A summary of the First Round Tests is attached as Appendix A. Changes to the First Round Test Plan that were implemented in the First Round Tests are summarized as Appendix B.

## **1.0 Scope**

The second round of tests will consist of six groups of tests:

- 1.0.1 Retests:** There will be retests at the same test parameters of those encoder/decoder pairs that failed in the first round. For each failed test, manufacturers were given the opportunity to show changed circumstances from the First Round Tests (e.g., software, hardware or operational modifications) in order to show that retests might be successful. There will be no retests at 4:2:0
- 1.0.2 Tests of New Codecs:** One new encoder will be added that was not included in the First Round Tests ("New Codec"). These New Codec will be tested against the decoders at the same audio test parameters previously tested in the first round ("Tested Codecs").
- 1.0.3 Latency:** All encoders will be tested for latency using Vistek equipment.
- 1.0.4 Lip Sync:** All encoders and decoders will be tested for Lip Sync using Vistek equipment.
- 1.0.5 Encryption:** A limited number of encoders and decoders have BISS capability, and they will be tested for interoperability.

- 1.0.6 Satellite:** All encoders and decoders will be tested on a satellite link using Newtech modulators/demodulators.

## **1.1 Interoperability Test Subgroup**

A subgroup of broadcasters and carriers, including representatives of Union Technical Committees, has been formed to monitor and address test issues. The Testing Subgroup is led by Mr. Tom Gibbon, representing NHK.

The Testing Subgroup will oversee the creation of the Second Test Plan, the Test Facilities, and will issue a final report.

## **1.2 Participation by Manufacturers.**

WBU-ISOG will invite manufacturers to participate in the interoperability testing program. Manufacturers who accept participation must commit to having one representative accompany their equipment, for the purpose of final setup and operation during the test. The representative must be available for the complete test period. Equipment must be shipped to the site in advance of the test dates, to arrive no later than 2 business days prior to the Test Period, and will be unpacked and placed in the test room by the Test Site Sponsor. After the test, the Sponsor will also re-pack the equipment into their shipping containers and prepare for pickup by a shipping carrier. Manufacturers will be required to ship the equipment to be tested directly to and from the test site, at their expense.

## **1.3 Test Period**

The Second Round Tests will take place Monday, July 18, 2005 through Friday, July 22, 2005.

## **1.4 Test Site Sponsor**

The Test Site Sponsor is Telesat Canada. The test location selected is the Telesat Lab at its headquarters office, located at 1601 Telesat Court in Ottawa, Ontario. Manufacturers will be required to ship the equipment to be tested directly to and from the Test Site, at their expense.

## **1.5 Equipment To Be Tested.**

New Codec will be selected by the manufacturer. All other codecs to be tested will be the Existing Codecs tested in the first round, with software and hardware modifications permitted. Documentation describing changes made and the expect result must be supplied prior to testing.

## **1.6 Interoperability Test Parameters**

- 1.6.1 Retests:** The first round of tests involved a combination of objective and subjective tests at 2 CH MPEG and 4 CH MPEG. In order to obtain uniform test data, all encoders and decoders will be tested at 4 CH MPEG subjective. Retests

of 2 CH PCM will be 2 CH PCM subjective tests. Retests of Dolby E failures will consist solely of verification of the Dolby E stream as described in 2.3.3. All audio tests will be at 1080i/59.94, 41.47 Mbps. The Dolby E at 2.44Mb/s test will be at the full Dolby E bit rate and will test whether the encoders and decoders are able to carry the Dolby E at 2.44 Mb/s stream.

- 1.6.2 **Tests of New Codec:** The New Codec will be tested for interoperability audio at 1080i/59.94 at 41.47 Mbps at a chroma sample of 4:2:2. The New Codec will be tested for 4 CH MPEG, 2 CH PCM and Dolby E at 2.44Mb/s.
- 1.6.3 **Latency:** All encoders will be tested for latency at 1080i/59.94 at 41.47 Mbps, 4:2:2, 4 CH MPEG. Each encoder will also be tested once at 64.509 Mbps.
- 1.6.4 **Lip Sync:** All encoders and decoders will be tested for Lip Sync using the VISTEK source generator. Each encoder/decoder pair will be tested at 4 CH MPEG, 2 CH PCM and Dolby E at 2.44Mb/s. All Lip Sync tests will be at 1080i/59.94 at 41.47 Mbps, 4:2:2. When testing Dolby E at 2.44Mb/s, only one stereo pair will be measured.
- 1.6.5 **Encryption:** Encoders and decoders capable of BISS encryption will be tested at 1080i/59.94 at 41.47 Mbps, 4:2:2, 4 CH MPEG.
- 1.6.6 **Satellite:** All encoders and decoders will be tested over a satellite link using Newtech modulators/demodulators at 1080i/59.94 at 41.47 Mbps, 4:2:2, 4 CH MPEG.

## 1.7 **Methods of Evaluation**

- 1.7.1 **Subjective Video Evaluation.** Expert viewers will evaluate the video for integrity, distortion and any other visible artifacts seen during a 2-5 minute test transmission using the classifications in Section 2.3.1. Different test tapes will be used for 1080i/59.94, 720p/59.94 and 1080i/50.
- 1.7.2 **Subjective Audio Performance.** Expert listeners will evaluate the audio for integrity and distortion heard during a 30-60 second test transmission. The same video/audio tape content will be used for all tests. The classifications will be pass/fail.
- 1.7.3 **Latency.** The Vistek system for Lip Sync, known as the "VALID" product shall be used to measure the Lip Sync error and the latency set to zero. This is accomplished by directly connecting the Audio & Video outputs of the VALID Generator to the Audio Encoder (either an external Dolby E encoder or the Video encoder's internal audio coder), and to the Video Encoder video input. The Decoder's outputs are directly connected to the VALID Receiver. The VALID system will then directly display the total audio to video timing error, the lip sync, of the transmission path. The VALID can measure up to 4 seconds of A/V delay.

Measurements will be made without prior lip sync adjustment of the diverse (i.e., different vendor than encoder) decoder.

- 1.7.4 **Lip Sync.** The Lip Sync measurement described above will be made on all Encoder/Decoder pairs over a short time period (1-3 minutes). Measurements will be made at the beginning and end of the short time period. The Lip Sync measurement will also be made over a long time period (12 hours) for one designated encoder to all decoders. Measurements will be made at the beginning and end of the long time period.
- 1.7.5 **Encryption.** The decoded video and audio will be evaluated simultaneously as stated in section 1.7.1 and 1.7.2.
- 1.7.6 **Satellite.** The demodulated audio and video will be evaluated simultaneously as stated in Section 1.7.1 and 1.7.2. The signal will then be interrupted and evaluated subjectively again.

## 1.8 Communication of Test Results

Raw test results of the Second Round Tests will be circulated to the manufacturers and to the Testing Subgroup. The Testing Subgroup will prepare test results of the First and Second Round Tests to be published on the WBU-ISOG website. The published results will identify the encoder/decoder pair, the test sequence and whether there was a pass or failure. If New Codecs experience failures, the Testing Subgroup will discuss whether there should be a limited opportunity for retests before publication of the test results.

## 2.0 Test Procedures

### 2.1 Test Configuration.

The Test Configuration is shown in Figure 1.

### 2.2 Test Procedures

- 2.2.1 The equipment will be unpacked, installed in the Test room, either on tables or in racks, and will be connected and powered by the Test Sponsor.
- 2.2.2 All Encoders and Decoders for evaluation will be operated by their respective representatives.
- 2.2.3 Encoders setups have been derived from the WBU-ISOG testing parameters table. The setups are specified in Sections 1.6.1 – 1.6.6. Each setup has been defined as a Test Sequence.
- 2.2.4 Each Encoder in turn will be configured for the different Test Sequences. Any Sequence may be skipped if the Encoder is not capable of operation with a particular Sequence. As each Sequence is confirmed on the Encoder by the Test

Sponsor, all Decoders capable of operation will be evaluated and the results recorded. Operators of the Encoders and Decoders will be given up to 5 minutes to clear any problems for any individual Test in any Test Sequence.

- 2.2.5 For documentation, a Master Test Table will be created. For each individual measurement of each Test Sequence, an Encoder/Decoder combination Test Record will be defined.

## **2.3. Testing Methods and Ratings**

### **2.3.1 Subjective Video Evaluation.**

The expert viewer will watch the Decoder output while the Video Test Loop plays. At the end, the video codes in Section 2.3.1 of the First Test Plan will be applied. If the expert viewer rates the video as V3, the video (unless obviously unacceptable) will be displayed on the best monitor and the majority vote of all expert viewers will determine the rating.

### **2.3.2 Subjective Audio Evaluation – 4 CH PCM and 4 CH MPEG**

The expert listener will listen to the Decoder output while the audio test loop plays. At the end, the expert listener will rate the audio as pass or fail.

### **2.3.3. Objective Audio Evaluation - Dolby E.**

The Dolby E output of the decoder will be evaluated for data stream errors using the Dolby DM-100 test set.

### **2.3.4. Lip Sync**

Lip Sync values, in milliseconds, shall be read directly from the VISTEK VALID, which displays the value on the Video Monitor output of the VALID Receiver unit.

### **2.3.5. Latency**

Latency values, in milliseconds, shall be read directly from the VISTEK VALID, which displays the value on the Video Monitor output of the VALID Receiver unit.

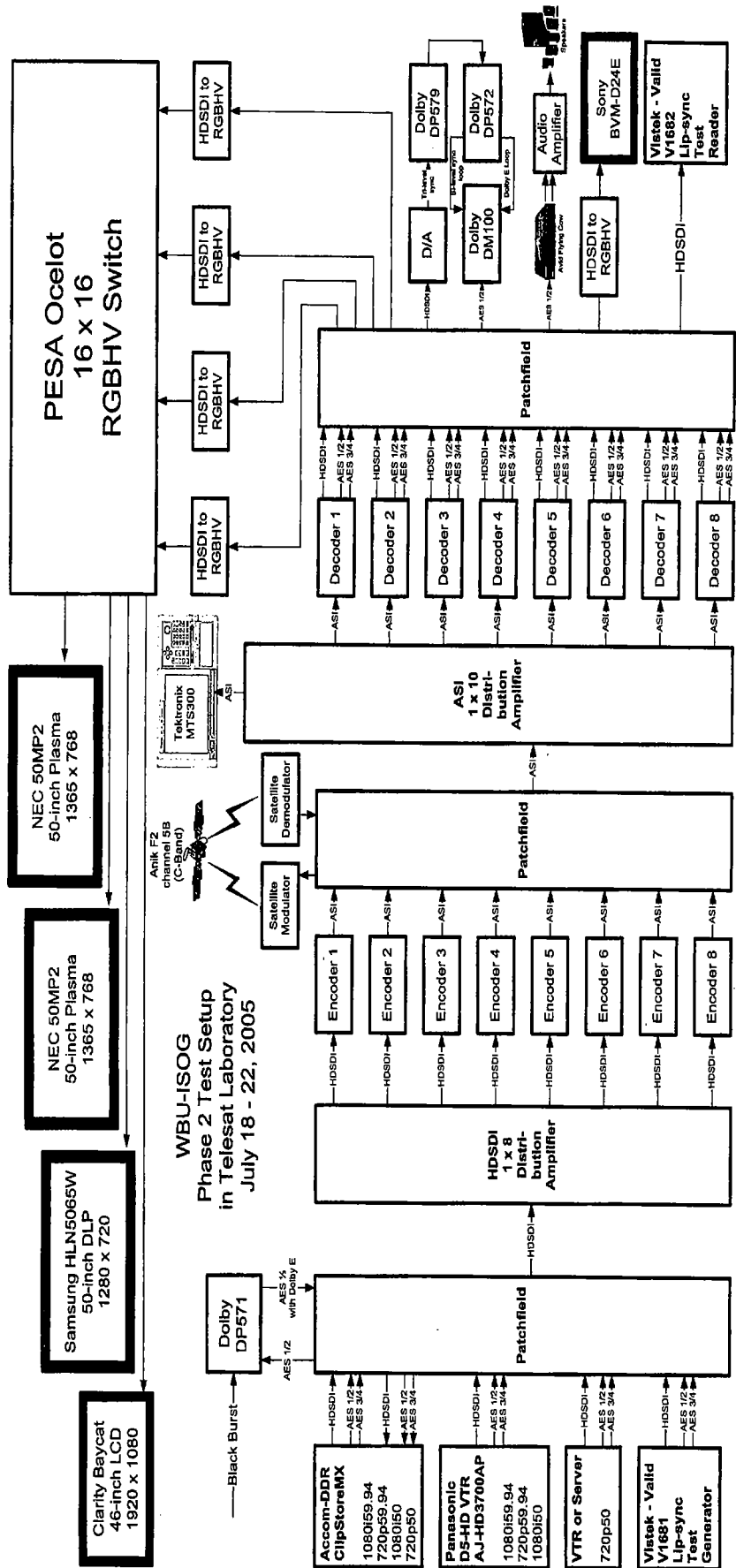
## **3.0 720p/50**

720p/50 will become part of the formal tests if information is provided to WBU-ISOG that shows that the conditions in the Test Parameters have been met. These conditions are: "If, for example, 720p/50 transmission equipment becomes commonly available and some broadcasters begin to use such 720p/50 codecs for international contribution feeds in advance of the present interoperability test, WBU-ISOG will add

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720p/50 as a parameter.” If such information is not furnished, then testing of 720p/50 will be done if there is time and if the manufacturers and Telestat agree. Testing will be done only for those encoders and decoders that have stated in questionnaire responses that they are capable of 720p/50 transmissions.

Figure 1



## **Participants**

A list of the 39 participants is attached. In summary, there were 9 manufacturers from Europe, the U.S., Canada and Japan. Ken Hunold from Dolby provided invaluable audio test assistance. Representatives from New Skies, Intelsat and SES attended and provided expert viewing assistance. Fox, CNN/Turner, NHK and CBC attended and helped to make decisions about the tests and provided technical assistance. The three experts from CRC helped to oversee the tests, provided constant updates to the test schedule and procedures as technical decisions were made, served as expert viewers and recorded test data. Telesat served as overall test director and its two engineers solved technical issues, oversaw all cable and switch connections for each test, implemented each test and performed the audio objective tests. NABA and Telesat provided administrative assistance. The entire group worked together, without competitive jockeying or preferential requests, under heavy time and technical pressure, including several late nights, in order to complete the tests.

## **Testing Schedule**

- Monday:** Set-up and 1080i/60 and 720p/60 subjective video testing (excluding Mitsubishi and Harmonic encoders and Mitsubishi decoder)
- Tuesday:** 1080i/60 and 720p/60 video testing (cont'd); objective audio testing
- Wednesday:** Objective audio testing (cont'd); subjective audio testing
- Thursday:** Subjective audio testing (cont'd); 1080i/60 and 720p/60 video testing for Mitsubishi and Harmonic encoder and Mitsubishi decoder; 1080i/60 and 720p/60 video testing for 4:2:0 Sencore decoder; 1080i/50 testing for supporting codec pairs; 720p/50 informal testing for supporting codec pairs.
- Friday:** Objective audio testing (cont'd); data input; review and future tests meeting; clean-up.

## **720p/50 Testing**

There was a strong request for 720p/50 testing from Fox and EBU. This testing could not be part of the formal tests because the 720p/50 format did not meet the criteria for testing in the test plan. After discussion, it was decided that such testing could take place on an informal basis if there were time, if there were available source material, if there were available monitors, and if the manufacturers agreed. It was decided that any such test results would not be reported with the formal test results, but would be reported as an addendum.

## **Results**

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Overall, there was interoperability for 92.9% of the video tests and 62.7% for the audio tests. Raw results were distributed to the Testing Subgroup and the manufacturers. All test results will be held strictly confidential until completion of the Second Round Tests. At the completion of the Second Round Tests, the test results will be made public, including identification of the codecs used in each test. Raw test results will never be made public. The public test results will simply state interoperable or not interoperable for each specific encoder/decoder test.

**Attachment to Appendix A**

**List of Participants and Contributors to WBU-ISOG Interoperability Tests  
Held at Telesat, March 7<sup>th</sup> to 11<sup>th</sup>, 2005**

	<b>Name</b>	<b>Affiliation</b>
1	Phil Proulx	Aastra
2	Anthony Caruso	CBC
3	Vincent Desmarais	CBC
4	David A. Chilson	CBS
5	Dick Tauber	CNN
6	André Vincent	CRC
7	Ron Renaud	CRC
8	Filippo Speranza	CRC
9	Kenneth R. Hunold	Dolby
10	Didier Debellemanière	EBU
11	Brian Flowers	EBU
12	Richard M. Friedel	FOX
13	Steven Silva	FOX
14	Norbert Kutter	Harmonic/Divicom
15	Michael Nudi	Harmonic/Divicom
16	Alex Diamantopoulos	Intelsat
17	Masami Kato	Mitsubishi
18	Anh Ngo	NABA
19	Takayoshi Nakashima	NTT Electronics
20	Takaharu Nakamura	NTT Electronics
21	Jotaro Igarashi	NTT Electronics
22	Phil Rigby	New Skies Satellites
23	Thomas Gibbon	NHK
24	Akira Negishi	NHK
25	Damon Semprebbon	Radyne/Tiernan
26	Jan Dalum	Scientific Atlanta
27	Joel Orvis	Scientific Atlanta
28	Michael Harris	Sencore
29	Doug Spears	Sennheisser (Doremi)
30	Indra Khatri	SES Americom
31	Philip Bird	Tandberg
32	Tony Howard	Tandberg
33	Jon Birchmore	Telesat
34	Fred Markhauser	Telesat
36	Charles Schneider	Thomson/Nextream
37	Merrick Ackermans	Turner

March 15, 2005

**REVISIONS TO FIRST TEST PLAN**

1. No tests at 20 Mbps
2. All tests at 4:2:2 except for 1 decoder
3. No encryption tests
4. Audio tested at 41.47 Mbps only
5. Audio tested only at 1080i/60
6. No objective audio test of 2 ch MPEG (relied on 4 ch MPEG test)
7. Subjective audio test only when CODEC pairs passed objective audio test
8. Subjective audio test at 4 ch MPEG and 2 ch PCM
9. 4:2:0 decoder not tested with objective audio – failed subjective tests
10. Each participant given up to five (5) minutes to clear any problems