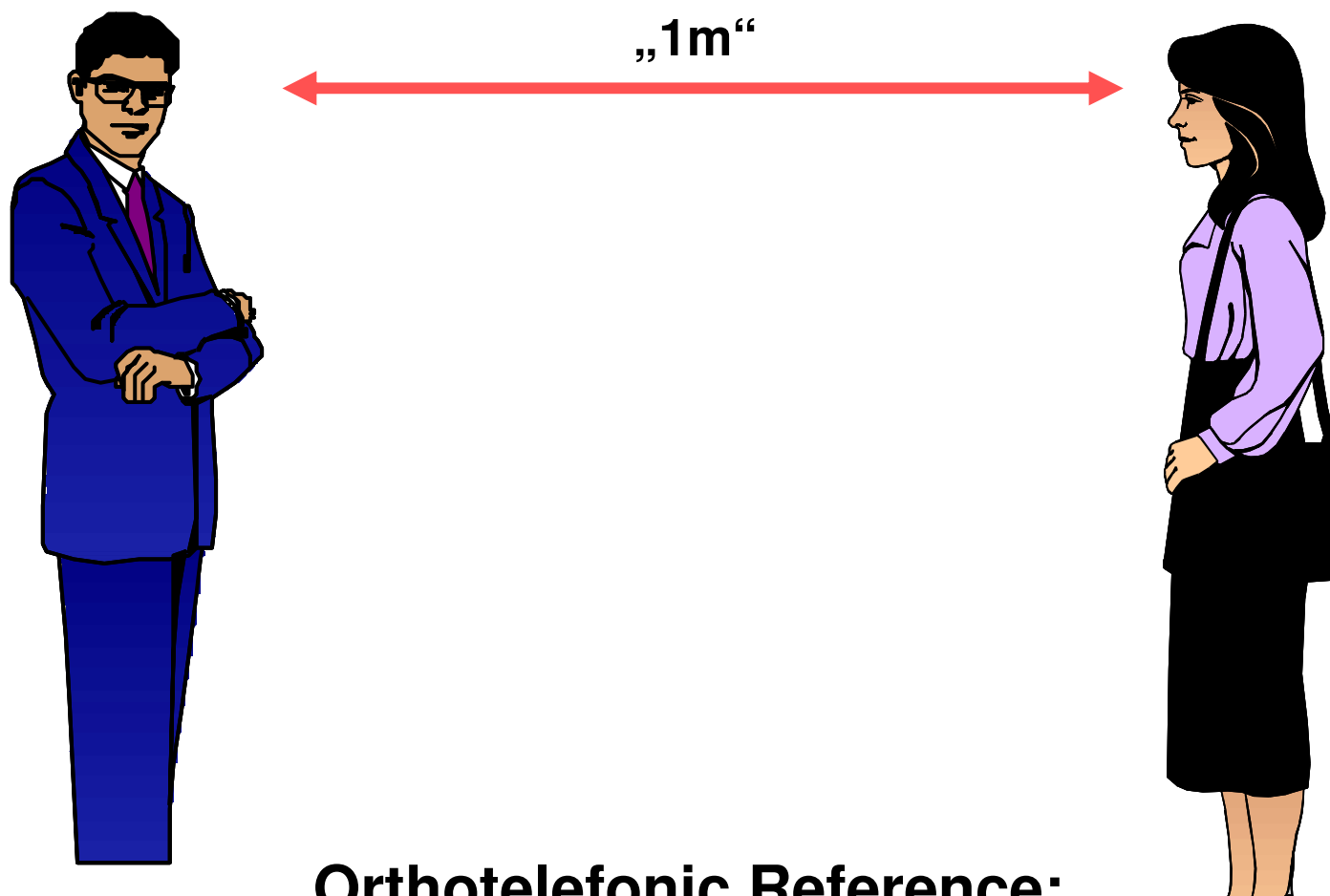


# Mouth to Ear Speech Quality: An Introduction to ETSI EG 201 377-2

EG 201 377-2:  
Specification and measurement of speech  
transmission quality;  
Part 2: Mouth to ear speech transmission  
quality including terminals

H.W. Gierlich, HEAD acoustics GmbH  
Vice-Chairman ETSI STQ

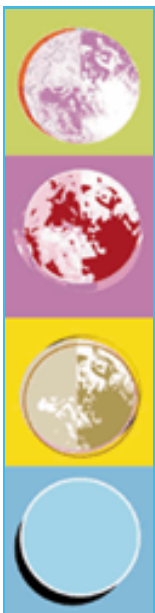
# Speech-Communication



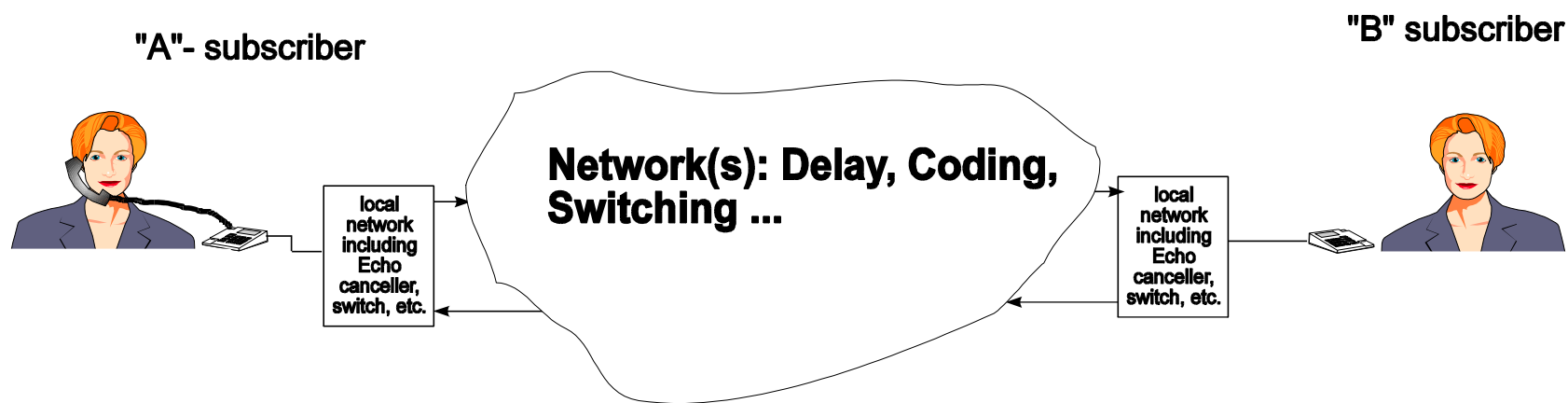
**Orthotelephonic Reference:  
The Basis of EG 201 377-2**

## The Structure of EG 201 377-1

- ☐ General considerations
- ☐ Test configurations
- ☐ Test conditions
- ☐ Measurement of “standard” parameters
- ☐ Advanced measurement procedures, taking into account the conversational situation



# General Considerations

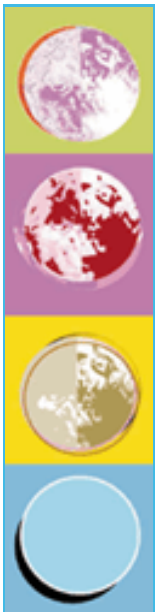


- ❑ Test have to include terminals and typical network configurations
- ❑ The basis of all objective procedures are subjective test as defined in the ITU-T P.800 series:
  - Conversational tests
  - Talking and listening tests
  - Double talk test
  - Third party listening tests

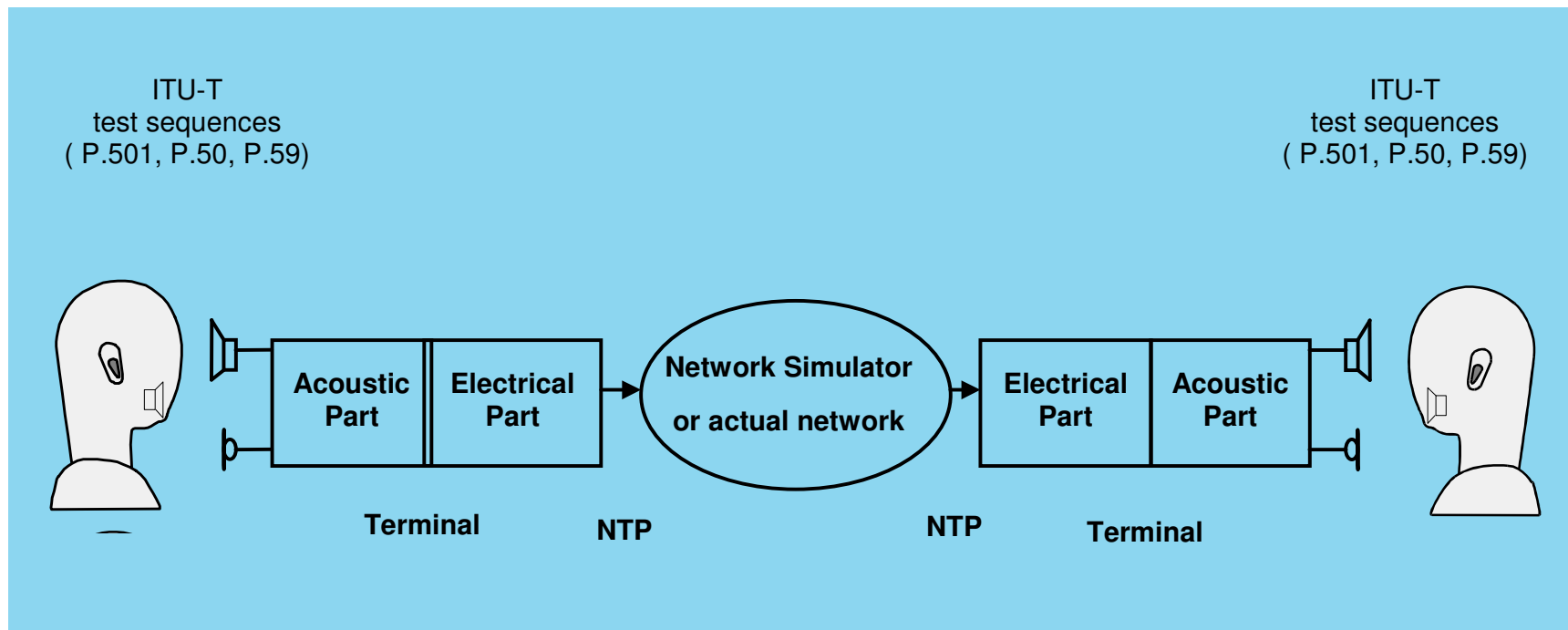
## Parameters, Influencing Speech Quality

### □ The overall quality is determined by:

- Delay and echo.
- Sound quality.
- Quality of background noise transmission at idle, in single talk and double talk conditions.
- Speech level variations during single talk and double talk.
- Disturbances caused by switching during single talk and double talk (completeness of speech transmission).
- Disturbances caused by echoes during single talk and double talk.



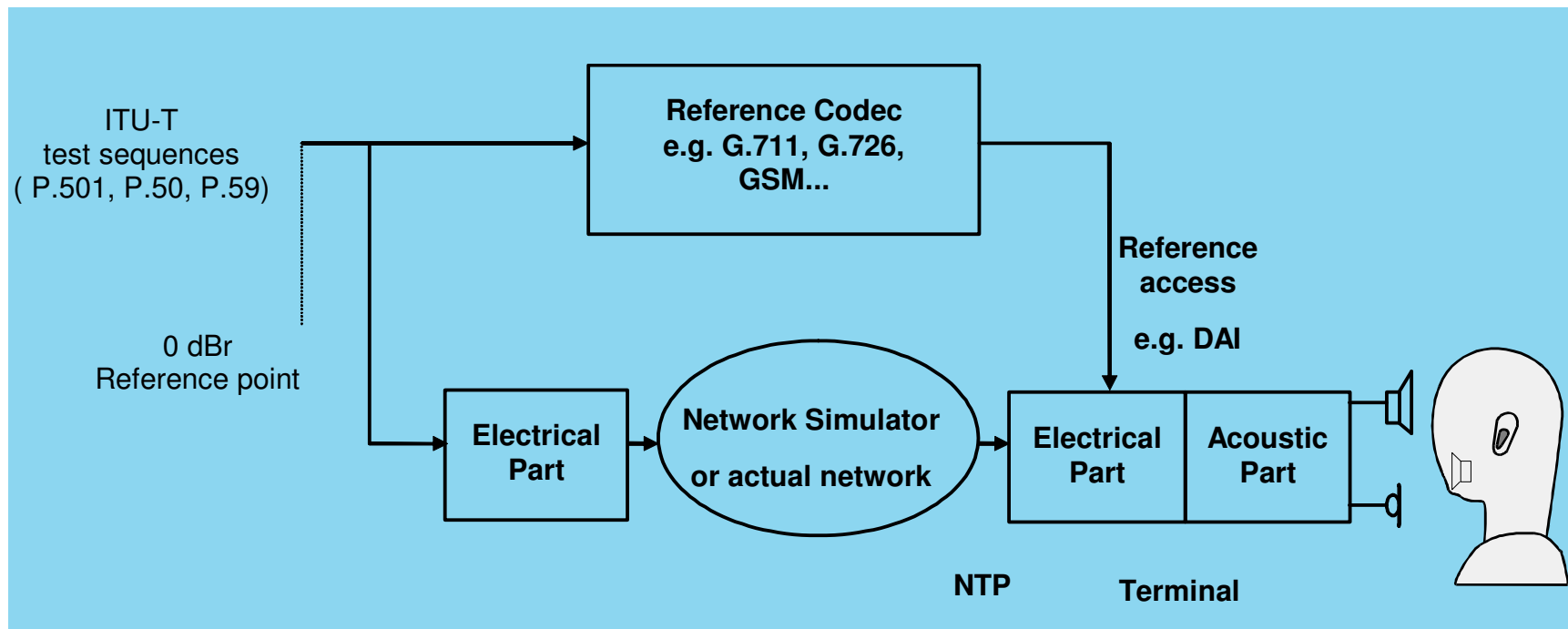
# Test Setups



**Test setup for terminals, acoustical access in end to end scenarios including a network or using a network simulator**



# Test Setups



**Test setup for terminals, electrical access using a "reference" access or a network simulator**

Hands-free and loudspeaking terminals: ITU-T P.340, P.581

## “Standard” Parameters

- Frequency Response in Sending and Receiving Direction;
- Overall Frequency Responses;
- SLR            Sending Loudness Rating;
- RLR            Receiving Loudness Rating;
- OLR            Overall Loudness Rating;
- STMR          Sidetone Masking Rating;
- LSTR          Listener Sidetone Rating;
- D               D-Value of Terminal;
- TCLw          Terminal Coupling Loss (weighted);
- WEPL          Weighted Echo Path Loss;
- TELR          Talker Echo Loudness Rating;
- qdu            Number of Quantizing Distortion Units;
- Nc              Circuit Noise referred to the 0 dBr-point;
- Distortion in Sending and Receiving Direction;
- Out-of-Band Signals in Sending and Receiving Direction.



## Test Description of Standard Parameters

- ❑ EG 201 377-2 contains for all standard parameters:
  - Description of the individual test setup
  - Type of test signal used for the individual measurement
  - Analysis and detailed description of the result calculation
- ❑ BUT: No limits are given!  
Limits need to be derived from the individual relevant standards

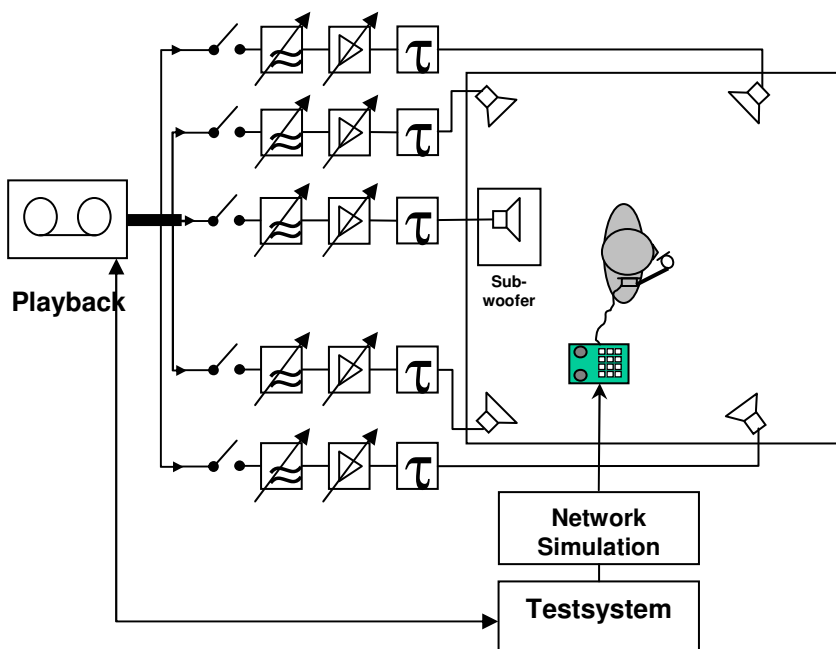
# Advanced Measurement Procedures

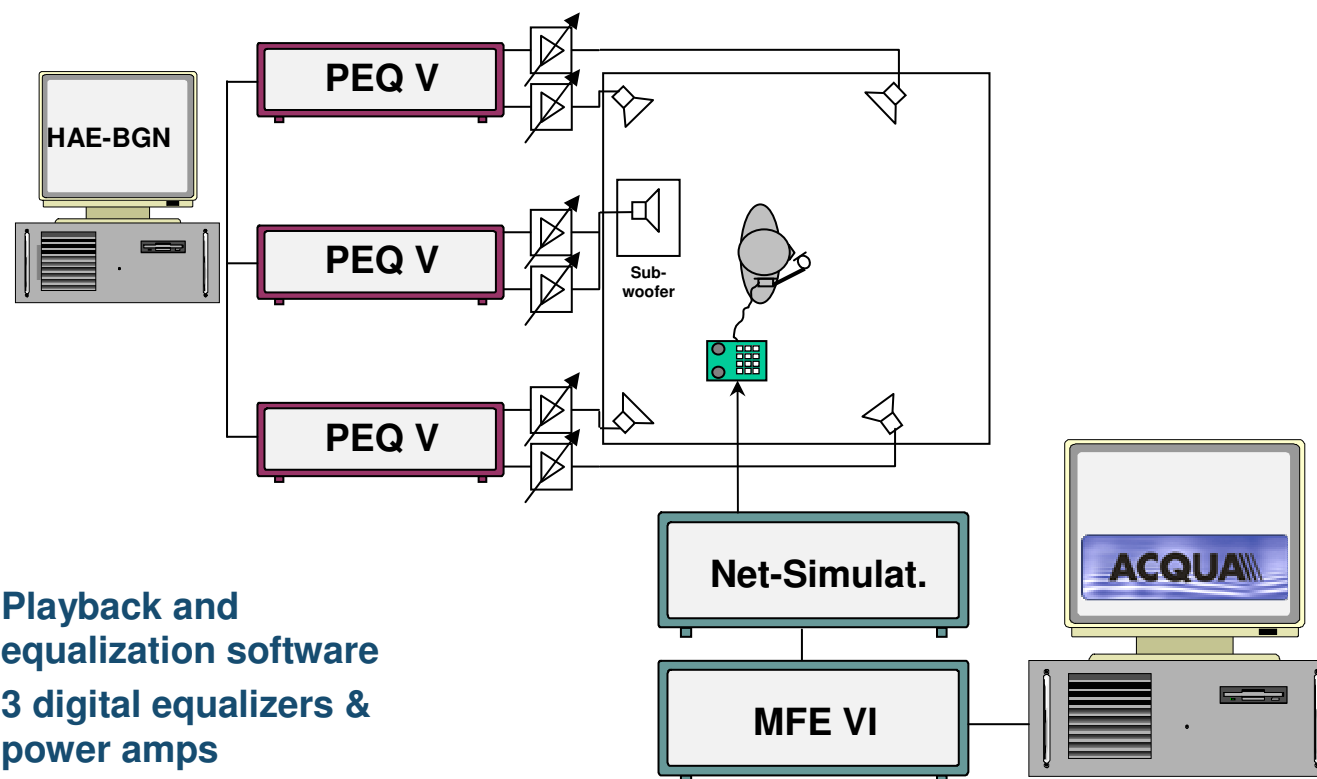
- ☐ Quality of background noise transmission
- ☐ Double talk performance
- ☐ Switching characteristics
- ☐ Level adjustments by companding or AGC
- ☐ Additional echo disturbances
- ☐ Speech sound quality

# Setup for Quality of Background Noise Transmission

- Detailed description in *ETSI EG 202 396-1: 4.1 loudspeaker setup arrangement*

- Four loudspeaker
- Subwoofer
- Description of the equalization
- Database with background noises



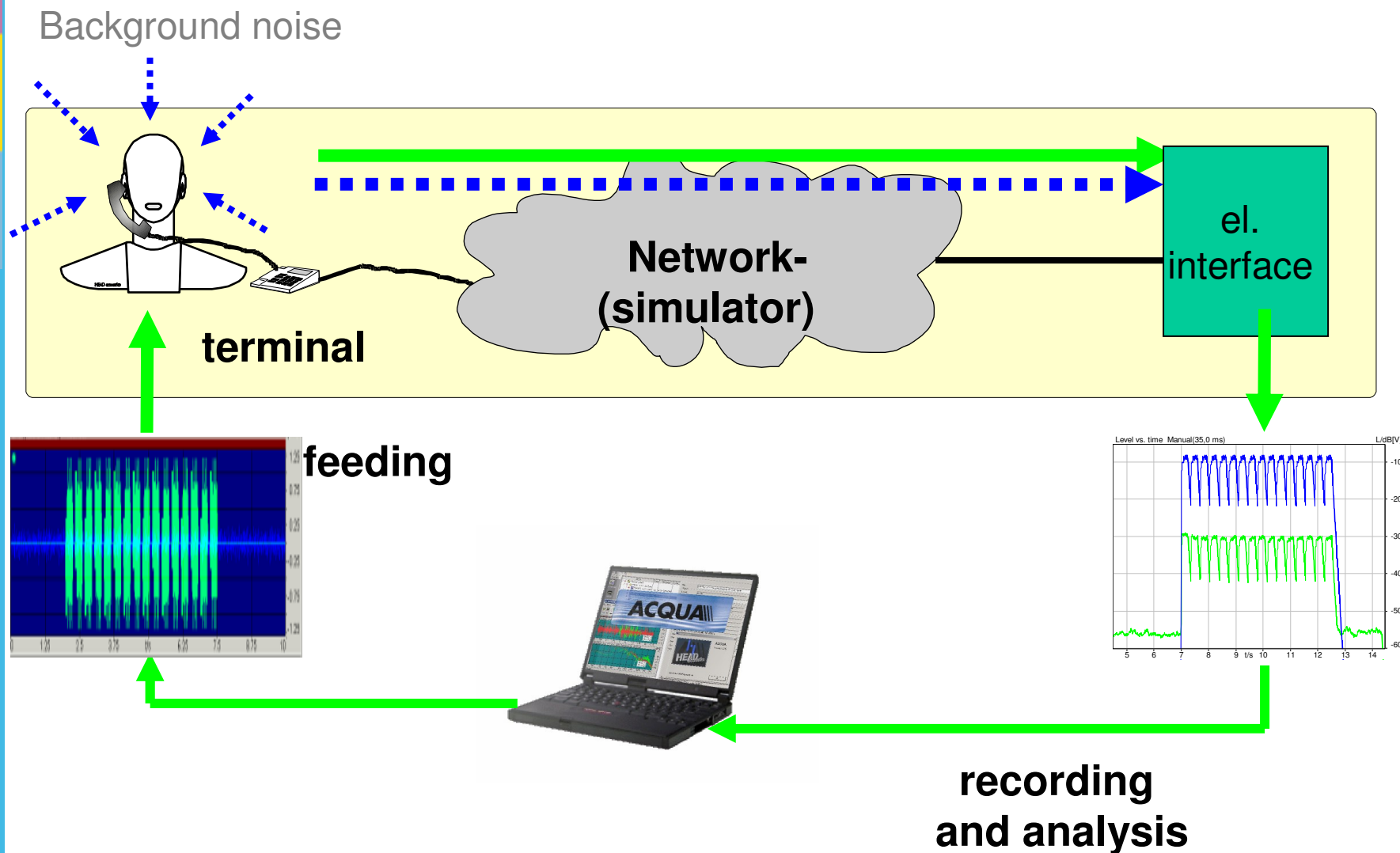


- **Playback and equalization software**
- **3 digital equalizers & power amps**

# Background Noise Tests

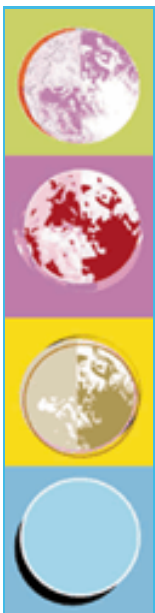
- ☐ **At idle mode**
  - Calculation of D-value with realistic noise
  - S/N calculations
  - Level fluctuation
  
- ☐ **With far end speech**
  - Level variations
  - Relative Approach tests
  
- ☐ **With near end speech**
  - Level variations
  - Relative Approach tests

# The Principle of Background Noise Tests



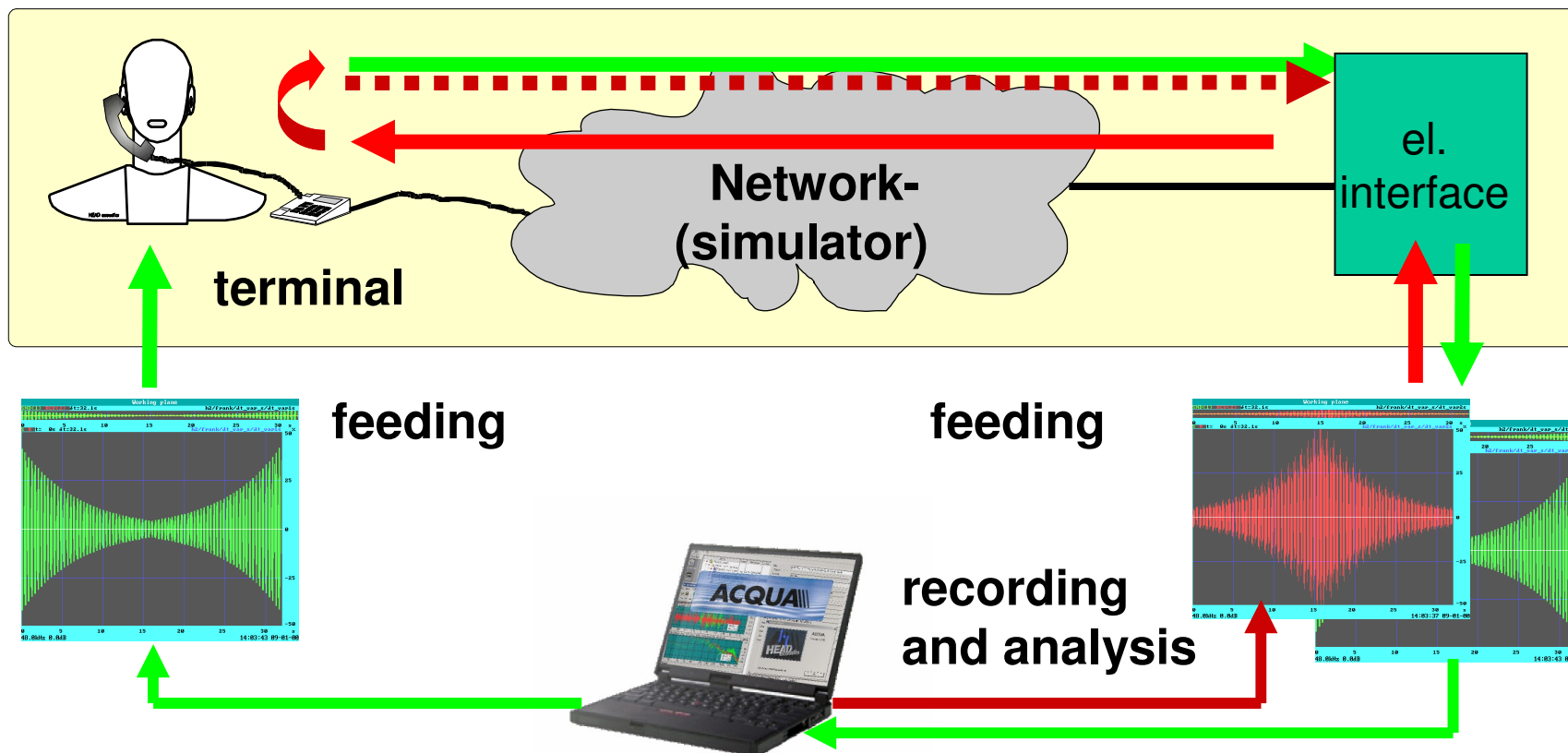
# Double Talk Tests

- ❑ Simulation of the conversational situation:
- ❑ Verifying the performance of
  - Attenuation range between single talk and double talk in sending and receiving
  - Switching characteristics between single talk and double talk in sending and receiving
  - Echo performance during double talk



# Double Talk Testing

## Simulation of the conversational situation

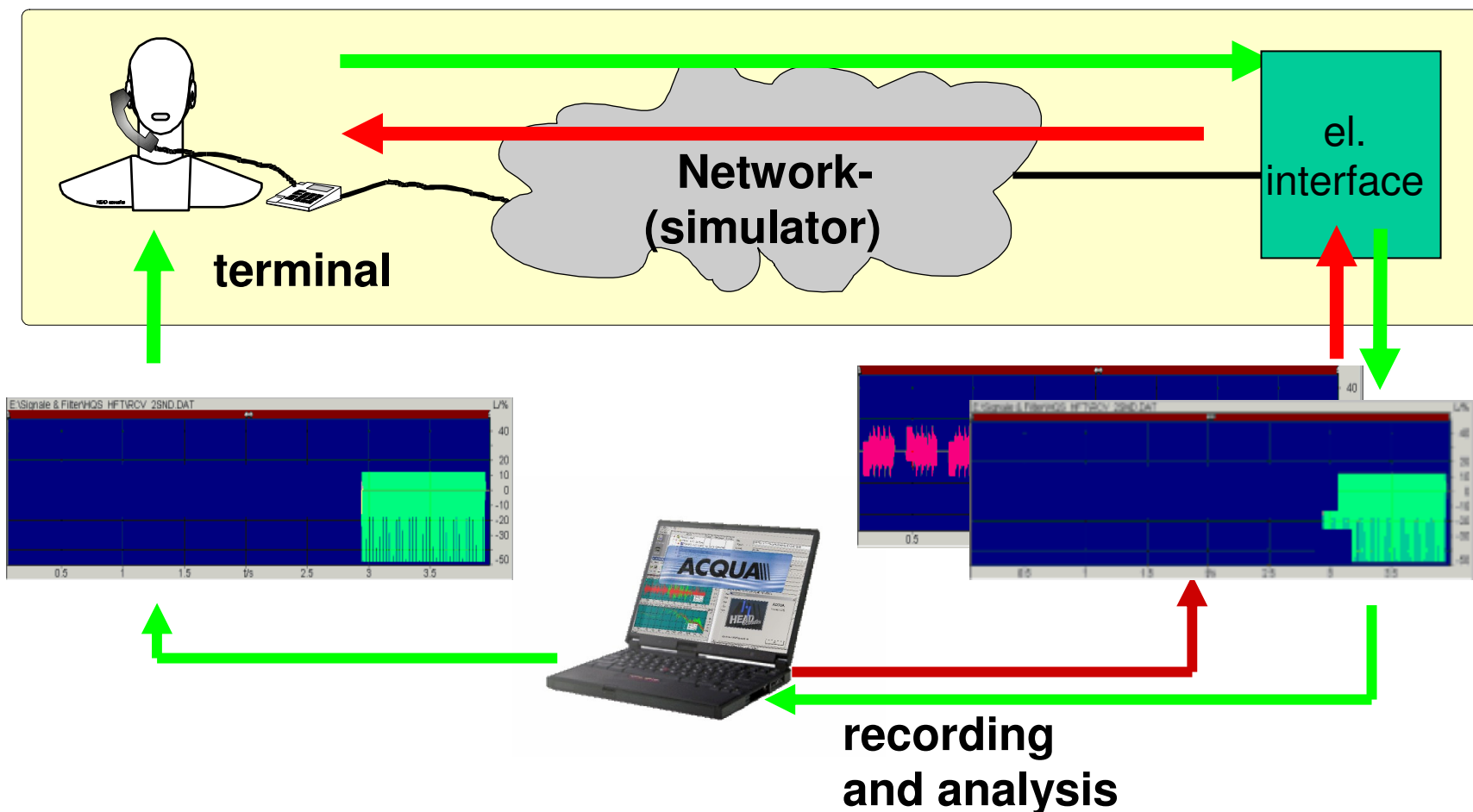


- ❑ Analysis methods: double talk measurements based on two uncorrelated Composite Source Signals (ITU-T P.501 and P.502)



# Switching Characteristics

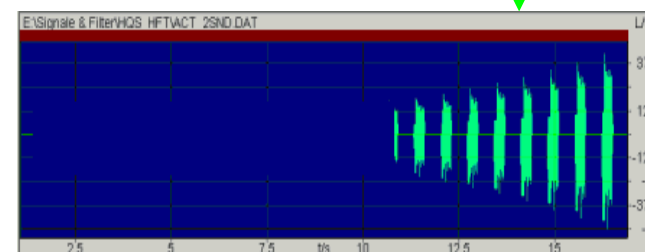
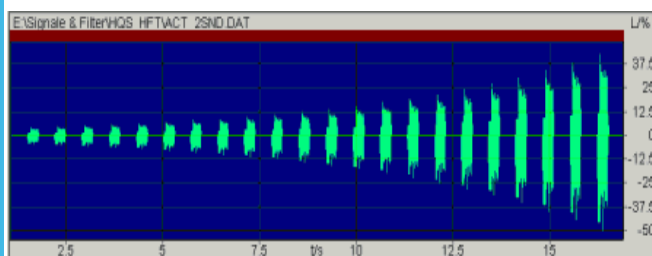
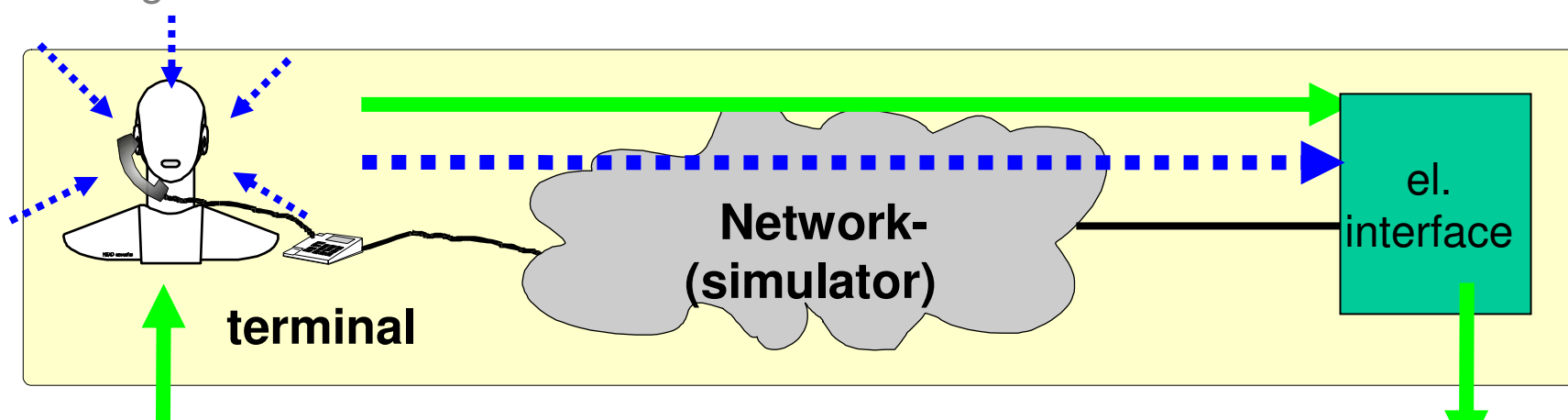
## □ Attenuation range testing



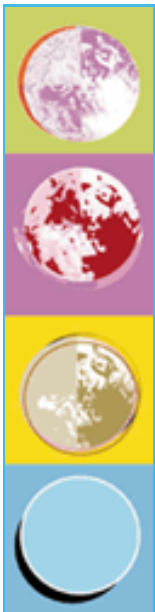
# Minimum Activation Level

## □ Activation threshold testing

Background noise



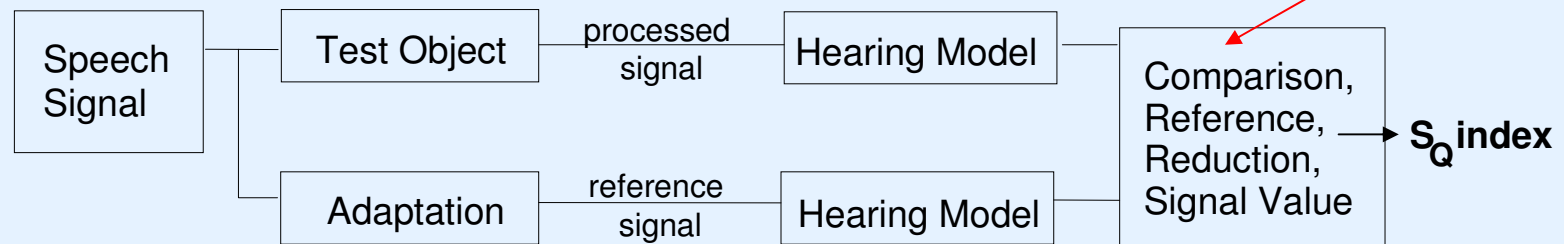
recording  
and analysis



# Speech Sound Quality

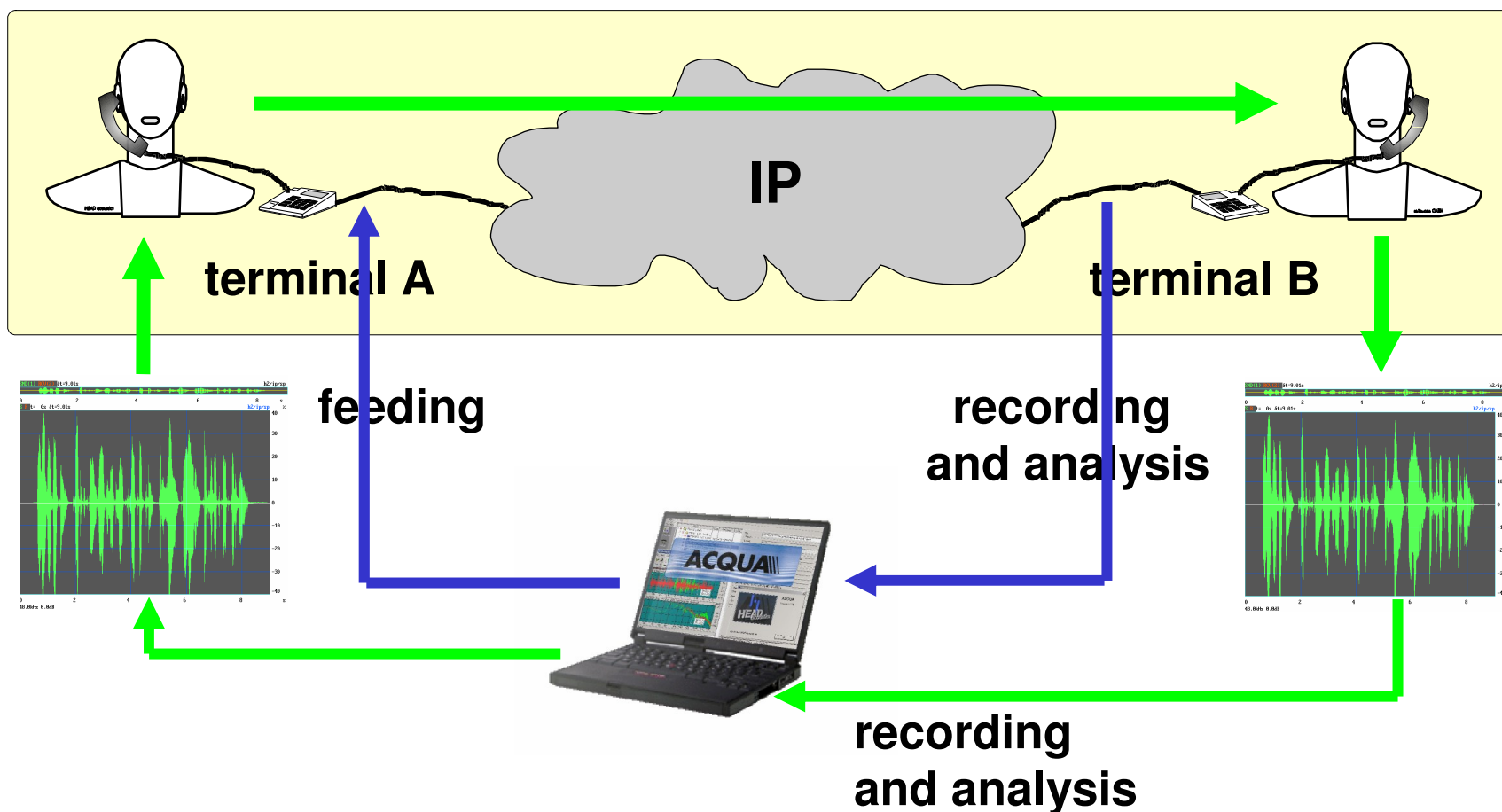
- ❑ Method for tests with electrical access:  
PESQ (ITU-T P.862)
- ❑ Method for tests with acoustical or electrical/  
acoustical access: TOSQA 2001 (also used in ETSI  
VoIP speech quality test events)

## Typical Processing Steps (Schematic):



# Speech Sound Quality

□ Test setup for measuring TOSQA (—) and PESQ (—)



# Summary

- EG 201 377-2 is a framework standard providing
  - An overview about the traditional parameter in telephony and their measurement in non linear and time variant systems
  - A detailed description of advanced parameters useful and needed to determine different speech quality parameters for the conversational situation
  - Can be applied for
    - Terminal testsAs well as for
    - The test of mouth to ear scenarios including terminals