



# ITU-T Workshop

## From Speech to Audio: bandwidth extension, binaural perception



unrestricted



# Session 1 : Loudness

The multimedia revolution has led to an increase in the required audio signal bandwidth for next-generation networks. In addition to existing narrowband and wideband codecs, development of full band is taking place.

The goal of this session is to initiate significant technical work on a common loudness rating algorithm for all bandwidths from narrowband to full band audio signals.

In this context, two contributions have been presented.

# High frequencies for the hearing impaired

- demonstrate perceptual benefit of extended bandwidth of amplification and to compare normal hearing to hearing-impaired subjects.
- 4 Normal Hearing and 9 hearing-impaired subjects .
- Preference for NH people at bandwidth up to 16 KHz, Experiments showed that for 5 on 9 hearing-impaired subjects insufficient audibility at frequencies upper than 6 KHz occurs.
- Conclusion:
- benefit for extending bandwidth from 4KHz to 6 KHz inconclusive about benefit of further bandwidth extension due to limited audibility above 6 KHz.
- acclimatation to extended bandwidth amplification be done in order to verify on hearing-impaired subjects the real benefit for upper frequency bands to 6 KHz
- propose a gain prescription based on alternative rationales to the loudness equalization strategy that was used in this study.

# Quality impact of diotic versus monaural listening on processed speech

32 subjects according to ACR opinion tests

- two listening conditions on 5 VoIP codings (sound level at 69 dB SPL for diotic and 79 dB Spl for monaural listening condition).
- NB :G.711, G.729.1 12, G.729.1 8, AMR 12.2, AMR 4.75
- WB: G.722, G.729.1 6k, G.729.1 32, AMR WB12.65, AMR WB 23.85
- conclusions
- diotic listening, quality judged more severely when speech is degraded, seems to help subjects to better discriminate degradations, highlights the benefits of high quality coders.
- difference of listening level between the monaural and diotic conditions leads to hide noise defects.
- Degradations impact more or less strong resulting in shifts in coder ranking between the two listening modes.
- **results suggest that audio coders should be chosen carefully depending on use cases.**

## Conclusion for ITU-T

- measured results helping to have a better view on the interest and when it is interesting to extend the bandwidth.
- comment on the calculation of loudness ratings based on telecommunication matter on a real comparison to an existant model received different comments.
- in the past the job has been done in a full band condition.
- complete separation done on the model used -> consequently 2 methods for calculating the loudness ratings (NB & NB-WB) and full WB conditions in ITU-T/ P.79.
- Huge work stays on the definition of loudness calculation for interconnected NB, WB and fullband transmission interconnected NW for a common preferred method for loudness calculation applicable for each bandwidth.
- Also listening conditions as handset, headsets and handsfree should be taken into consideration.