Acoustics of wideband terminals: a 3GPP perspective

Orange Labs

Stéphane RAGOT – Orange Delegate in 3GPP & 3GPP SA4 Vice-Chair

Co-Rapporteur of 3GPP work item on "Requirements and Test Methods for Wideband Terminals"

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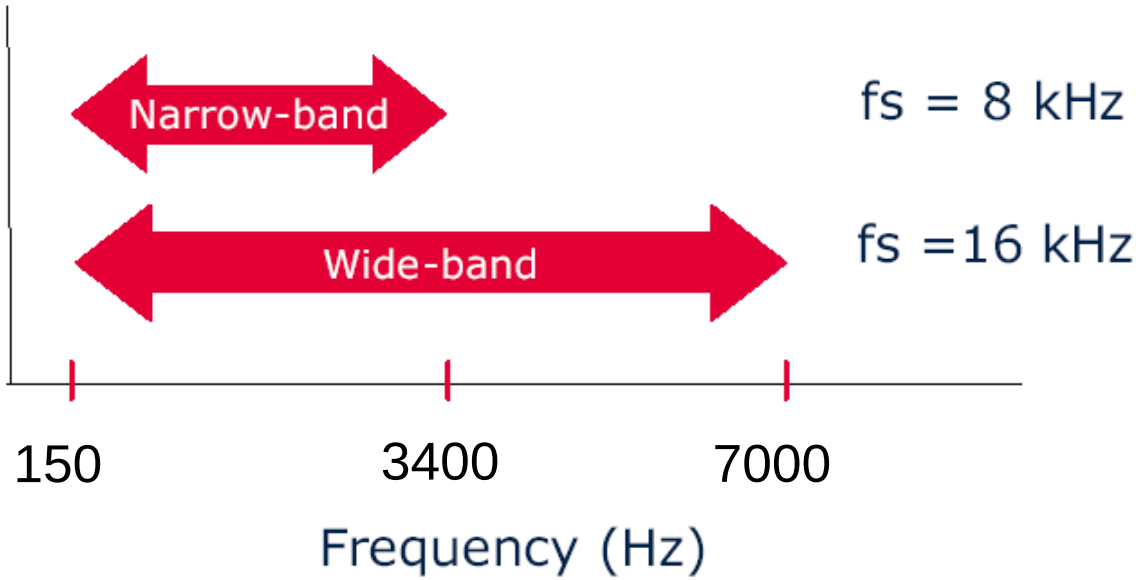
Speech Quality in 3G Telephony

- **Going to wideband (150-7000 Hz)**



  - **New challenges for terminal electro-acoustic design**

    Transducers for wideband (more acoustic bandwidth, loudness, …)

    Pre-/post-processing at 8/16 kHz (dual mode)

- Quality evaluation: subjective tests vs **objective tests**
  - **Terminal acoustic characteristics impact the end user perceived quality as much as the speech coder itself**

Small is beautiful, but…

- The **form factor** of 3G terminals implies strong physical constraints on electro-acoustic parts

Mobile handsets (phones…) vs other terminals (DECT, IP

Necessary trade-offs between acoustic characteristics (loudness, frequency response, distortion…)

- Excerpt from 3GPP specification (TS 26.131):

The objective for narrow-band services is to reach a quality as close as possible to ITU-T standards for PSTN circuits. However, due to technical and economic factors, there cannot be full compliance with the general characteristics of international telephone connections and circuits recommended by the ITU-T.

Acoustic Characteristics of 3G Terminals: TS 26.131 and TS 26.132

- **Two specifications** address 3G terminal acoustic characteristics
  - TS 26.131: **minimum performance requirements**
  - TS 26.132: **test methods**
  - Scope: Narrowband and wideband telephony
  - Interfaces: handset, headset, vehicle/desktop-mounted hansdree, handheld handsfree
- History by 3GPP Release:
  - R'99: Creation with focus on **narrowband telephony only** (Wideband did not exist in GSM)

    Information taken from **ITU-T SG12 and existing GSM 13.50 specification**

    Main difference: **no agreement to adopt the DIA interface**
  - R4: standardization of AMR-WB speech coder
  - **R5**: specification of wideband telephony service (signalling, acoustics, etc.) → **Wideband ready "on paper"**

    […]
  - **R8 (ongoing): update of TS 26.131 and TS 26.132 (wideband part only)** to ensure adequate perceived quality for wideband speech services and convince customers

Status of discussions on Speech Quality (SQ) in 3GPP SA4

- **Ongoing work item (R8)** to update TS 16.131/TS 26.132: **wideband part only**

  Co-Rapporteurs: Orange and Ericsson/Sony Ericsson

- Key agreements so far:

  TS 26.131:

  – **Revision of required performance**: **loudness, frequency masks, distortion**…
  – Addition of new **performance objectives**, e.g. introduction of **sidetone delay** performance objective
  – Introduction of **receiving** 1/3 octave band **idle noise requirement**

  TS 26.132:

  – In handset/headset mode, systematic **use of HATS** instead of LRGP
  – Loudness ratings computed according to **P.79 Annex A** instead of Annex G
  – Distortion measured in terms of **signal to harmonic distortion** instead of signal to total distortion, using **multiple test frequencies** (300 Hz to 1kHz) instead of 1 kHz
  – Use **AMR-WB at 12.65 kbit/s** for wideband testing
  – Introduction of **new softphone test setup**

Open issues in 3GPP

- Short term: **Sidetone delay measurement**: test method to be defined (two proposals)
- Long term
  - Alternative **distortion measurement**, e.g. amplitude-modulate tone, multitone test signals…
  - **Diffuse-field correction** for receiving frequency response

  It is more rationale to use a flat response for sending and a diffuse field correction for receive measurement. The existing approach is to use ERP to DRP correction.
  - New **test methods for weighted Terminal Coupling Loss (TCLw)**

  P.50 may have some problems, and values may differ for male or female test signals. There could be an issue in measuring noise
  - Handsfree specific measurement: **Double talk and switching characteristics test methods**

  Current test methods are not reliable enough to set requirements in double talk conditions
  - **Best frequency response in practice?**