INTERNATIONAL TELECOMMUNICATION UNION

ITU-T

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STANDARDIZATION SECTOR
OF ITU

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TELEPHONE TRANSMISSION QUALITY

OBJECTIVE ELECTRO-ACOUSTICAL MEASUREMENTS

MEASUREMENTS ON SUBSCRIBERS' TELEPHONE EQUIPMENT

ITU-T Recommendation P.62

(Previously "CCITT Recommendation")

FOREWORD

The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of the International Telecommunication Union. The ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Conference (WTSC), which meets every four years, established the topics for study by the ITU-T Study Groups which, in their turn, produce Recommendations on these topics.

ITU-T Recommendation P.62 was revised by the ITU-T Study Group XII (1988-1993) and was approved by the WTSC (Helsinki, March 1-12, 1993).

NOTES

1 As a consequence of a reform process within the International Telecommunication Union (ITU), the CCITT ceased to exist as of 28 February 1993. In its place, the ITU Telecommunication Standardization Sector (ITU-T) was created as of 1 March 1993. Similarly, in this reform process, the CCIR and the IFRB have been replaced by the Radiocommunication Sector.

In order not to delay publication of this Recommendation, no change has been made in the text to references containing the acronyms "CCITT, CCIR or IFRB" or their associated entities such as Plenary Assembly, Secretariat, etc. Future editions of this Recommendation will contain the proper terminology related to the new ITU structure.

2 In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

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MEASUREMENTS ON SUBSCRIBERS' TELEPHONE EQUIPMENT

(amended at Malaga-Torremolinos, 1984; Melbourne, 1988 and Helsinki, 1993)

1 Measurement of the attenuation distortion of a telephone set

The curve of the variation of the absolute sensitivity of an item of telephone equipment (sending or receiving system) as a function of frequency does not supply complete information on the manner in which this equipment reproduces the human voice or music, although such a curve may often be called the frequency characteristic.

However, the curve of variation of the absolute sensitivity of telephone equipment as a function of frequency gives useful indications from the point of view of the transmission of speech. On the other hand, for the transmission of music, in the absence of a precise criterion of the quality of transmission (corresponding to articulation, or repetition rate, in commercial telephony) such curves should be sufficient to enable the quality of the terminal equipment used (microphone or loudspeakers) to be appreciated.

For tracing sensitivity/frequency characteristics the methods described in Recommendation P.64 and in subclause 3.6.3 of the *Handbook on Telephonometry* [1] may be used.

2 Measurement of the nonlinear distortion of a telephone set and of microphone noise

While the nonlinear distortion of telephone receivers is in general negligible, microphones (and particularly carbon microphones of the type generally used in commercial telephone equipment) show considerable non-linearity: the relationship between the variation of microphone resistance and the acoustic pressure on the diaphragm is not linear. This non-linearity becomes more important as the variation of resistance in relation to the total resistance of the microphone increases, i.e. when the microphone is more sensitive. Furthermore, there may be two supplementary effects:

1) The microphone is less sensitive to acoustic pressure lower than a certain value (threshold of excitation).

2) As a consequence of the mechanical inertia of the carbon granules (delay in establishing electrical contact between the granules), the various states of agitation of the carbon under the influence of acoustic waves are not the same for all frequencies (for example, slow beats between two sounds are in general enhanced in reproduction by a carbon microphone).

Existing information on the general effect of harmonic distortion on telephone speech quality indicates that the effect of second order distortion is considerably less than that of third order distortion. Absolute detection thresholds obtained in different test are, however, difficult to compare because of differences in definition and measurement of the distortion.

NOTES

1 It is clear that measurements with sinusoidal signals can predict the speech transmission performance of nonlinear systems only to a limited extent, particularly if the peak value of the test signal is much smaller than the transmitted speech signal. A complex signal having the same spectral density at the same amplitude density function as real speech (see Recommendation P.50) is therefore expected to be a more useful test signal.

2 The application of complex test signals or actual speech signals for the measurement of non-linearity in telephone circuits is under study.

Certain types of carbon microphones may produce an audible stationary noise, often depending on the size of feeding current. The measurement of this kind of noise and its effect on transmission quality is the same as for other kinds of additive circuit noise.

3 Objective measurement of loudness rating (LR)

Examples of apparatus that objectively measure LRs conforming to Recommendation P.65 are "CERF" of the French Administration [2], "AURAL" of NTT [3], "TIGGER" [4] of British Telecom and "Loudness Rating Meter" [5] of STL. Short descriptions of the apparatus named above can be found in Chapter 5 of the CCITT *Handbook on Telephonometry* [8].

References

[1] CCITT *Handbook on Telephonometry*, 2nd edition, ITU, Geneva, 1993.

[2] CCITT Contribution COM XII-184, *Equipment for the objective measurement of equivalent R25 and of the sidetone – used by the French Administration* (France), Study Period 1981-1984.

[3] CCITT Contribution COM XII-79, *Objective loudness rating measurement system*, (NTT), Study Period 1981-1984.

[4] WARD (H. F.), CROSS (R. C.): TIGGER – An Automatic Test System for measuring the Transmission Performance of Telephones, *British Telecommunications Engineering*, Vol. 2, July 1983.

[5] CCITT Question 15/XII, Annex 6, Contribution COM XII-No. 1, Study Period 1985-1988.