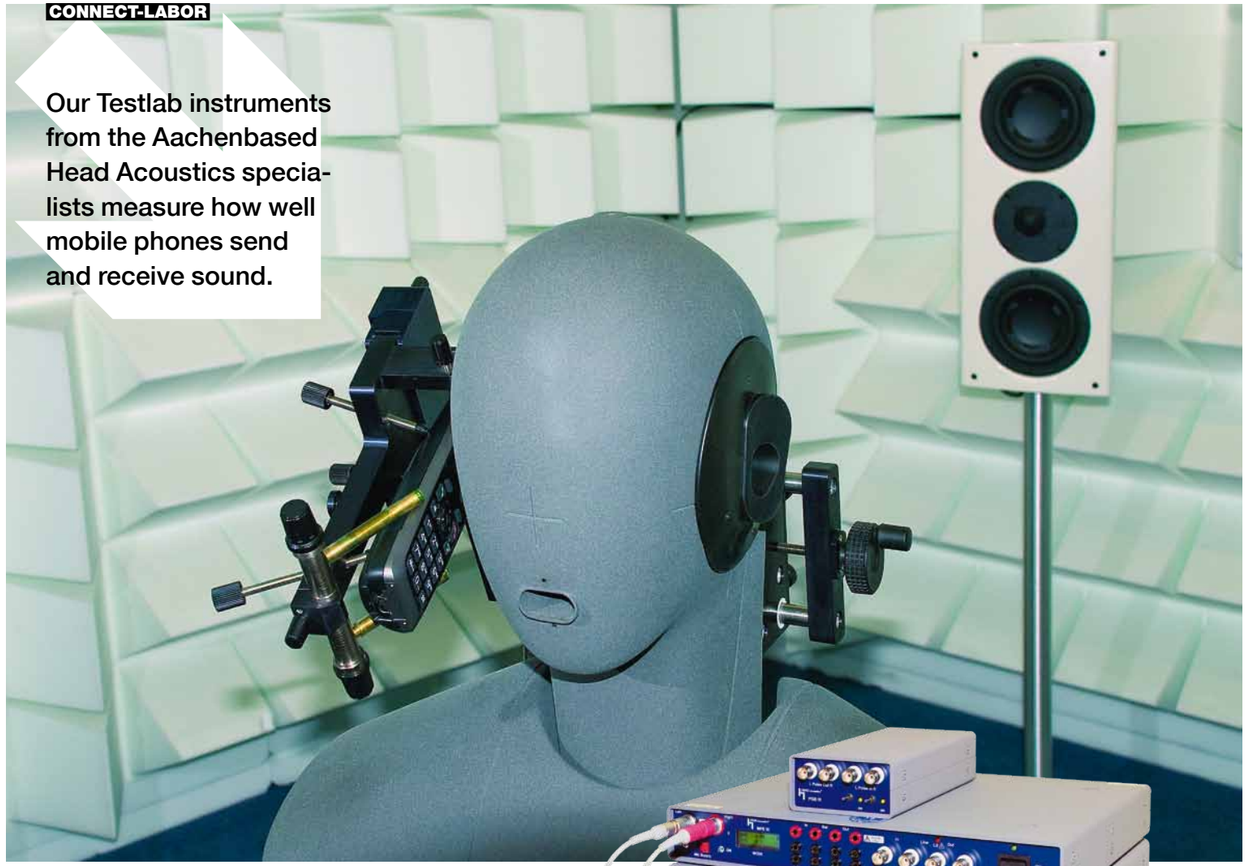


Our Testlab instruments from the Aachenbased Head Acoustics specialists measure how well mobile phones send and receive sound.

LOOK, WHO´S TALKING

The man was shouting so loud into the phone, you'd have thought the other side wouldn't need a phone to hear him. A raised voice often indicates that you cannot hear the person you are talking to – as anyone who has spoken to a hearing impaired person will know. Alongside bad hearing, poor sound is often also the cause for a raised voice when talking by phone. The Testlab goes to great lengths to measure accurately the sound transmission of smartphones and DECT telephones.

Room and equipment

This starts with the room where the measurement takes place, and which has been recently reinstalled at the new location in Haar near Munich. Doublelayered walls with double planking and chambered soundproofing ensure that no noise from the adjacent laboratory areas affect the measurements. In addition to insulation of external sound, the soundproofing inside is of the highest level. 60centimetre deep wedge absorbers prevent that middle and high frequencies are reflected by the walls behind them; behind them a system of plate absorbers is responsible for low frequenciy absorption. In terms of sound insulation and attenuation, the new measuring room far eclipses its predecessor in Stuttgart.

Testlabs Head Acoustics Acqua Frontend is the interface between the artificial head HMS II.3, the communication tester from Rohde & Schwarz and the two PCs necessary to control the measurements.

What has remained is the measuring equipment; its centrepiece is an Acqua System from the measurement specialists Head Acoustics, based in Herzogenrath. This system alone, which consists of six components, carried a six-digit price tag. It is accompanied by a network simulator by Rohde & Schwarz, which serves as high-precision base station that works independent of mobile networks, and for which connect made another high fivedigit investment. Four audio amplifiers and four monitor speakers are available for particularly important measurements – but more on that later.

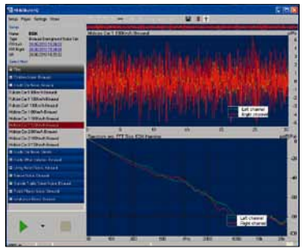
The measurements are made on a speaking and hearingenabled artificial head, the Head Acoustics HMS II.3, with a holding device with which the phone can be pressed to the head with an pressure accuracy of a tenth of a Newton.

Abstract values

First, a number of more or less abstract values are captured, such as maximum volume in the send and receive directions. The loudspeaker of a good smartphone should be able to sound a little louder than the voice speaking into the microphone, to compensate for losses due to unfavourable mouth position or noisy environment. The frequency response, which describes how the gain of the amplifier changes with frequency, is also important. If high pitches are transmitted too weakly, the voice sounds muffled and intelligibility suffers. But this is hardly a problem with today's HDvoice enabled phones. Very often, the Testlab has observed a frequency curve sloping towards lower pitches in the direction of reception with corresponding thin sounds. This is due to speakers being placed far on the edge on today's smartphones, preventing a close connection between speaker and ear. A good frequency response contributes significantly to users being able to recognize each other's voices.

Further disturbances may be created by nonlinear distortions, which are a measure for how much a pure (sine) sound is distorted by multiples of its frequency. Increased distortion sounds unpleasant, often rough, and can make longer conversations painful to bear. In addition to these parameters, the Testlab measures defects such as noise and the echo disturbances that often occur in telephony.

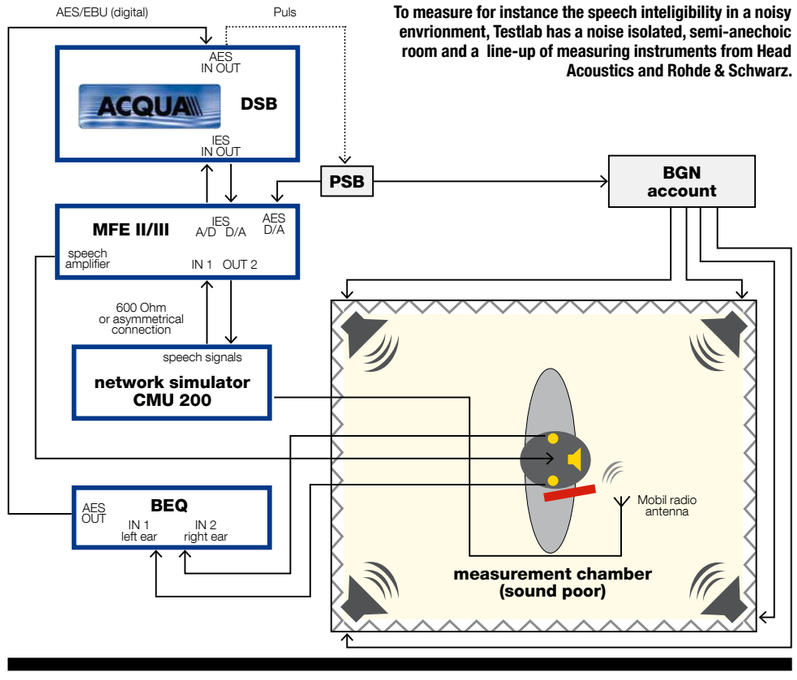
Speech intelligibility in a noisy environment, for instance a car, is evaluated with the so called TOSQA measurement.



Can you hear me?

As isolated readings are difficult to interpret, the Testlab also measures speech intelligibility (TOSQA), which is assessed via a fivestep psychoacoustic scale. Intelligibility suffers below the threshold of 2.7. Since most smartphones today can distinguish with more or less accuracy between the spoken word and environment noise, the Testlab also measures speech intelligibility in a disturbed environment (3QUEST). In this test, the measuring room is exposed to the standard sounds of a road crossing (homogeneous disturbance) and a pub (pulsating disturbance). To generate the necessary soundfield, the previously mentioned amplifiers and speakers are necessary. Differences between smartphones are particularly large in this important discipline. If both smartphones and the network play along at the highest level, you can almost feel as if the person you are talking on the phone with were standing next to you – if you close your eyes. **BERND THEISS, HEAD OF TESTLAB**

COMPLEX CONSTRUCTION



To measure for instance the speech inteligibility in a noisy envrionment, Testlab has a noise isolated, semi-anechoic room and a line-up of measuring instruments from Head Acoustics and Rohde & Schwarz.