**INTERNATIONAL ORGANISATION FOR STANDARDISATION**

**ORGANISATION INTERNATIONALE DE NORMALISATION**

**ISO/IEC JTC1/SC29/WG11**

**CODING OF MOVING PICTURES AND AUDIO**

**ISO/IEC JTC1/SC29/WG11/N14461**

**March/April 2013, Valencia, ES**

|  |  |
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| **Title** | **Listening Test Logistics for 3D Audio Phase 2** |
| **Source** | **Audio Subgroup** |

# Introduction

The Call for Proposals for 3D Audio (Call) [1] issued at the 103rd MPEG meeting held in Geneva, CH in January 2013. The Submission and Evaluation Procedures for 3D Audio Phase 2 Submissions [2] issued at the 106th MPEG meeting held in Geneva, CH in October 2013. The Phase 2 submissions are to be evaluated at the 109th MPEG meeting to be held in Sapporo, JP in July 2014.

This document gives timeline and logistics for conducting a listening test to evaluate submissions to the Call Phase 2.

# Listening Test Timeline

The following table gives the timeline for listening tests for evaluating Phase 2 submissions to the Call.

Table 1 – Timeline for Phase 2

|  |  |
| --- | --- |
| **Meeting / Date** | **Action** |
| April 14, 2014 | Proponent Contact sends email to Test Administrator declaring the intent to participate in Phase 2 testing. |
| April 18, 2014 | Proponent Contacts that have declared their intent will receive Call FTP site information from Test Administrator |
| May 9, 2014 | Companies send email to the Test Administrator indicating their intent to submit benchmark MPEG systems to the test. |
| May 16, 2014 | Proponent processed test items submitted to Call FTP site, for both Call submissions and MPEG benchmark items. |
| May 23, 2014 | Test items available to Listening Labs on Call FTP site |
|  | Conduct evaluation listening tests |
| June 27, 2014 | Listening Labs submit * Raw scores via email to Test Administrator
* Contribution to 109th MPEG meeting describing their test setup.
 |
| 109th meeting, July 2014 | Review subjective test data and all other data as part of selection of Phase 2 technology  |

**Test Administrator**

The Test Administrator for the Call shall be the MPEG Audio Chair, whose contact information is:

Schuyler Quackenbush

Audio Research Labs

Email: srq@audioresearchlabs.com

Phone: +1 908 490 0700

# Systems under Test

At the time of writing this document it is not known how many Phase 2 submissions there will be, but for the purposes of evaluating test workload, this document will assume that there are three submissions to the Phase 2 Call for Proposals. Since the tests conducted as part of the evaluation of Phase 2 submitted technology use the MUSHRA methodology [3], tests will include a Hidden Reference and a 3.5 kHz low-pass filtered reference as the anchor systems under test.

In addition to the proponent systems under test and the anchor systems under test, the following benchmark systems will be included in the tests:

CO tests will include the following benchmark system:

* Phase 1 RM0-CO at 256 kb/s (decoded waveforms from the Phase 1 CfP)

HOA tests will include the following benchmark system:

* Phase 1 RM0-HOA at 256 kb/s (decoded waveforms from the Phase 1 CfP)

Finally, it is envisioned that each test may include one additional benchmark system that shows the performance of submitted technologies relative to MPEG technologies. Such benchmark systems might include:

* Phase 1 3D Audio, at e.g. 128 kb/s
* Discrete channel HE-AAC at e.g. 128 kb/s for 5.1 or more channels
* MPEG Surround/HE-AAC at e.g. 64 kb/s or 48 kb/s for 5.1 or more channels

WG11 invites companies to submit such benchmark systems, i.e. bitstreams and decoded waveforms. Companies should sent email to the Test Administrator no later than May 9, 2014 indicating the possibility of submitting benchmarks. The Test Administrator will make upload directories on the Test FTP server available for this purpose, and benchmark uploads shall occur no later than May 16, 2014.

The number of possible systems under test in each Phase 2 listening test is summarized in the following table:

|  |  |
| --- | --- |
| **Number** | **Description** |
| 1 | Hidden Reference |
| 1 | 3.5 kHz LPF Reference |
| 3 | Proponent systems (estimated) |
| 2 | Benchmark systems |
| **7** | **Total systems under test** |

# Subjective Testing Procedures

The following table shows labs that will participate in the Phase 2 listening tests.

**Table 2 – Listening Labs Participating in Listening Tests**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **LL\_ID** | **Company** | **Contact Name** | **Email** |
|  | ETRI | ETRI | Jeongil Seo | seoji@etri.re.kr |
|  | HUA | Huawei | Peter Grosche | peter.grosche@huawei.com |
|  | IDMT | Fraunhofer IDMT | Thomas Sporer | spo@idmt.fhg.de |
|  | IIS | Fraunhofer IIS | Andreas Silzle | andreas.silzle@iis.fraunhofer.de |
|  | MGL | McGill University | Clemens Par | mail@swissaudec.com |
|  | ORG | Orange | Gregory Pallone | gregory.pallone@orange.com |
|  | QUAL | Qualcomm | Deep Sen | dsen@qti.qualcomm.com |
|  | TECH | Technicolor | Oliver Wuebbolt | oliver.wuebbolt@technicolor.com |
|  | SAM | Samsung | Sunmin Kim | Sunmin21.kim@samsung.com |
|  | SONY | Sony | Toru Chinen | Toru.Chinen@jp.sony.com |

The following table shows the tests in which each lab will participate. The minimum number of listeners for any lab for any test is 8.

**Table 3 – Listening Labs Participating in Each of the Listening Tests**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Test** | **Bitrate** | **ETRI** | **HUA** | **IDMT** | **IIS** | **MGL** | **ORG** | **QUAL** | **SAM** | **SONY** | **TECH** | **N** |
| Test2-1-CO | 128 kb/s | X |  | X | X | X |  |  | X | X |  | 6 |
|  | 96 kb/s | X |  | X | X | X |  |  | X |  |  | 5 |
|  | 64 kb/s | X |  | X | X | X |  |  |  | X |  | 5 |
|  | 48 kb/s | X |  |  | X | X |  |  |  | X |  | 4 |
| Test2-1-HOA | 128 kb/s |  | X |  | X | X | X | X |  |  | X | 6 |
|  | 96 kb/s |  | X |  |  | X | X | X |  |  | X | 5 |
|  | 64 kb/s |  | X |  |  | X |  | X |  |  | X | 4 |
|  | 48 kb/s |  | X |  | X | X |  | X |  |  | X | 5 |

The test items that shall be used in the tests are indicated in [1] and [2].

Listening laboratories shall submit raw scores to the Test Administrator in an Excel spreadsheet template to be provided by the Test Administrator. The Test Administrator shall apply post-screening to these scores, as described in [2].

The Test Administrator will provide test results in a contribution to the 109th MPEG meeting.

# Figure of Merit

A Figure of Merit (FoM) is computed for each system under test, including anchors and benchmarks, for all tests. It is computed as follows:

* The mean score (M) for each system under test is computed for each test.
* For each test, the highest mean score is identified (Mmax) and the value Mnorm = 100 – Mmax is computed.
* For each test, the mean scores are scaled as Mscaled = M + Mnorm. In this way, the highest mean score is translated to 100.
* In each test, the lower (L) and upper (U) value of the confidence interval for each system under test is scaled using the offset Mnorm as Lscaled = L + Mnorm and Uscaled = U + Mnorm.
* The FoM for a system under test is the sum of the weighted Mscaled.
* In addition for a system under test the sum of the weighted Lscaled and Uscaled are computed.

In summary, the FoM is computed as:

where *i* is the index over test and *N=8*. If a proponent does not submit for all tests (i.e. submits for only C/O or HOA), then the FoM is compute of the C/O or HOA tests and *N=4.*

Submissions shall be evaluated, taking into account all submitted information including subjective listening test results. Performance relative to benchmark systems will be considered. Based on this information, if there is a single submission that is best for both C/O and HOA, then it is the selected technology.

Otherwise, the submission that is best for C/O will be selected as the CO technology and the submission that is best for HOA will be selected as the HOA technology. Audio experts will draft a workplan to merge the two submissions into an integrated architecture

# References

1. N13411, Call for Proposals for 3D Audio
2. N14064, Submission and Evaluation Procedures for 3D Audio Phase 2 Submissions
3. ITU-R Recommendation BS.1534-1, “Method for the Subjective Assessment of Intermediate Sound Quality (MUSHRA)”, International Telecommunications Union, Geneva, Switzerland, 2001