**3GPP TSG-SA WG4 Meeting #120-e** ***S4-221049***

**Online, 17th – 26th August 2022**

**Source: Fraunhofer IIS**

**Title: Proposed Default BRIR Set for IVAS**

**Document for: Agreement**

**Agenda Item: 7.5**

## 1. Introduction

The IVAS Design Constraints document [1] currently mentions support of both, HRTF and BRIR for binaural rendering. For subjective testing, usage of HRTF/BRIR reference sets is advisable for both, reference and CuT conditions, and a definition of a default HRTF/BRIR set with a verified quality is recommended.

This contribution aims to propose a default set of Binaural Room Impulse Responses (BRIR) for the the IVAS\_codec work item. The proposed BRIR set, created by Fraunhofer IIS, is contained in the attached zip-file. The proposed BRIR set was already used during the standardization of the MPEG-H 3D Audio Standard [2]. A default set of HRTFs is proposed in contribution S4-221027 [3].

## 2. Proposed BRIR Set

### Description

The BRIR set was measured at Fraunhofer IIS listening test room “Mozart” with following room properties:

|  |  |
| --- | --- |
| **Room dimensions** | Mozart  |
| Length [m] | 9.3 |
| Width [m] | 7.5 |
| Height [m] | 4.2 |
| Size [m2] | 70 |
| Volume [m3] | 293 |
| Aspect ratio BS.1116 fulfilled | yes |
| **Room acoustic properties** |  |
| BS1116 reverberation time T60 [s] | 0.36 |
| Actual reverberation time [s] | 0.36 |
| T60 inside BS1116 limits | yes |
| Noise rating curve with equipment on | NR15 |

In this room 28.2 BRIR pairs are recorded corresponding to the following loudspeaker positions:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **No.** | **Az °** | **Az. Tol. °** | **El. °** | **El. Tol. °** |
| **1** | 0 | ±2 | 0 | ±2 |
| **2** | 30 | ±2 | 0 | ±2 |
| **3** | -30 | ±2 | 0 | ±2 |
| **4** | 60 | ±2 | 0 | ±2 |
| **5** | -60 | ±2 | 0 | ±2 |
| **6** | 90 | ±5 | 0 | ±2 |
| **7** | -90 | ±5 | 0 | ±2 |
| **8** | 110 | ±5 | 0 | ±2 |
| **9** | -110 | ±5 | 0 | ±2 |
| **10** | 135 | ±5 | 0 | ±2 |
| **11** | -135 | ±5 | 0 | ±2 |
| **12** | 180 | ±5 | 0 | ±2 |
| **13** | 0 | ±2 | 35 | ±10 |
| **14** | 45 | ±5 | 35 | ±10 |
| **15** | -45 | ±5 | 35 | ±10 |
| **16** | 30 | ±5 | 35 | ±10 |
| **17** | -30 | ±5 | 35 | ±10 |
| **18** | 90 | ±5 | 35 | ±10 |
| **19** | -90 | ±5 | 35 | ±10 |
| **20** | 110 | ±5 | 35 | ±10 |
| **21** | -110 | ±5 | 35 | ±10 |
| **22** | 135 | ±5 | 35 | ±10 |
| **23** | -135 | ±5 | 35 | ±10 |
| **24** | 180 | ±5 | 35 | ±10 |
| **25** | 0 | ±2 | 90 | ±10 |
| **26** | 0 | ±2 | -15 | +5-25 |
| **27** | 45 | ±5 | -15 | +5-25 |
| **28** | -45 | ±5 | -15 | +5-25 |
| **29** |  45 | ±15 | -15 | ±15 |
| **30** | -45 | ±15 | -15 | ±15 |

#### Playback Settings:

* Dynaudio BM6A MKII Speakers
* Delay and level compensated
* No speaker equalization
* No bass management

#### Dummy Head Settings:

* Cortex Manikin MK1 dummy head
* 1.25m ear height
* Diffuse field equalization
* Max. 110dB input level
* G.R.A.S. Microphones RA0045
* High Pass Filter 24.4Hz

#### Post Processing:

* Length was trimmed to 1 second
* Initial delay was trimmed to be between 100 and 300 samples
* The difference in the time of arrival between symmetric speaker positions to the closest ear limited to not exceed 5 samples
* Level normalization to minimize clipping
* Diffuse field equalization

The 28.2 BRIR positions are provided by means of two-channel WAV-files with the following properties:

* 2ch Files, <1ch: left ear> <2ch: right ear>
* Naming convention: IIS\_BRIR\_A<azimuth\_angle>\_E<elevation\_angle>.wav
* Length: 48000 samples @ 48kHz (1s)
* Bitdepth: 16 bit

### License

The BRIR set is provided under the following license:

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## 3. Conclusion

We suggest considering the attached proposal as a default BRIR set for the IVAS\_codec workitem. The proposed BRIR set was already used during the standardization of the MPEG-H 3D Audio Standard.

It is proposed to include the proposed BRIR set as default BRIR set in an appendix to IVAS-4, including the following Editor’s Note:

Editor’s Note: Inputs on ways of modelling combined direct/early-reflections/late-reverb binauralization are invited.

## 4. References

[1] 3GPP S4-220822, IVAS Design Constraints (IVAS-4) v0.5.0

[2] ISO/IEC JTC1/SC29/WG11 MPEG2017/N16584, “MPEG-H 3D Audio Verification Test Report”
[3] 3GPP S4-221027, On binaural rendering