Background Noise Transmission Quality for Wideband Systems

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ETSI – Workshop on Wideband Speech Quality in Terminals and Networks

supported by:

DEGA

ITU International Telecommunication Union

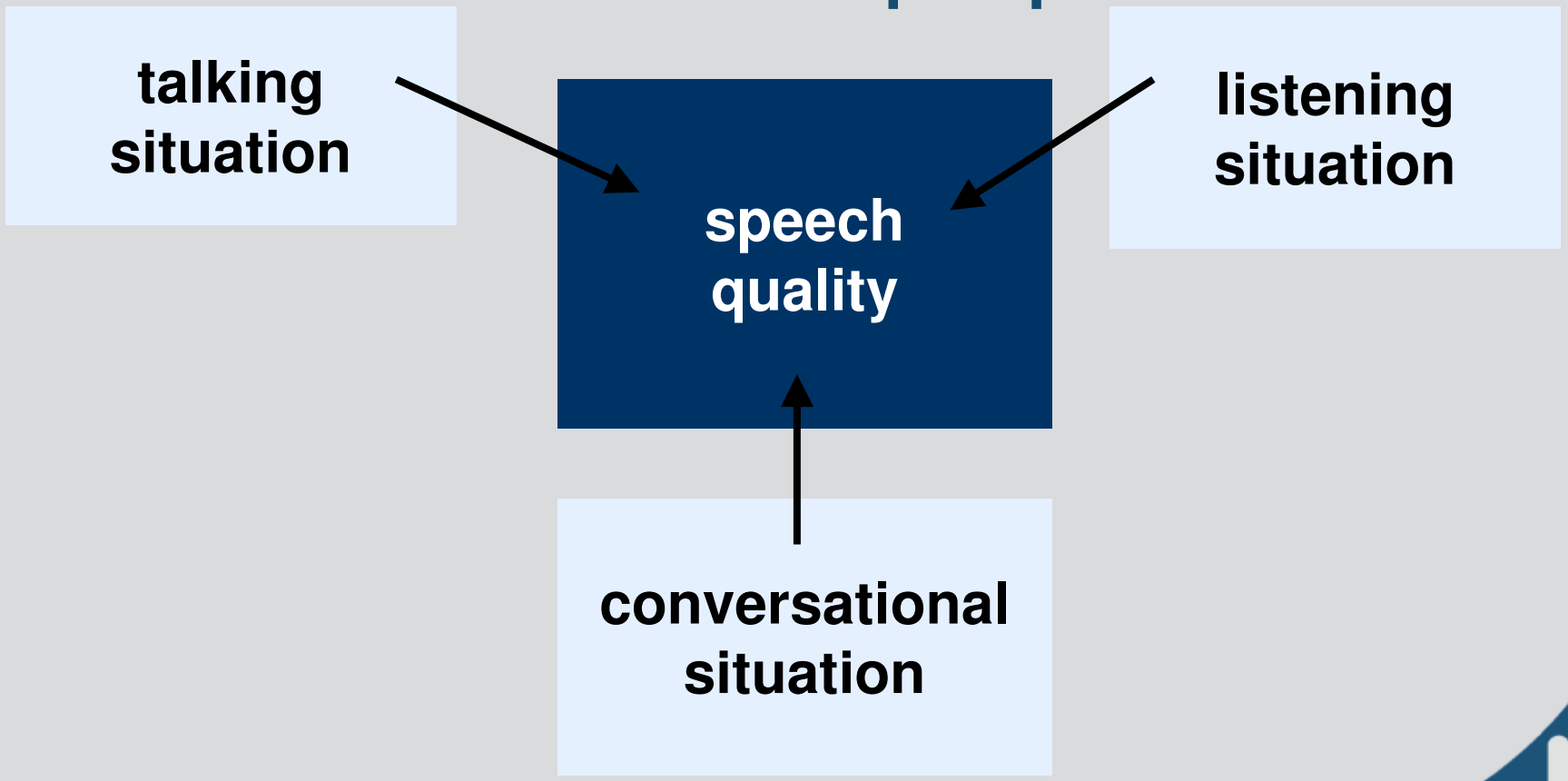
TIA

Outline

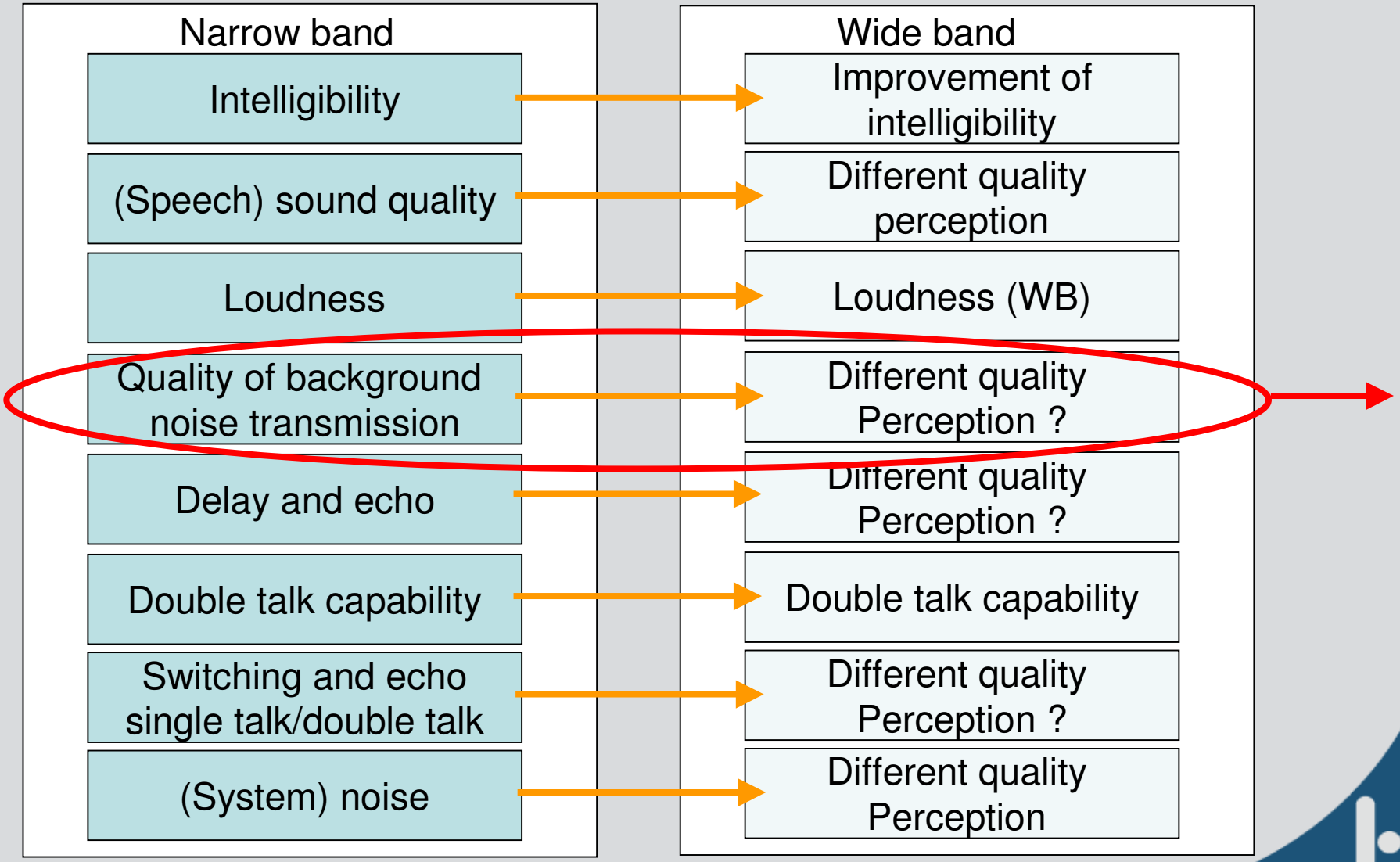
- General aspects of speech quality in wideband systems
- Subjective tests on background noise transmission
- Objective evaluations
  - Test procedures
  - Test signals
- Summary

Speech Quality Parameters

… from the user's perspective



Auditory Parameters



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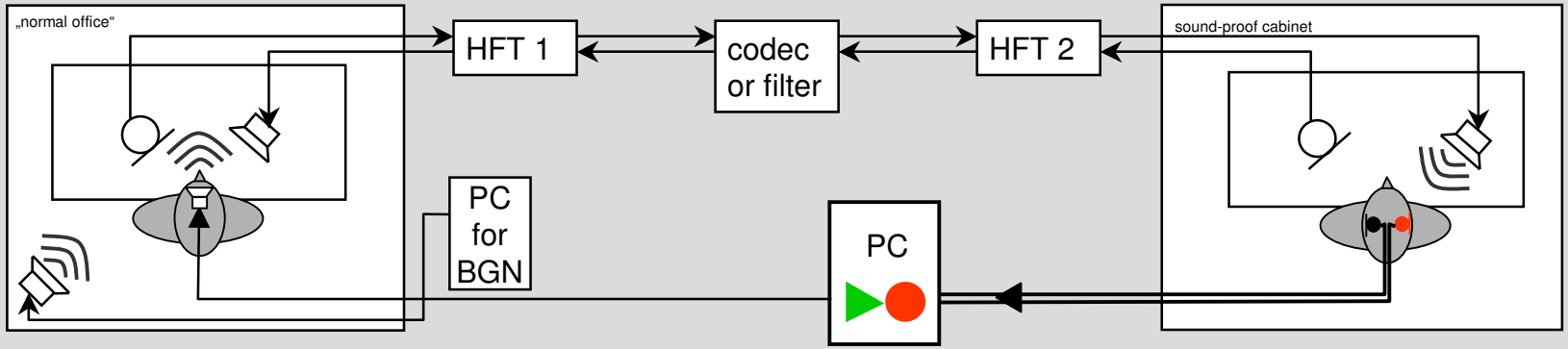
Background noise tests

- Recording listening samples:

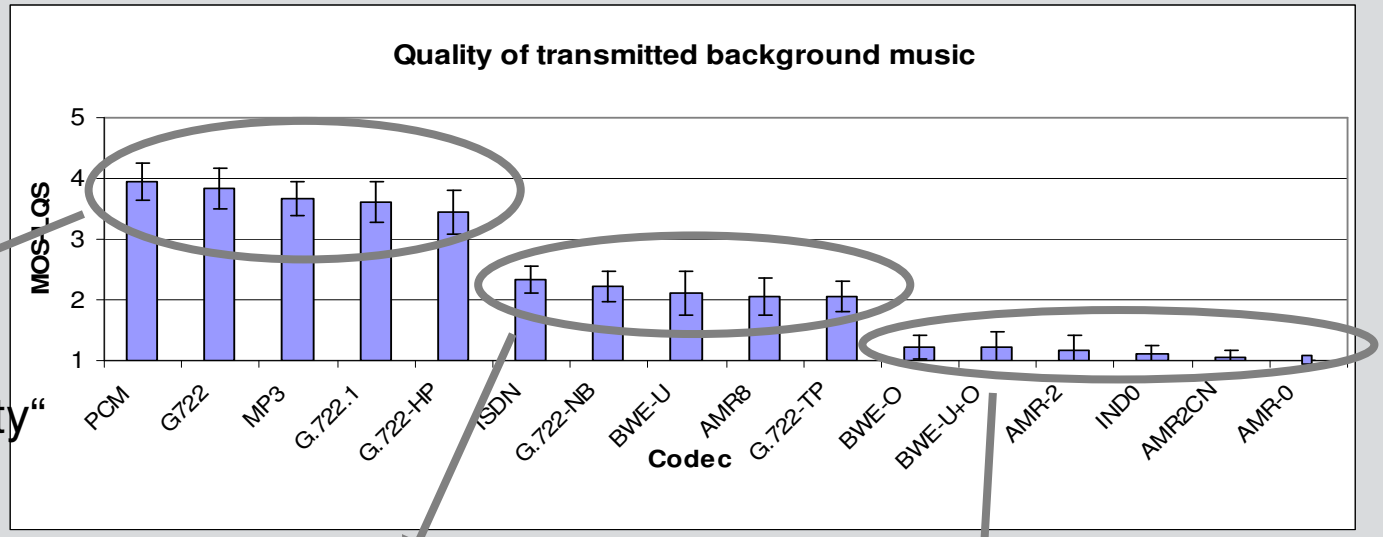


- Listening:
  test persons listen to artificial head recordings
- ACR scale:

  excellent – good – fair – poor – bad

Results

- 3 quality levels with significantly different MOS - values



- wideband
- good „intelligibility“ of music

- narrowband
- good „intelligibility“ of music

- mostly wideband
- bad „intelligibility“ of music

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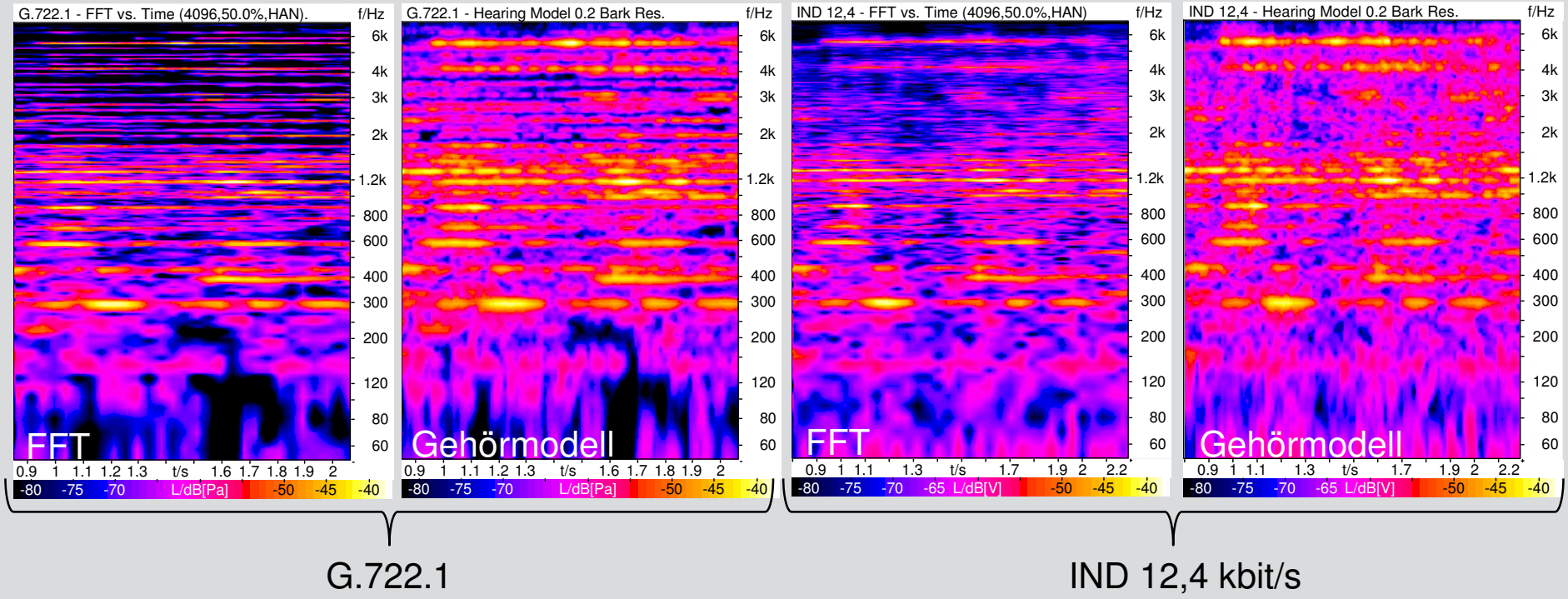
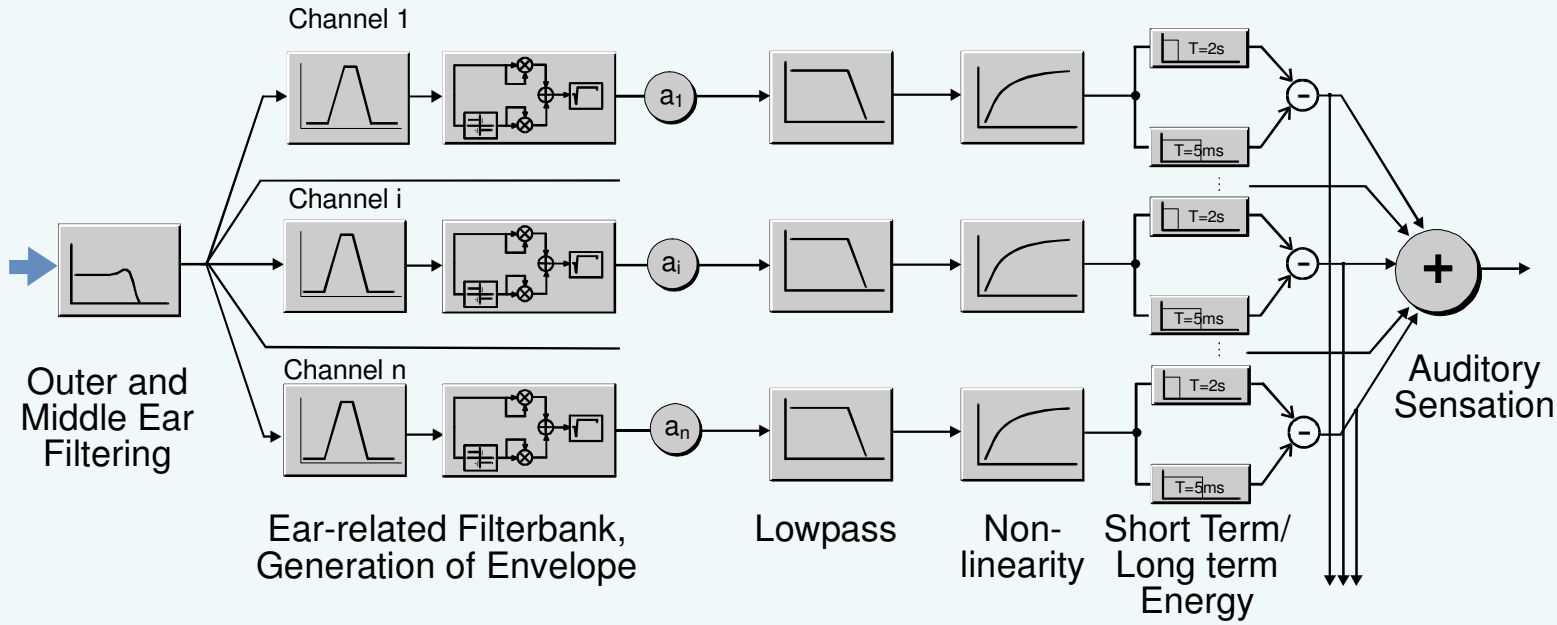
Comparision FFT – Hearing model



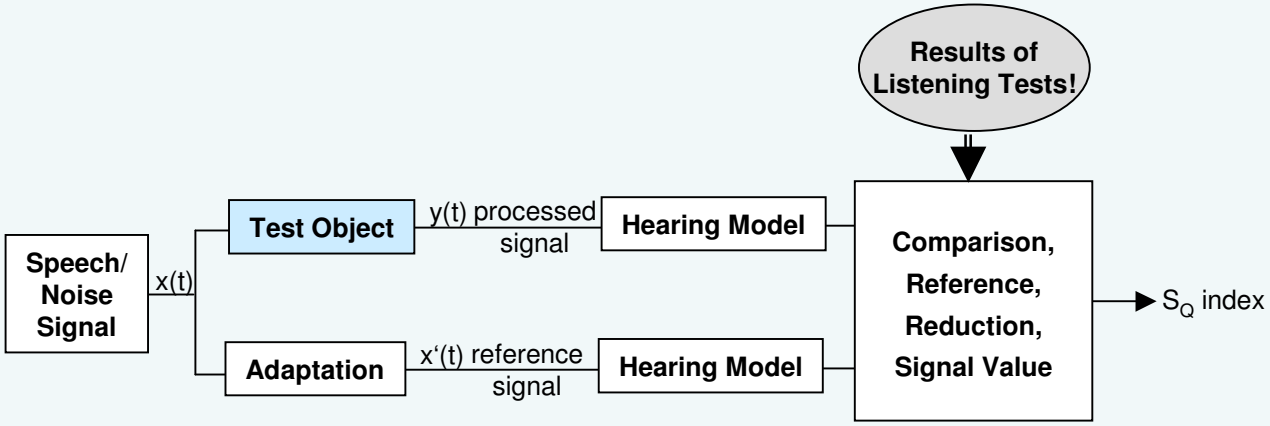
→ Hearing model in general gives a better representation of the impairments perceived

Hearing Model & Relative Approach

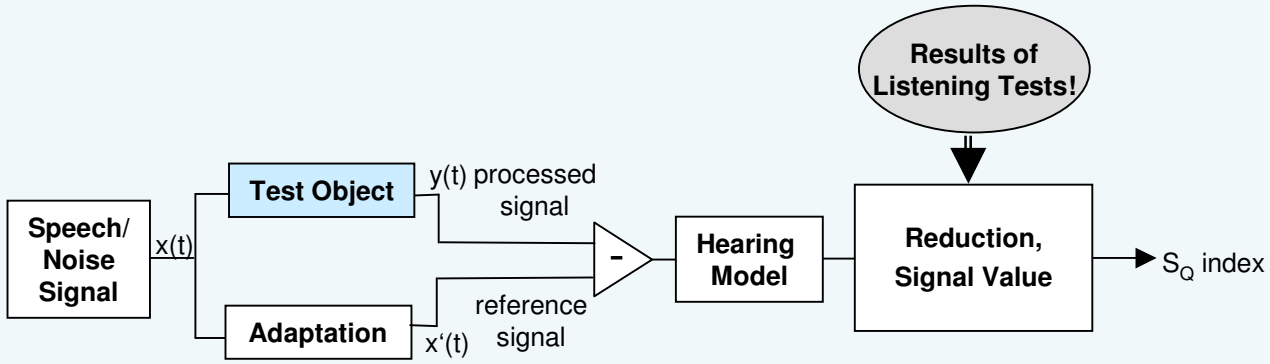


Model of the "Relative Approach":
Hearing model and calculation of the energy differences in critical bands

Hearing Model Based Approaches



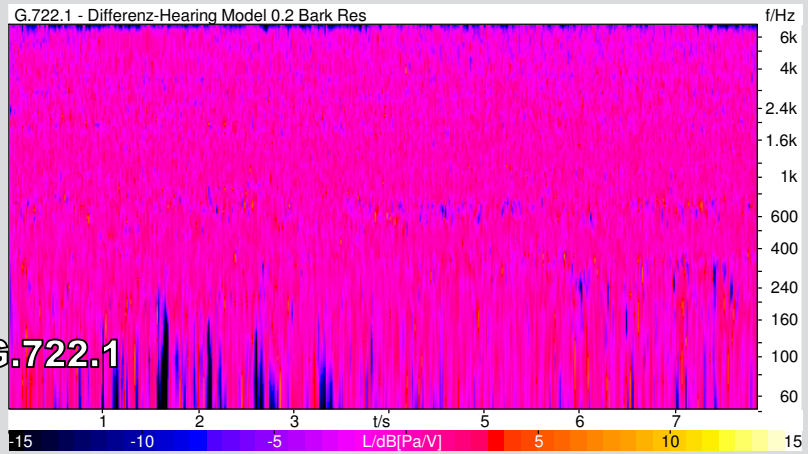
Hearing model approach based on a reference hearing model output

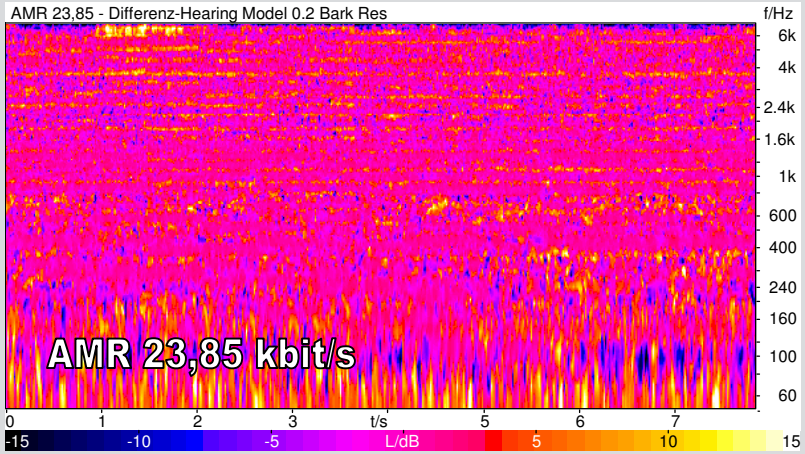


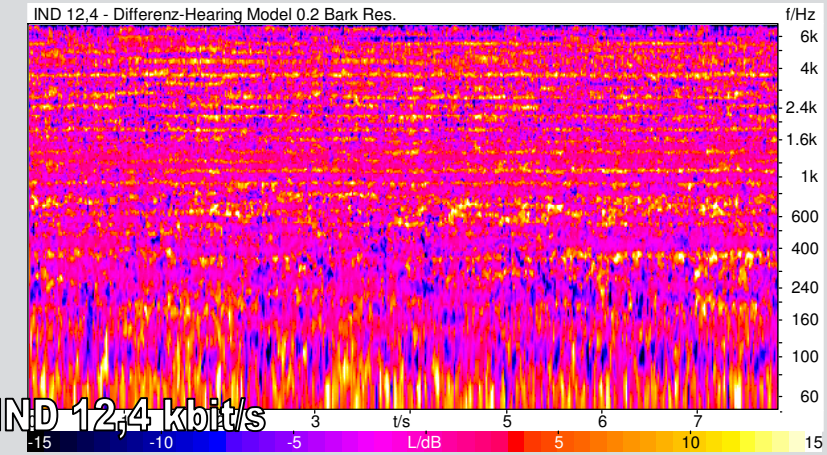
Hearing model approach based on a differential signal

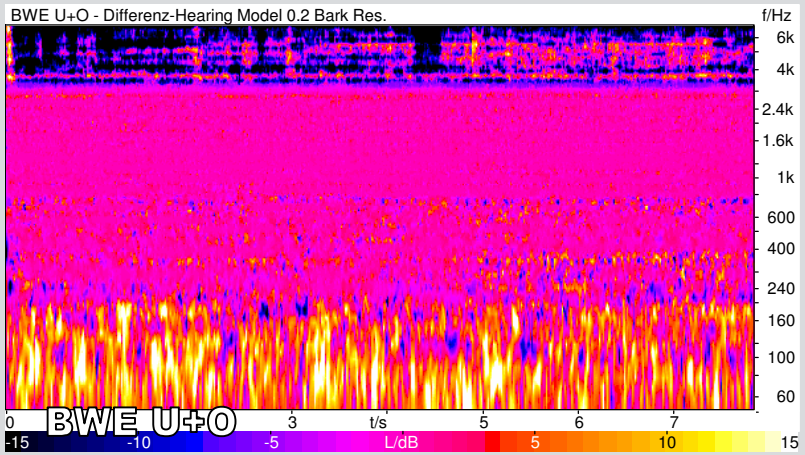
Objective Analysis

Hearing model output –
referenced to hearing model output of input signal





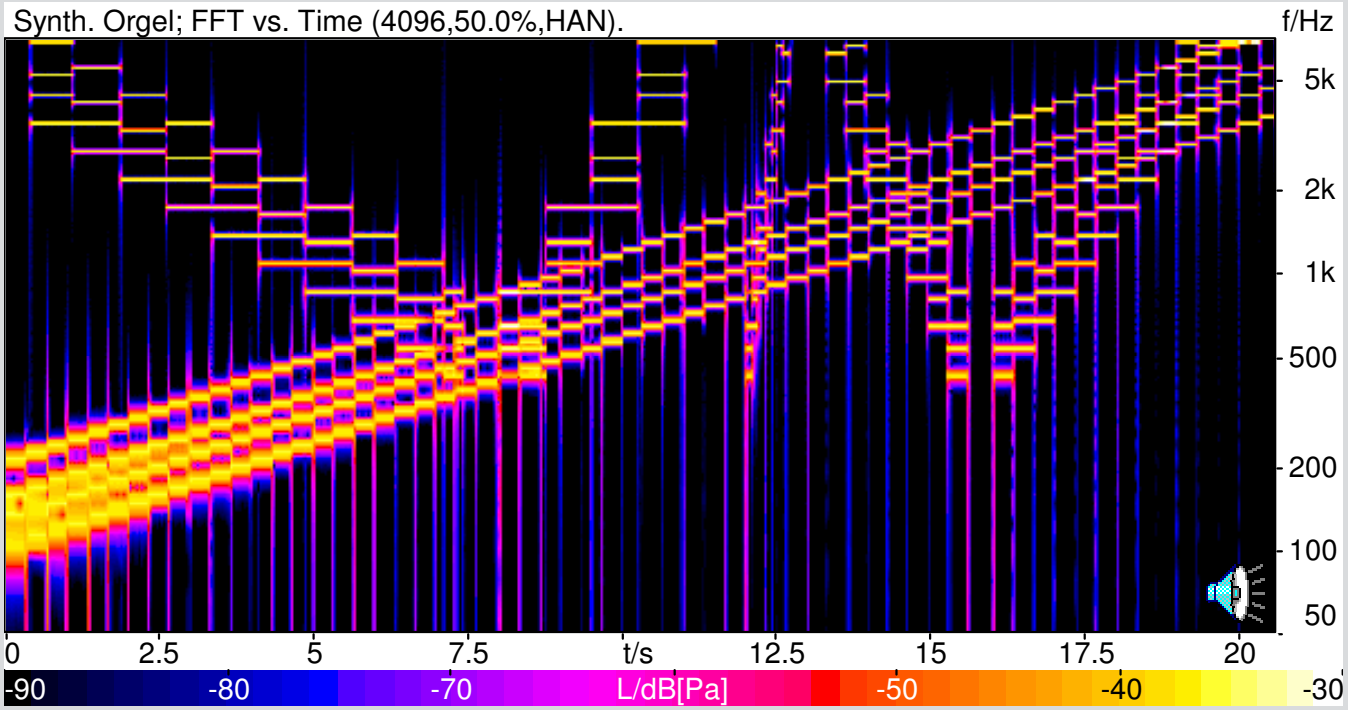




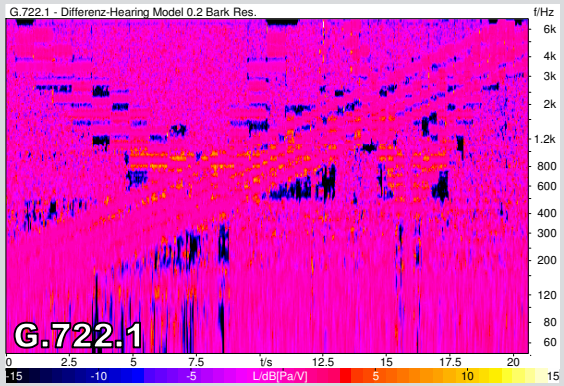
Background Noise Testsignal

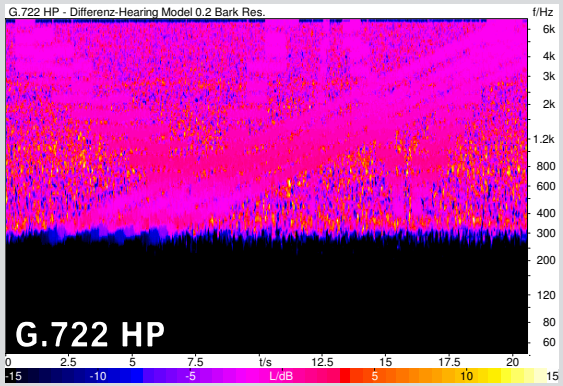
Mathematically defined signal based on major chords

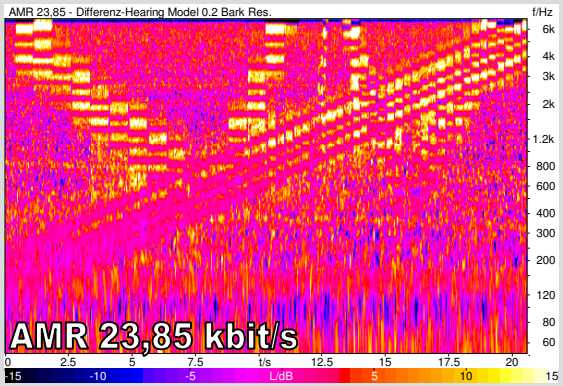
- representing time and frequency structure of tonal background noises

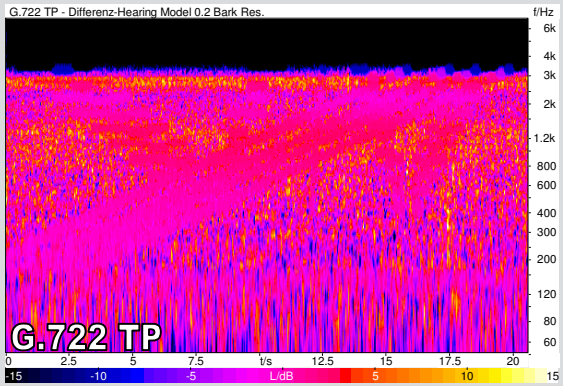


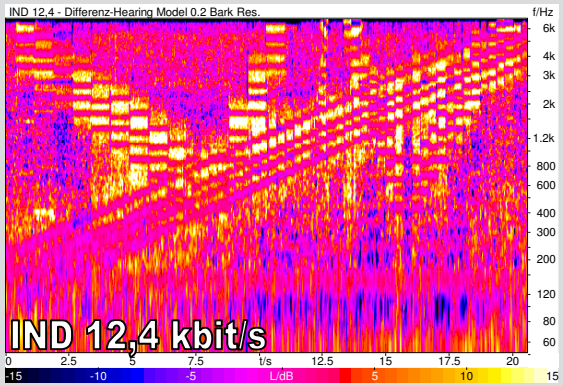
Results

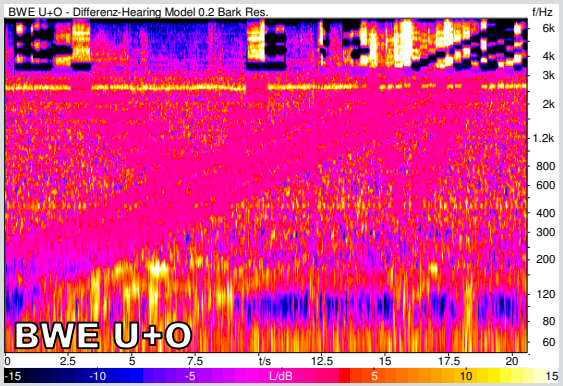

G.722.1 - Differenz-Hearing Model 0.2 Bark Res.
f/Hz
6k
4k
3k
2k
1.2k
800
600
400
300
200
120
80
60
0
2.5
5
7.5
t/s
12.5
15
17.5
20
-15
-10
-5
L/dB[Pa/V]
5
10
15
G.722.1


G.722 HP - Differenz-Hearing Model 0.2 Bark Res.
f/Hz
6k
4k
3k
2k
1.2k
800
600
400
300
200
120
80
60
0
2.5
5
7.5
t/s
12.5
15
17.5
20
-15
-10
-5
L/dB
5
10
15
G.722 HP


AMR 23,85 - Differenz-Hearing Model 0.2 Bark Res.
f/Hz
6k
4k
3k
2k
1.2k
800
600
400
300
200
120
80
60
0
2.5
5
7.5
t/s
12.5
15
17.5
20
-15
-10
-5
L/dB
5
10
15
AMR 23,85 kbit/s


G.722 TP - Differenz-Hearing Model 0.2 Bark Res.
f/Hz
6k
4k
3k
2k
1.2k
800
600
400
300
200
120
80
60
0
2.5
5
7.5
t/s
12.5
15
17.5
20
-15
-10
-5
L/dB
5
10
15
G.722 TP


IND 12,4 - Differenz-Hearing Model 0.2 Bark Res.
f/Hz
6k
4k
3k
2k
1.2k
800
600
400
300
200
120
80
60
0
2.5
5
7.5
t/s
12.5
15
17.5
20
-15
-10
-5
L/dB
5
10
15
IND 12,4 kbit/s


BWE U+O - Differenz-Hearing Model 0.2 Bark Res.
f/Hz
6k
4k
3k
2k
1.2k
800
600
400
300
200
120
80
60
0
2.5
5
7.5
t/s
12.5
15
17.5
20
-15
-10
-5
L/dB
5
10
15
BWE U+O

Classification

of the different disturbances (based on the hearing model output)

Spectral distortion			Distortion in time	Expected MOS-score
50-300 Hz	300-3400 Hz	3400-7000 Hz		
< 3 dB	< 3 dB	< 3 dB	----	> 3,5
< 3 dB	< 12 dB	> 12dB	----	2 – 3
< 3 dB	> 12dB	< 12 dB	----	1 – 2
< 3 dB	> 12dB	> 12dB	----	1 – 2
< 12 dB	< 3 dB	> 12dB	X	1 – 2
	< 3 dB	< 3 dB	----	3 – 3,5
	< 3 dB	> 12dB	X	1 – 2
< 3 dB	< 3 dB		----	2 – 3
< 12 dB	< 3 dB		----	2 – 3
	< 3 dB		----	2 – 3

Conclusions

- Proposed test signal in combination with the hearing model based reference analysis approach is very promising for the evaluation of (tonal) background noise

- To do:
  - Additional subjective testing
  - Use additional background noises
  - Further development of the test procedure