Standards on Audio Quality - from a system-level view

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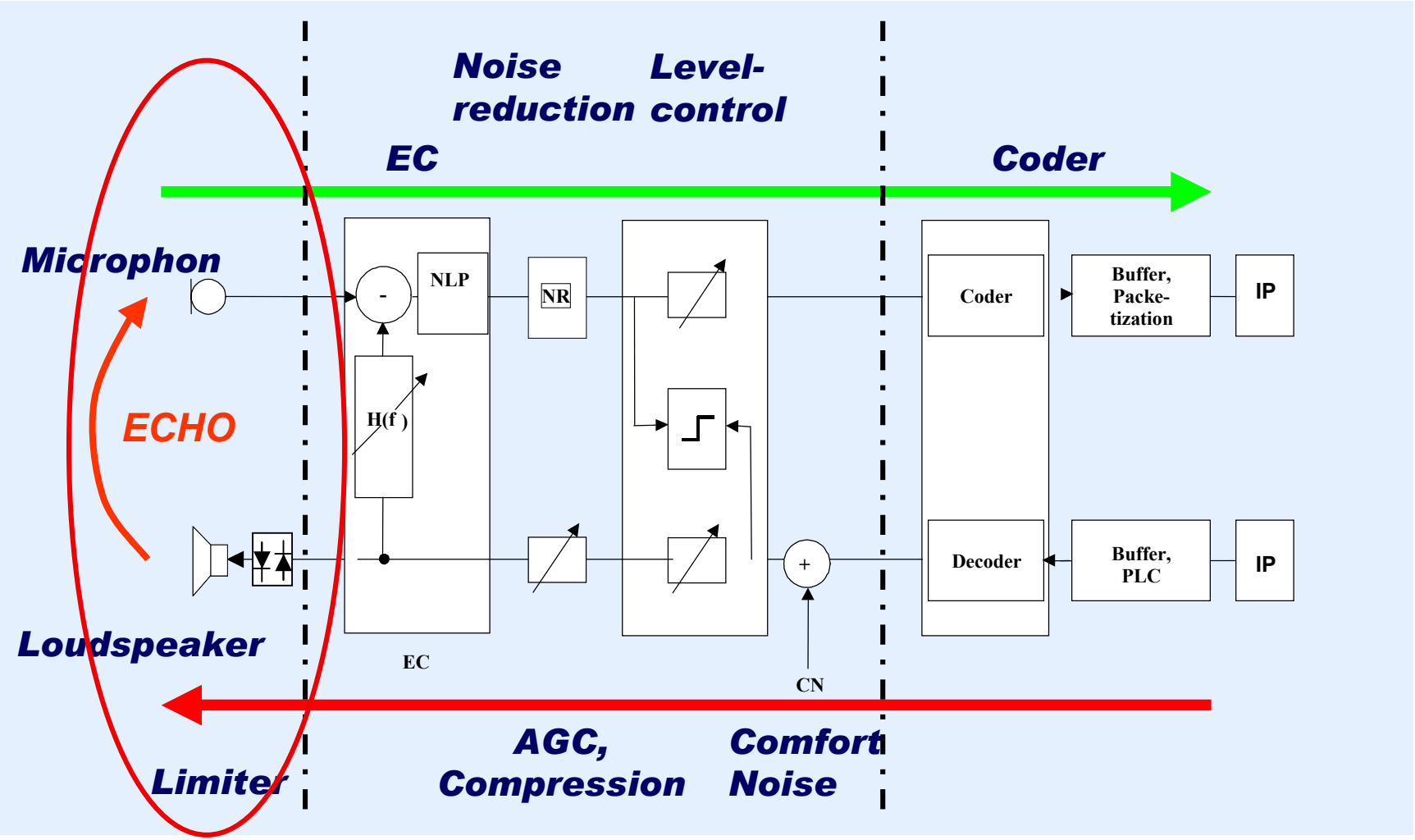
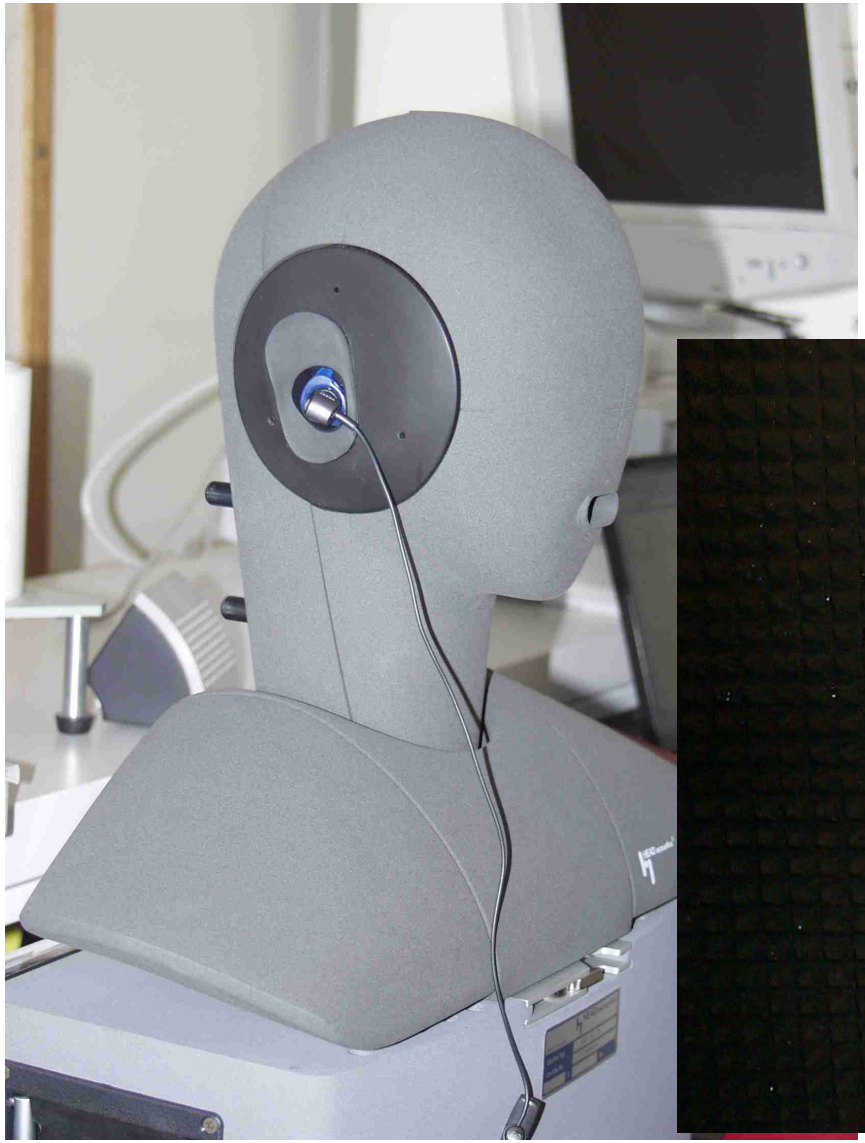
Overview

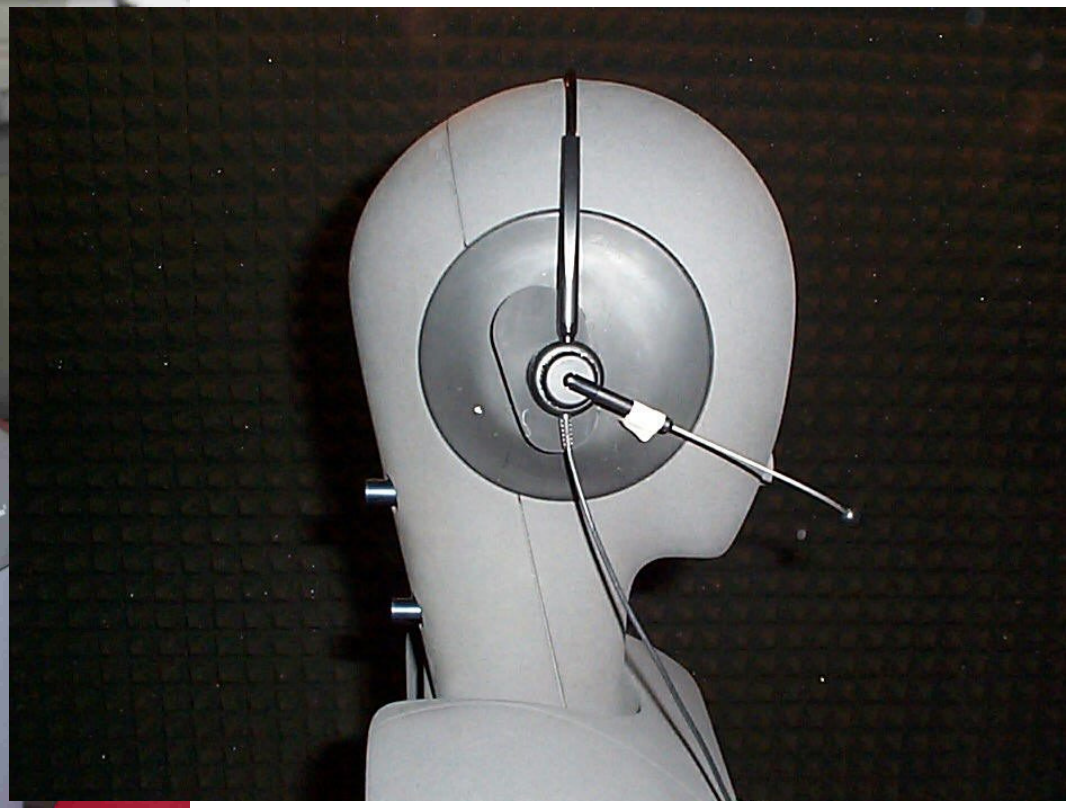
- Reference Points and Equalization
  - free field-/diffuse field equalization
  - DRP - ERP
  - MRP
- How to Measure – Non Linear Signal Processing
  - test signals and analysis
  - evaluation examples

Headset & Signal Processing

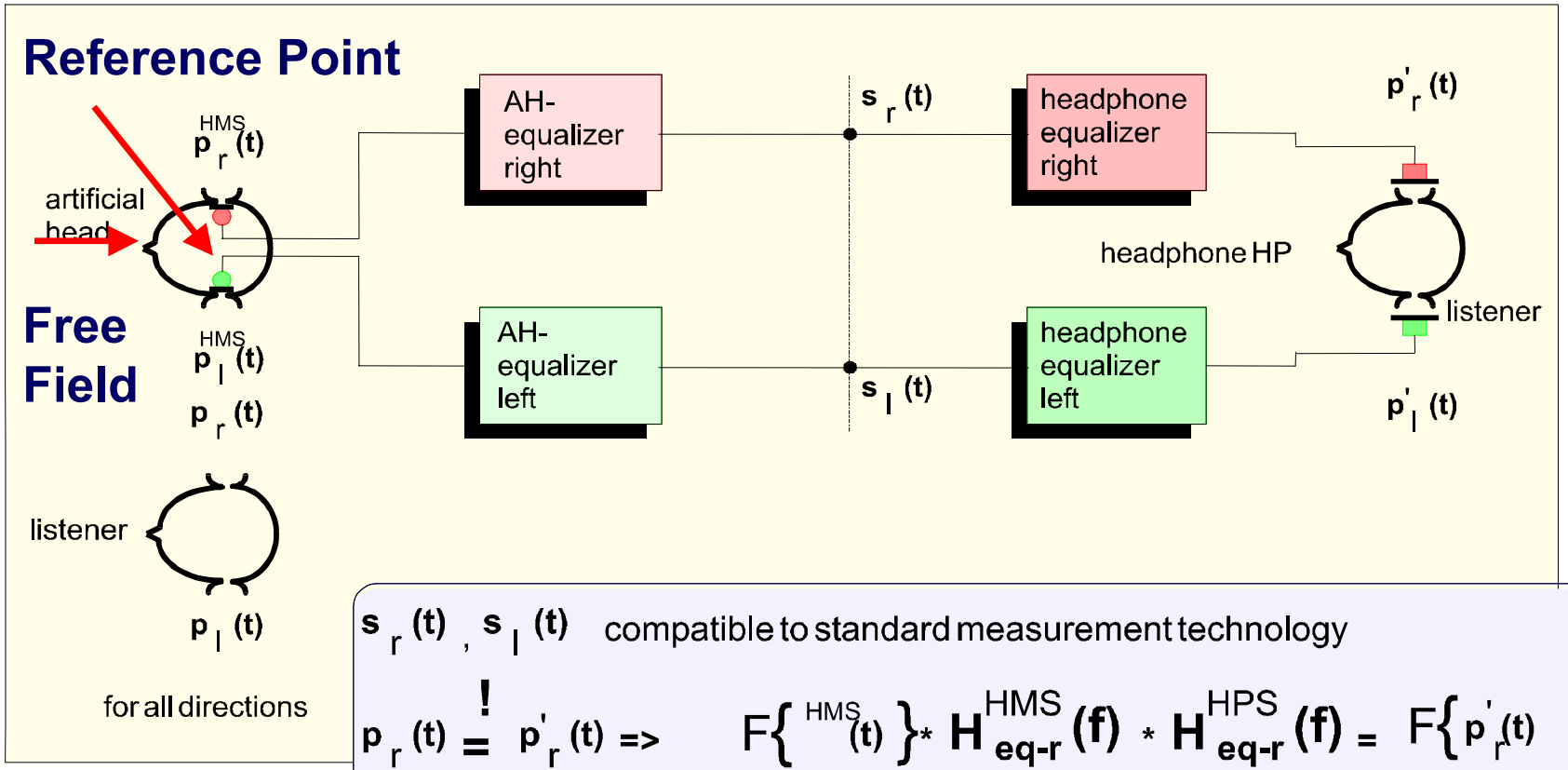


Acoustical Access





Artificial Head Technology – Equalization for Audio



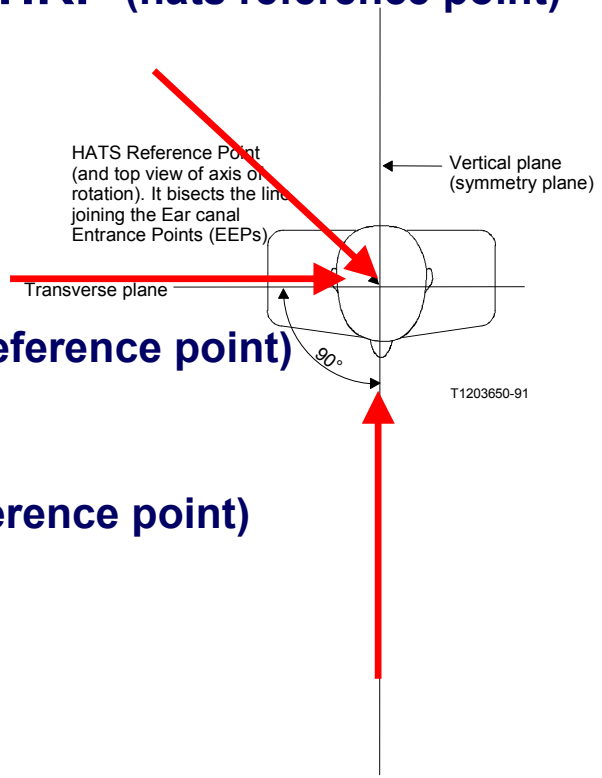
$s_r(t)$, $s_l(t)$ compatible to standard measurement technology

$$p_r(t) \overset{!}{=} p'_r(t) \Rightarrow \quad F\{ {}^{HMS}(t) \} * H^{HMS}_{eq\text{-}r}(f) * H^{HPS}_{eq\text{-}r}(f) = F\{ p'_r(t) \}$$

$$p_l(t) \overset{!}{=} p'_l(t) \Rightarrow \quad F\{ p_{l_r}^{HMS}(t) \} * H^{HMS}_{eq\text{-}l}(f) * H^{HPS}_{eq\text{-}l}(f) = F\{ p'_l(t) \}$$

Reference Points in Telephonometry - HATS

HRP (hats reference point)

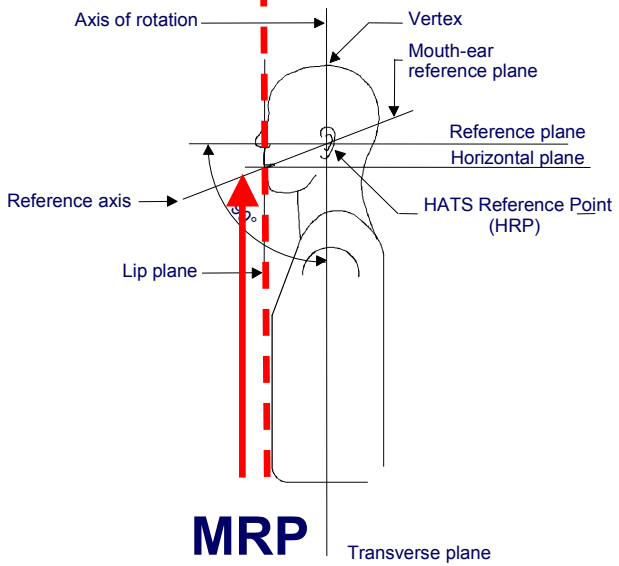


DRP
(drum reference point)

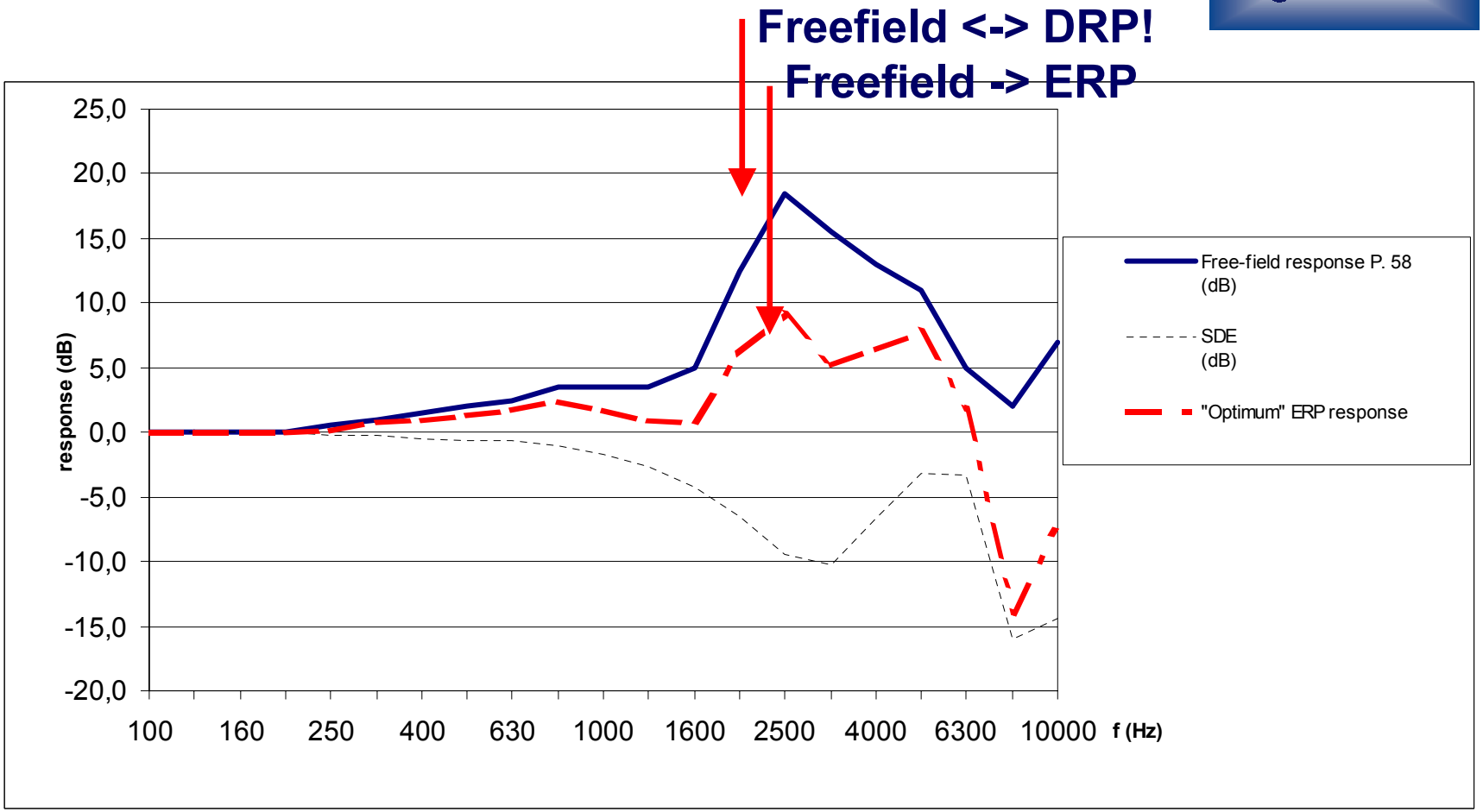
ERP
(ear reference point)

MRP/lip ring
(mouth reference point)

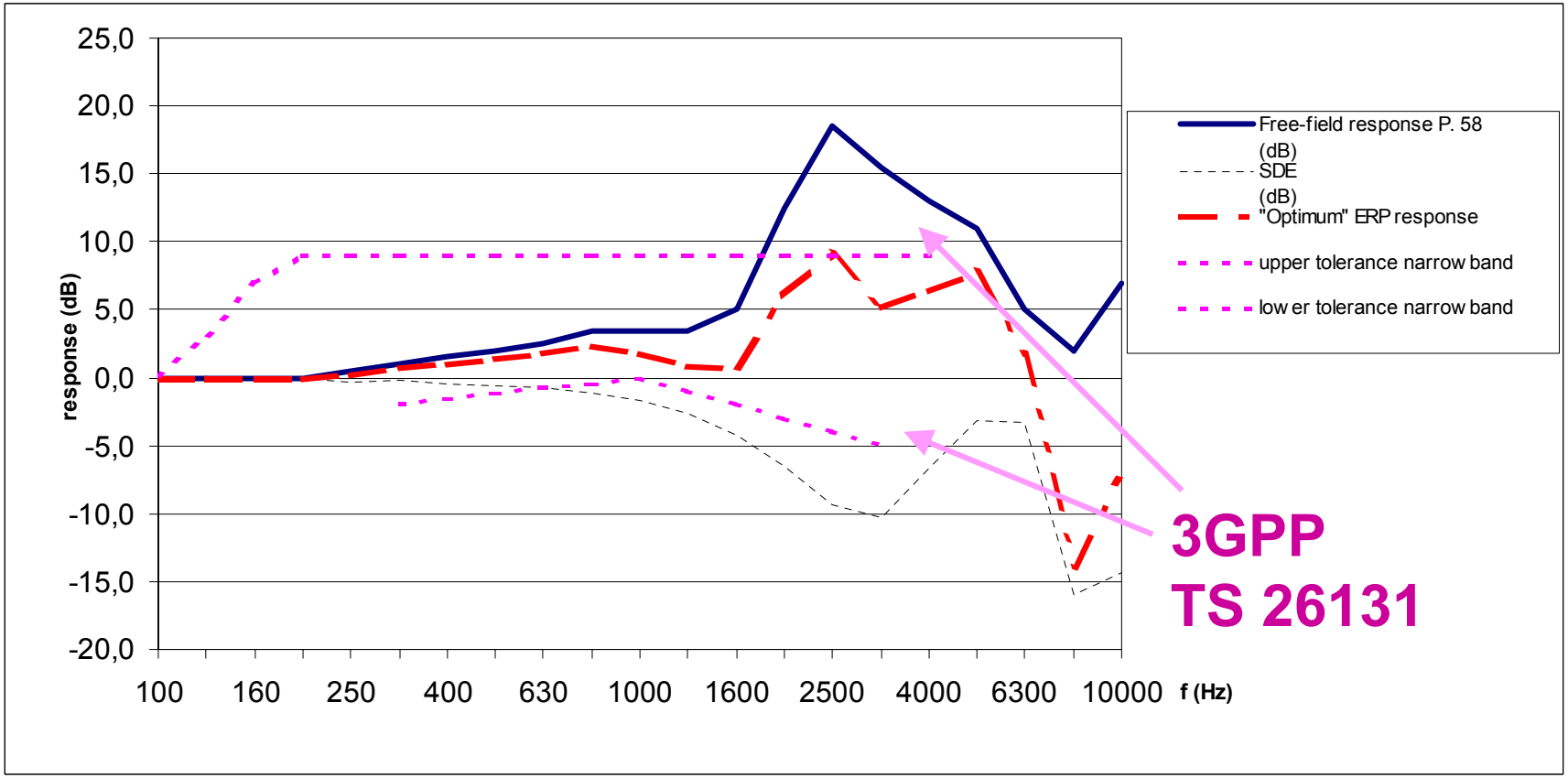
Lip ring



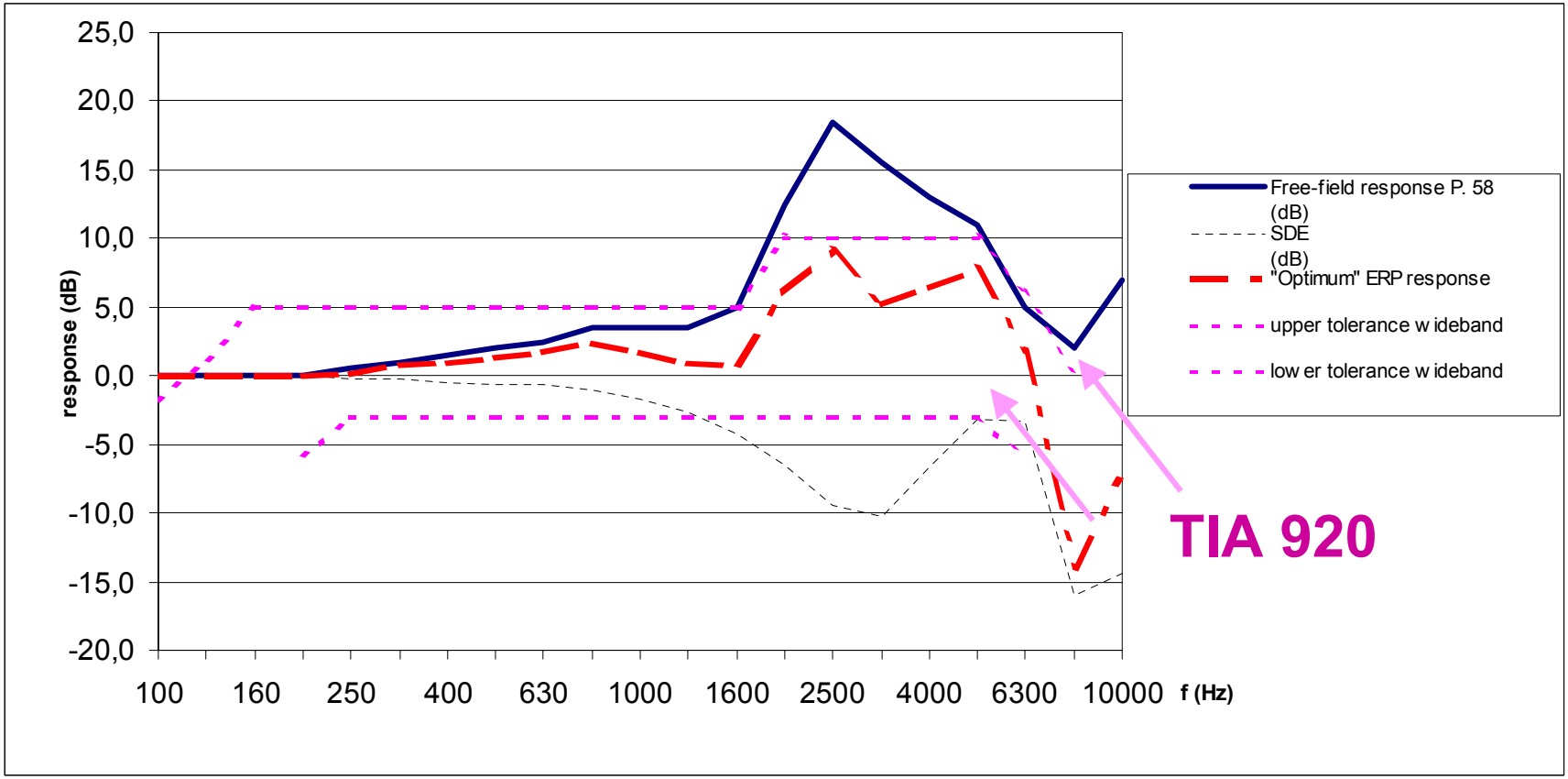
Freefield – DRP – ERP



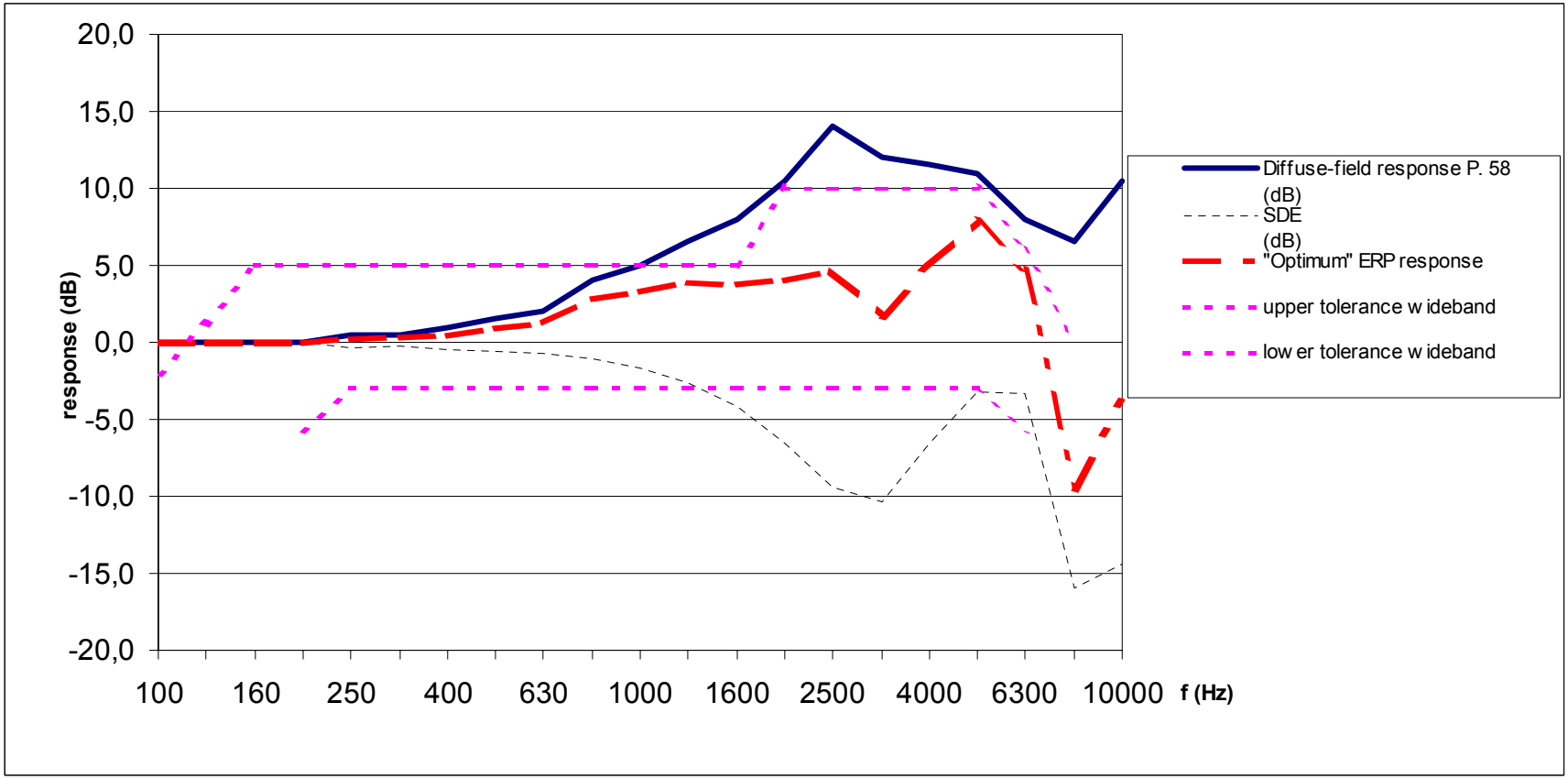
Freefield – ERP - Narrowband



Freefield – ERP - Wideband



Diffuse-Field - ERP



Acoustical Access

- *Adaptation of the frequency response requirements for headphones and headsets possible within the tolerances of telecommunication standards*
- *Reference point for frequency response requirements of minor importance: freefield or ERP can be transformed easily given that the open ear correction SDE is appliccable*
- *Loudness Ratings have to be calculated at ERP: ITU-T P.79*

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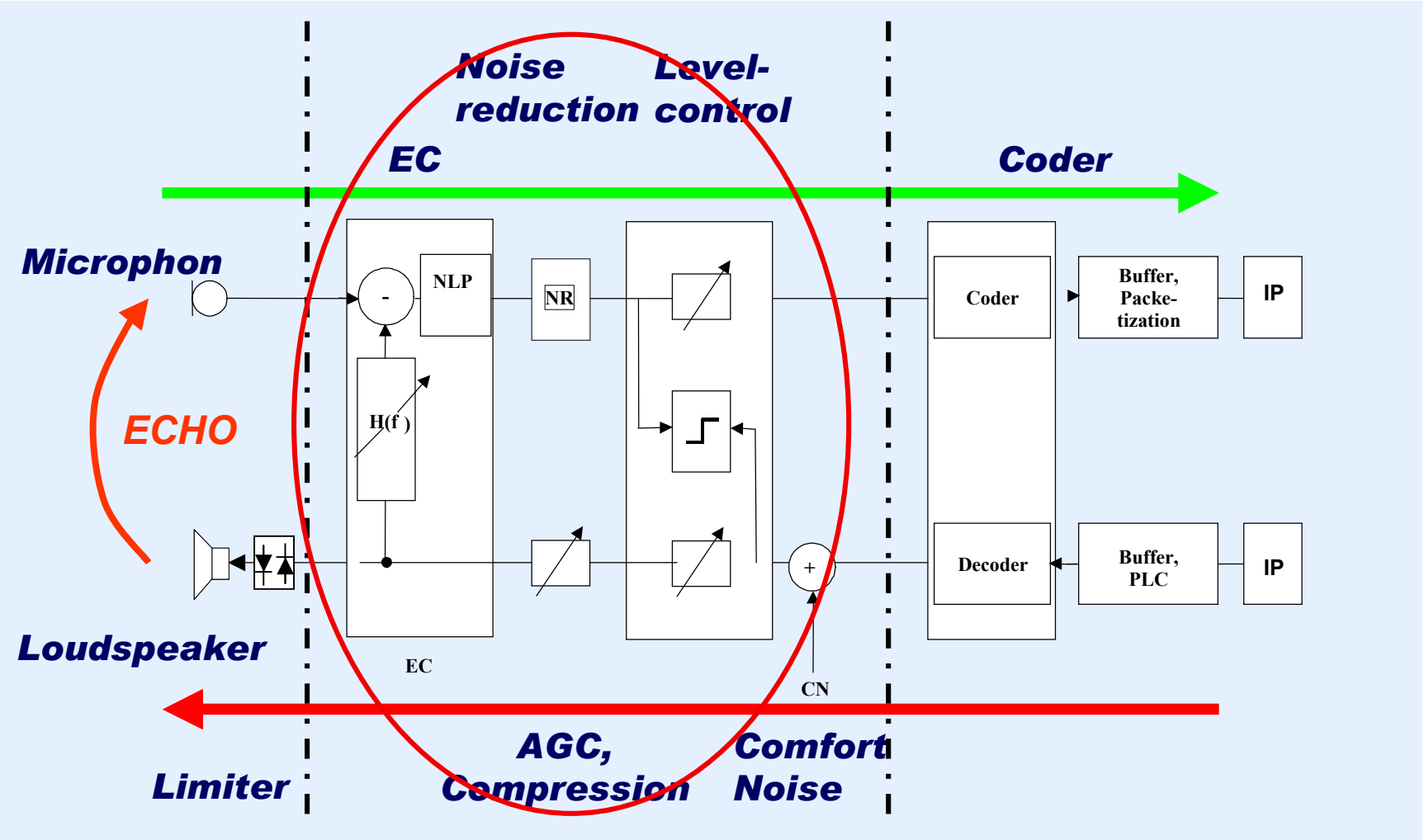
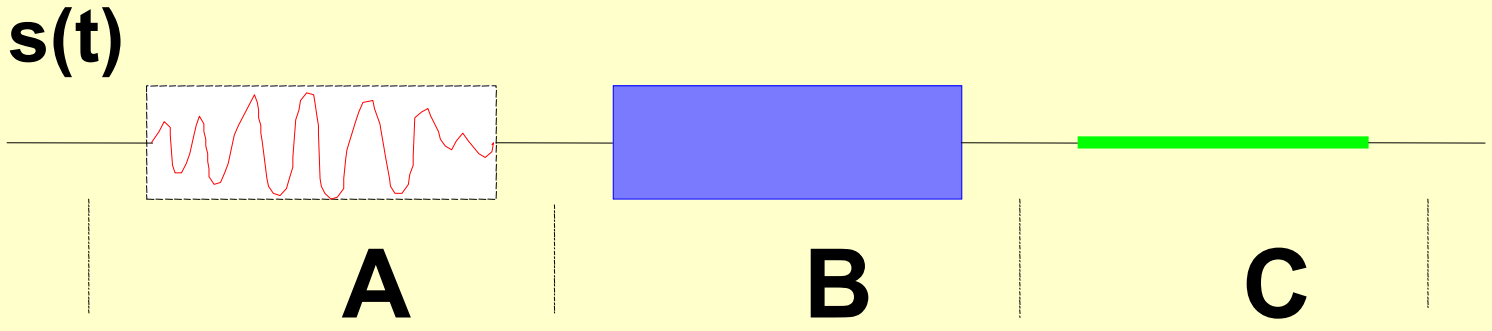
Headset & Signal Processing



Composite Source Signal (P.501)

CSS: Signal construction

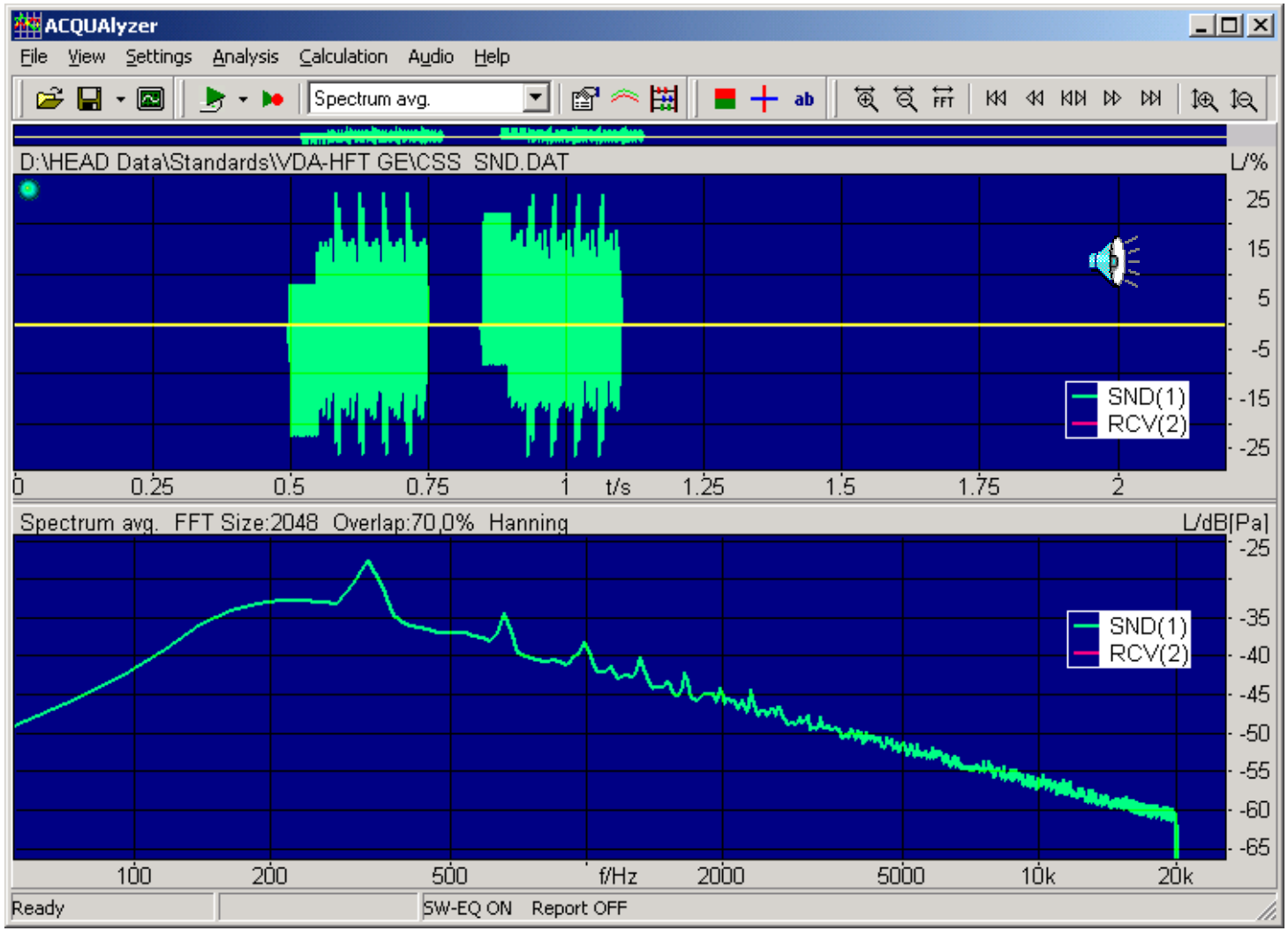


A - Voiced sound

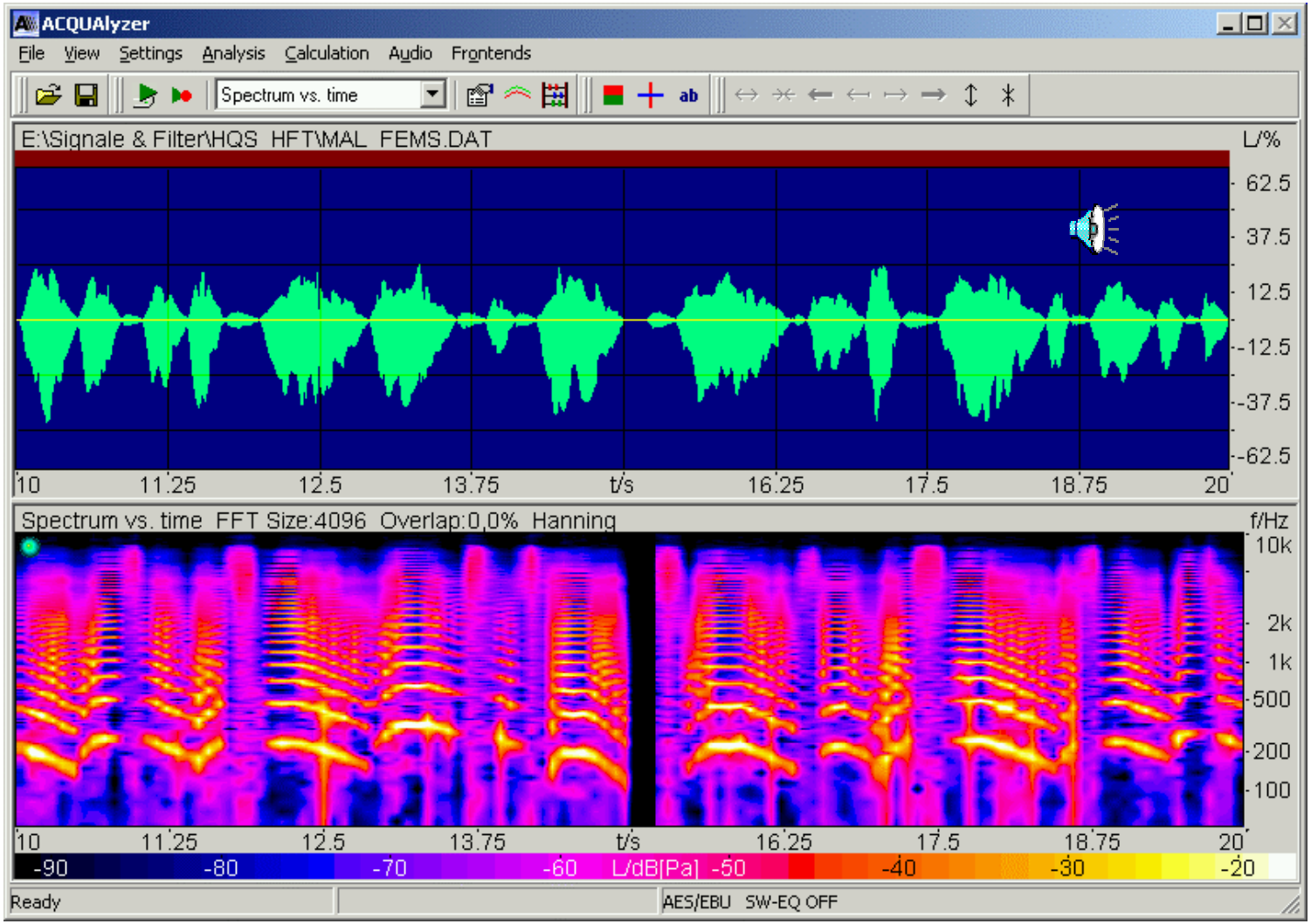
B - Noise sequence (e.g. pseudo random noise)

C - Pause

Composite Source Signal

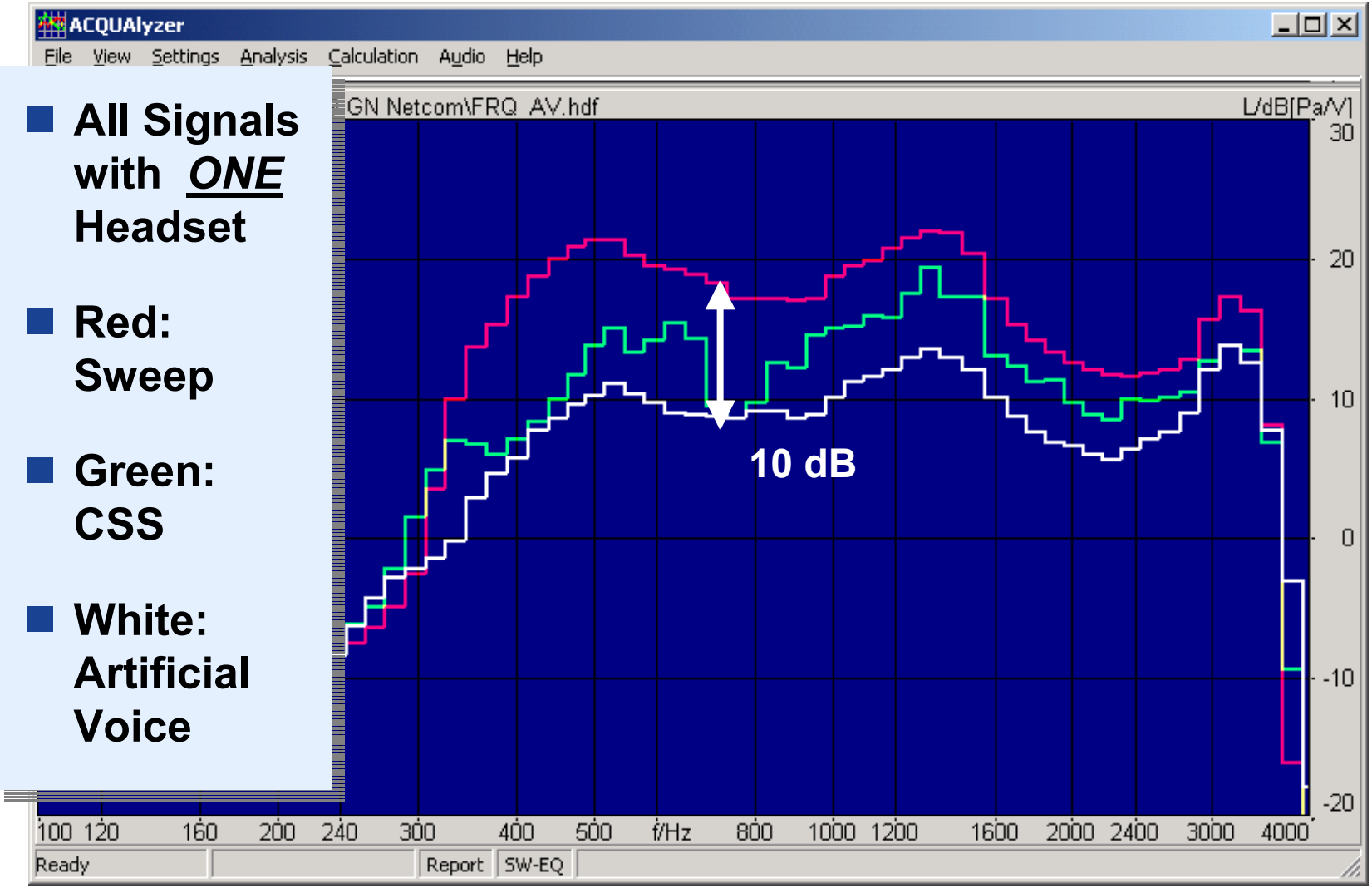


Artificial Voice (P.50)

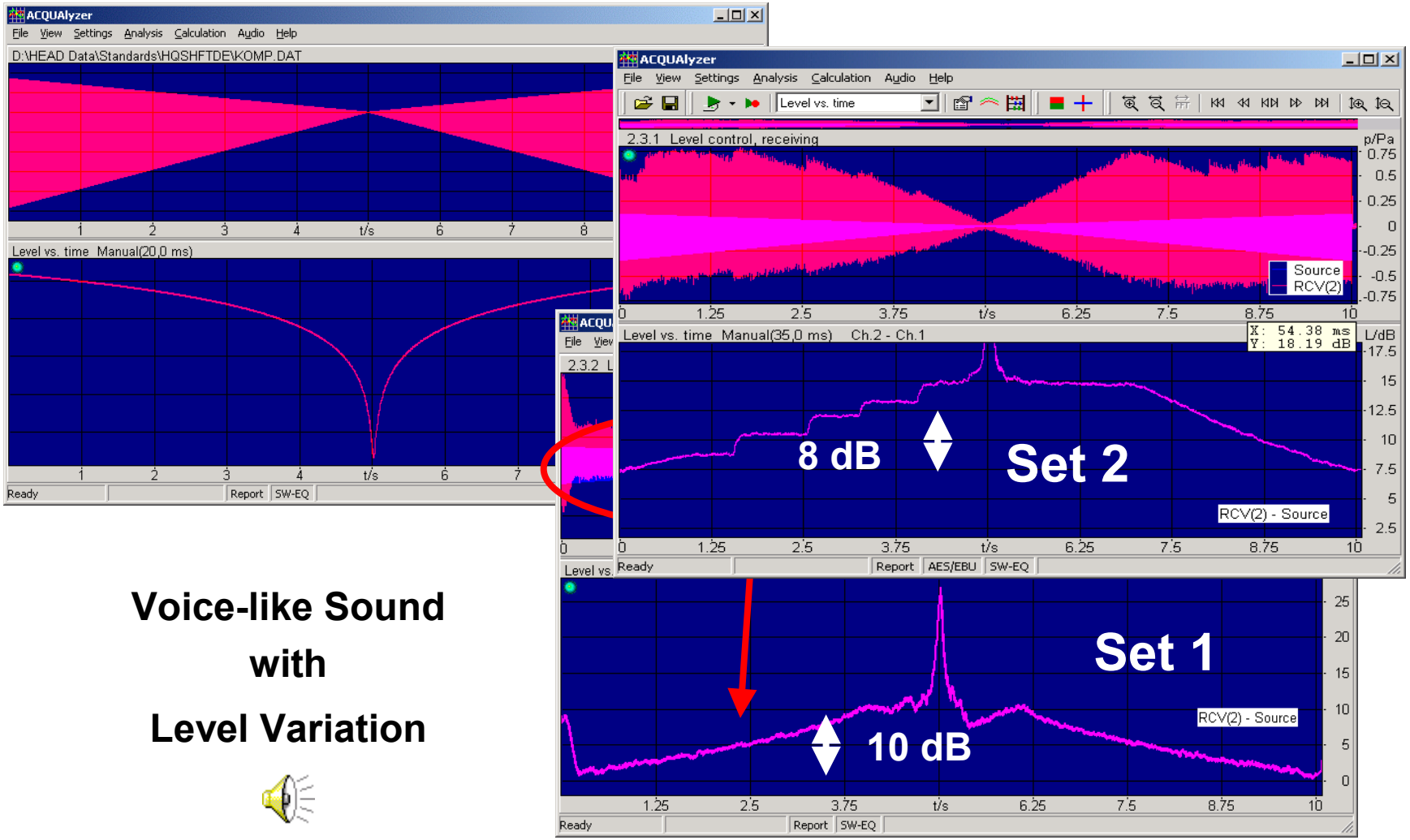


Frequency Responses

- All Signals with *ONE* Headset
- Red: Sweep
- Green: CSS
- White: Artificial Voice



Level Control (AGC, Companding)

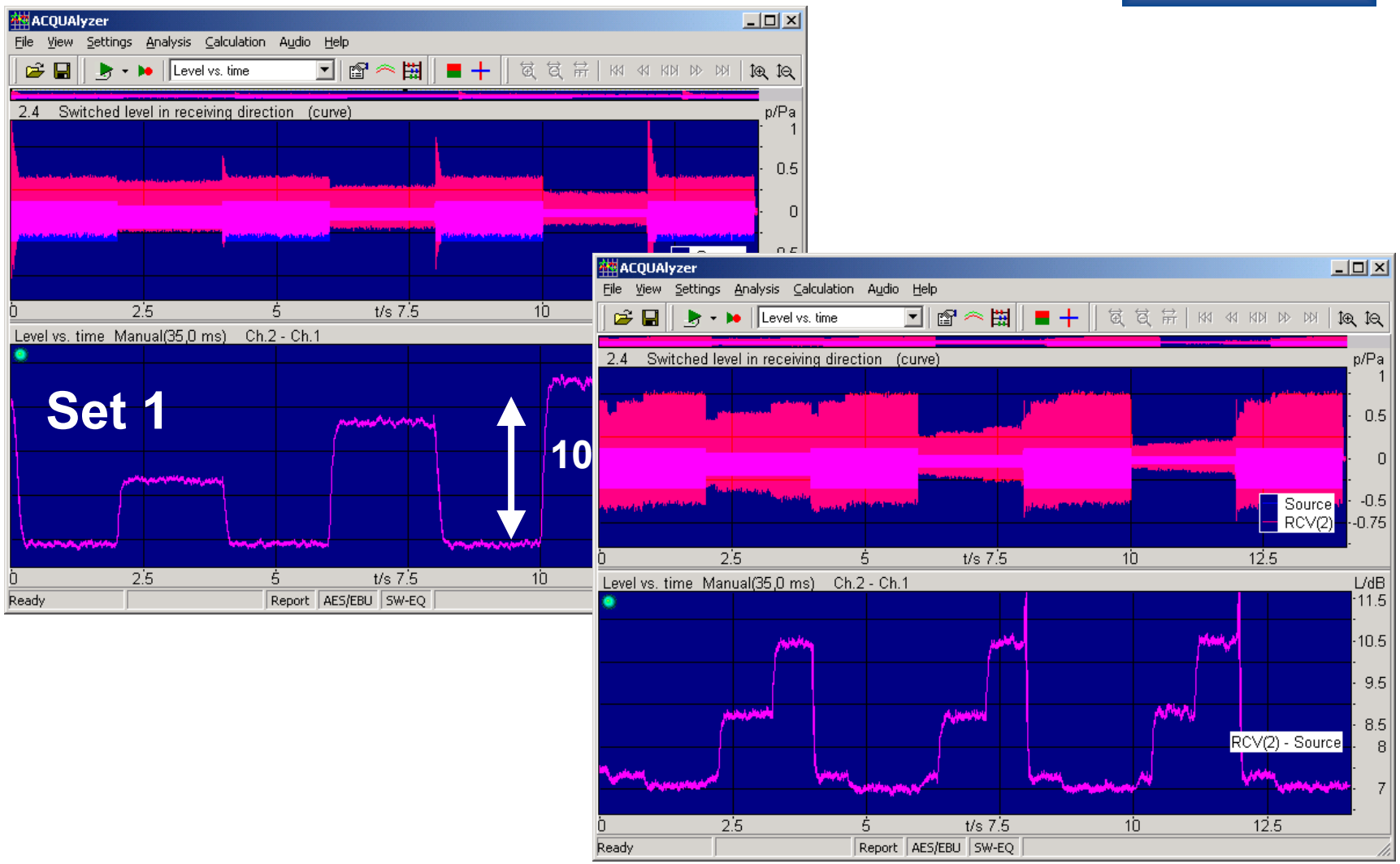


Voice-like Sound

with

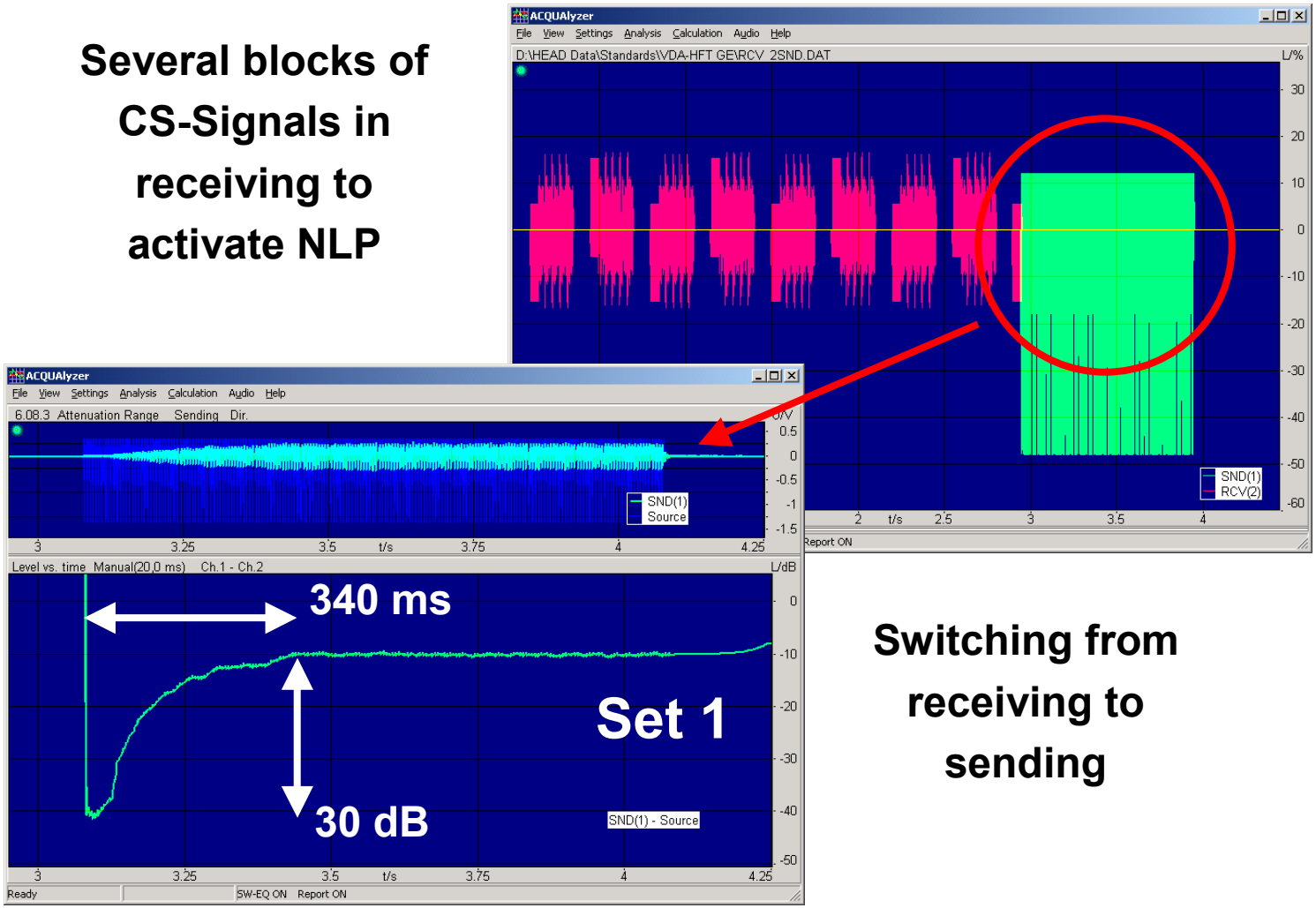
Level Variation

Level Control (AGC, Companding)



Switching Characteristics

Several blocks of CS-Signals in receiving to activate NLP



Switching from receiving to sending

Double Talk

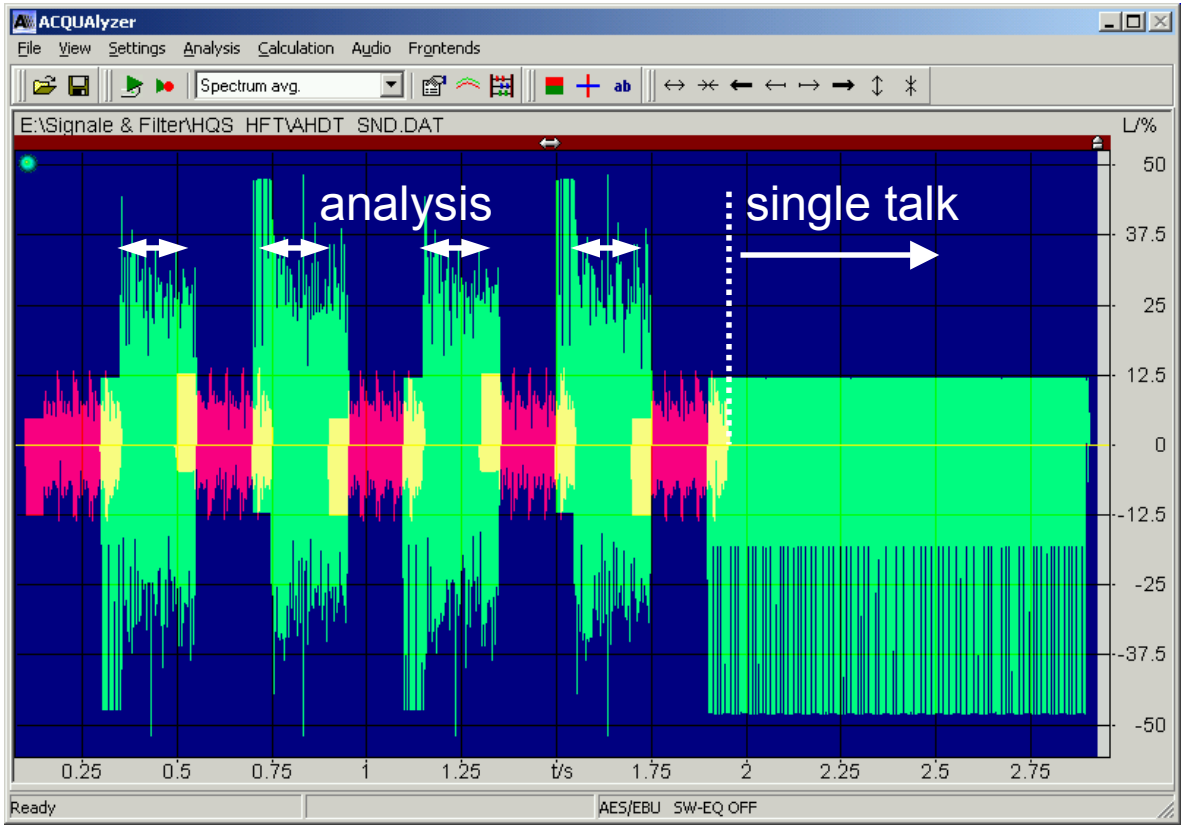
Combination of two Composite Source Signals (CSS)

green: near end signal

red: far end signal

Signal description in ITU-T Recommendation P.501

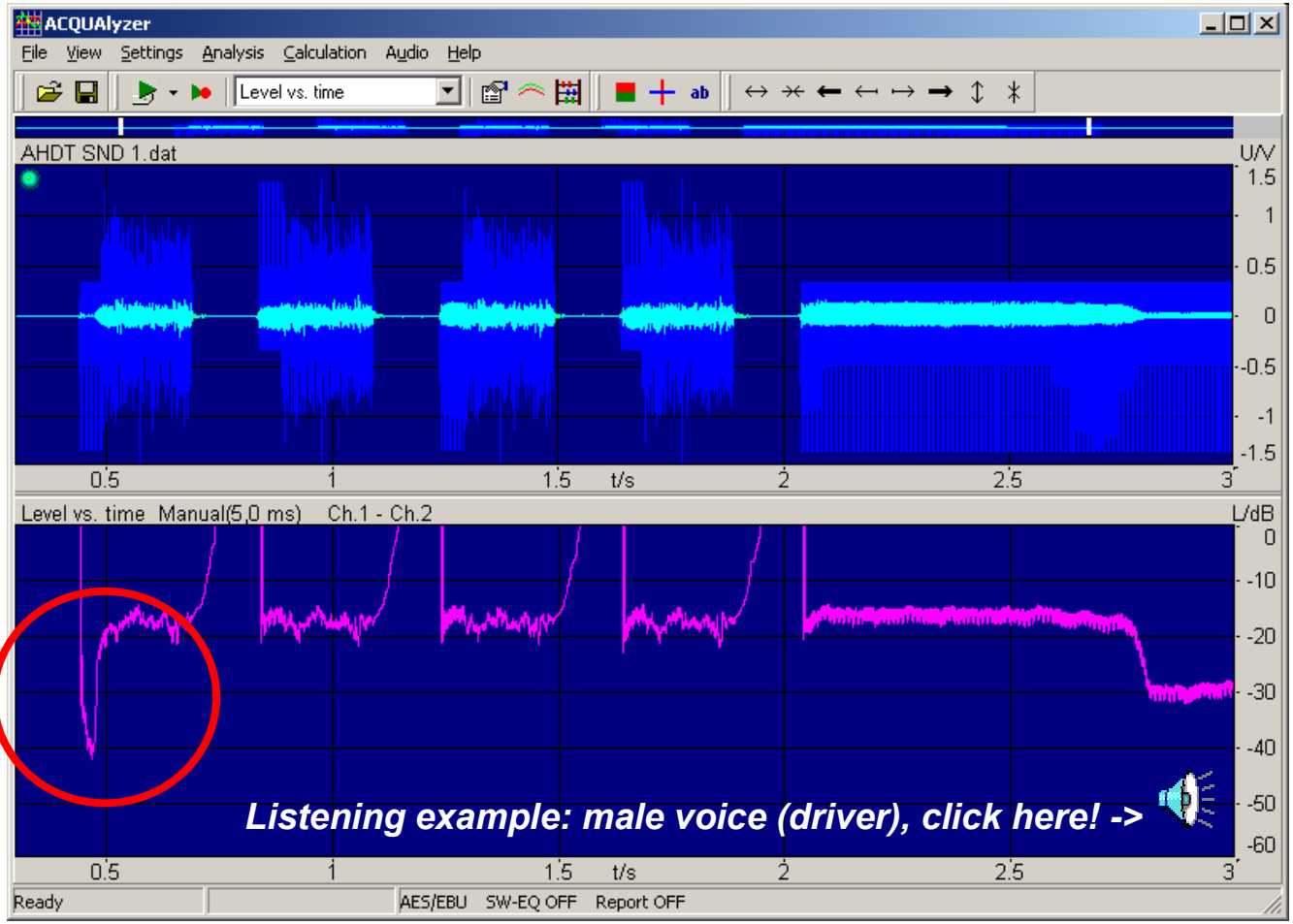
Description of analysis methods in ITU-T P.502



Double Talk

Analysis in sending direction based on the CSS

hands-free telephone 1



temporal clipping under double talk conditions

Summary

- *Acoustical access of headsets can be made easily using artificial head technology*
- *Acoustical reference points can be transformed easily (if current SDE can be used)*

- *More speech like test signals are required for modern headset systems*
- *Advanced analysis techniques are required in order to assess the speech quality in sending, receiving, double talk, ...*