

HQS-HFT (Codes 6764 - 6767)

HEAD acoustics Quality Standard

Objective Measurements according to HEAD acoustics Quality Standard HQS for Hands-free Telephones based upon ITU-T Recommendations P.340, P.501 and P.502

HQSHTGE (Read Only)	Reference	Type	Short Title	testprojekt gm
SND-RCV.MMD				
0.1.1 Delay at HFT position		dl2		
0.1.2 Delay in sending direction		dl2		
2.1.1 Level control, sending		lvl		
2.1.2 Level control, sending (characteristic curve)		lvl		
2.2 Switched level in sending direction (curve)		lvl		
2.2.1 Switched level in sending direction, 5 dB		lvl		
2.2.2 Switched level in sending direction, 10 dB		lvl		
2.2.3 Switched level in sending direction, 15 dB		lvl		
3.1 Frequency response in sending direction	●	frq		
4.1 Sending loudness rating	●	lrv		
5.1.1 Distortion, sending 315 - 530Hz		di2		
5.1.2 Distortion, sending 560 - 900Hz		di2		
5.1.3 Distortion, sending 950 - 1600Hz		di2		
5.1.4 Distortion, sending 315 - 530Hz, +10dB		di2		
5.1.5 Distortion, sending 560 - 900Hz, +10dB		di2		
5.1.6 Distortion, sending 950 - 1600Hz, +10dB		di2		
6.1 Simulated double talk, sending direction		tim		
7.1 Attenuation, sending (switch on)		lvl		
7.2.1 Attenuation, sending (switch over)		lvl		
7.2.2 Attenuation, sending (switch over, inv.)		lvl		
8.1 Switch-on time, sending direction		lvl		
8.2 Switch-over time, sending direction		lvl		
9.1 Minimum activation level, sending direction		lvl		

Measurement tree for HQS-HFT-GE in communication analysis system ACQUA

Introduction

Technical realizations of hands-free telephones get more sophisticated due to the combination of noise reduction, echo cancellation algorithms, levels switching or companding devices. The echo suppression and level attenuation especially in double talk situations or with background noise are often responsible for an insufficient quality. Moreover, technical realizations of hands-free telephones based only on level switching devices can also guarantee a subjectively perceived good quality, if the attenuation control performs reliable and well balanced. The importance of the attenuation control during double talk and the kind of implementation of level attenuation in sending and receiving direction is also demonstrated by the ITU-T Recommendation P.340. It distinguishes between different types of hands-free telephones (type 1, 2a, 2b, 2c and 3), based on three parameters: echo attenuation during double talk as well as level variation and its control in sending and receiving direction.

Preconditions for Testing

The basis for hands-free testing during the development process or for commercially available products is the possibility to measure objectively the relevant parameters which determine the subjectively perceived quality. On the one hand these parameters must be known and on the other hand suitable measurement signals and analysis techniques are necessary. Proposals for tests were presented to SG 12 in ITU-T and suggested to be implemented in ITU-T Recommendation P.340 and others. ITU-T Recommendation P.501 describes a multitude of test signals, corresponding analysis methods are defined in ITU-T Recommendation P.502. Moreover, requirements based on subjective tests are available.

Based upon the experience in the field of subjective and objective testing of hands-free telephones objective measurements were developed. In addition to standardized measurements like transfer function, loudness ratings and others the HEAD acoustics Quality Standard HQS-HFT particularly aims at covering the quality of conversation.

The main aspects are as follows:

Acoustic quality in sending and receiving direction

Beside standardized parameters like transfer functions or loudness ratings harmonic distortions are determined. The resolution of exciting frequencies are much higher than normally used in standards in order to determine resonance more precisely.

Sine waves are used after activating the terminal equipment with speech like signals.

Attenuation range in sending and receiving direction

These parameters are important to determine the types of hands-free telephones according to ITU-T Recommendation P.340. The attenuation range and the switching characteristics in sending and receiving direction are determined under various conditions like idle mode, switch over or double talk.

The measurement signals used for these tests consist of decorrelated periodically repeated Composite Source Signals covering a wide range of different input levels on both sides of the hands-free telephone.

Attenuation control of companding devices

Attenuation range and control times are determined.

Periodically repeated voiced sounds taken from ITU-T Recommendation P.50 are used as the measurement signal. These signals are applied with continuously changing levels.

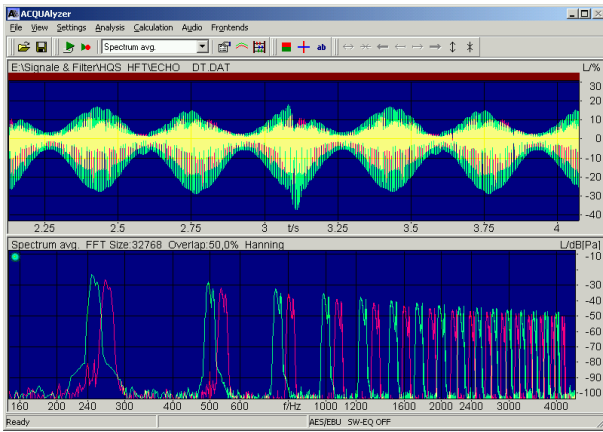
Sensitivity for speech like input signals

The minimum activation level in sending and receiving direction under various conditions is determined (idle mode, activation of opposite transmission direction, double talk detection).

Composite Source Signals are applied with different input signal levels on both channels.

Transfer characteristics of background noise in sending direction

The transfer characteristic of the ambient noise strongly influences the transmission quality of hands-free terminals. Several parameters like the absolute level or the



Amplitude and frequency modulated test signal

spectrum of the transmitted noise are important. Additionally, dynamic variations have to be determined.

The choice of background noise should be according to the normal use of the hands-free telephone, e.g. realistic office noise for telephones used in offices or realistic background noise in cars for mobile hands-free terminals in vehicles.

Echo characteristics under single talk conditions

Specially for devices equipped with echo cancellers beside the absolute echo level other parameters like spectral echo attenuation or level fluctuation vs. time are important.

Composite Source Signals with a speech-like spectral characteristics are used.

Echo characteristics under double talk conditions

During periods of double talk the ear is less sensitive to echo disturbances than under single talk conditions, however, echo disturbances can still be clearly perceived. Therefore the echo level during simulated double talk is measured. This parameter also forms the basis of the types of hands-free phones distinguished according to ITU-T Recommendation P.340.

Modulated signals in frequency and amplitude are used which on the one hand can be separated using a comb filter with the measured signal. On the other hand, this measurement method is insensitive to distortions in the measurement object.

Double talk capability in sending and receiving direction

The subjectively perceived quality of hands-free terminals is mainly determined by the double talk capability. In addition to the attenuation control of both transmission ways (sending and receiving) the double talk capability determines the classi-

fication of hands-free terminals according to ITU-T Recommendation P.340 (type 1, 2a, 2b, 2c or 3). A simple characterization like "double talk is not possible" or "double talk is possible" is not sufficient. Hands-free telephones with limited double capabilities can also achieve a good subjectively perceived quality. The tests which are carried out here allow the analysis of several parameters like echo level, switching times, level attenuation, loudness ratings and others dependent on different input levels in sending and receiving direction. All these parameters are determined during simulated double talk. The double capability can be analyzed in detail. Periodically repeated decorrelated Composite Source Signals are used. The signal level range in sending and receiving direction has a dynamics of 20 dB.

Recordings with real speech

In addition to the objective tests recordings in sending and receiving direction are prepared under single and double talk conditions. Compared to the objective tests with measurement signals as described above recorded speech samples are acoustically applied to the hands-free telephone via the artificial mouth or in receiving direction. Both transmission paths are recorded which gives the possibility to "listen to the transmission characteristics" of the device under test.

Male and female voices are used under double talk conditions in order to distinguish the far end and the near end speaker when listening to the recordings.

All measured results and its interpretation provide a detailed analysis of the transmission quality of the hands-free terminal under test. Those parameters which can be checked compared to limits from subjective tests are automatically presented on the screen in terms of tolerance schemes, single values or others.

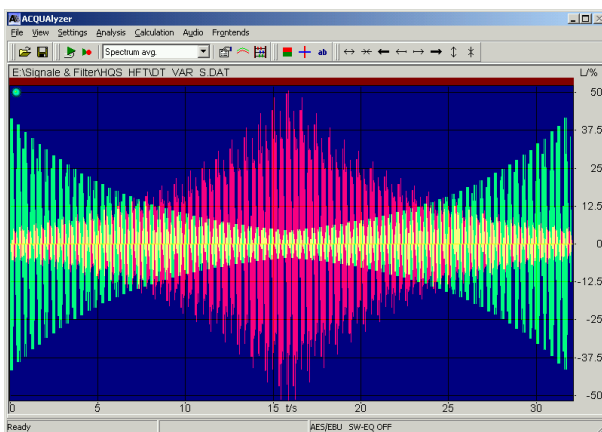
The results of all tests do not lead to a one-dimensional "single value" compared to a MOS value from a subjective test. Due to the different use of hands-free telephones for private purposes, in offices, in cars or during conferences and with its different users it is not useful to combine the single parameters to one "quality index". But these tests give the possibility to analyze hands-free telephones in detail, accurately and reproducibly.

Delivery Items

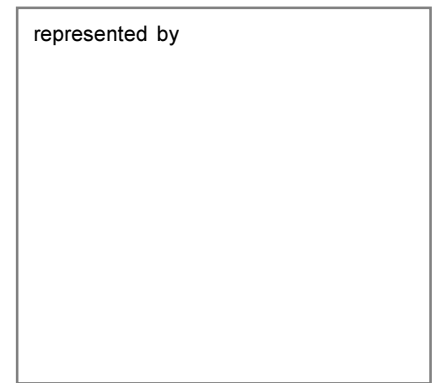
Disk or CD with the corresponding HQS-HFT standard

Options

- **HQS-HFT DE (Code 6764):**
Transmission Quality of Hands-free Telephones (Digital, English Version)
- **HQS-HFT GD (Code 6765):**
Transmission Quality of Hands-free Telephones (GSM, German Version)
- **HQS-HFT GE (Code 6766):**
Transmission Quality of Hands-free Telephones (GSM, English Version)
- **HQS-HFT AE (Code 6767):**
Transmission Quality of Hands-free Telephones (Analogue, English Version)



Test signal with simulated double talk by combination of two uncorrelated CS signals



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