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**TELEPHONE TRANSMISSION QUALITY
SUBSCRIBERS' LINES AND SETS**

**EFFICIENCY OF DEVICES FOR PREVENTING
THE OCCURRENCE OF EXCESSIVE
ACOUSTIC PRESSURE BY TELEPHONE
RECEIVERS**

ITU-T Recommendation P.36

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(Extract from the *Blue Book*)

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NOTES

- 1 ITU-T Recommendation P.36 was published in Volume V of the *Blue Book*. This file is an extract from the *Blue Book*. While the presentation and layout of the text might be slightly different from the *Blue Book* version, the contents of the file are identical to the *Blue Book* version and copyright conditions remain unchanged (see below).
- 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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Recommendation P.36

EFFICIENCY OF DEVICES FOR PREVENTING THE OCCURRENCE OF EXCESSIVE ACOUSTIC PRESSURE BY TELEPHONE RECEIVERS

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

The use of devices for preventing the occurrence of excessive acoustic pressure by telephone receivers is recommended in Recommendation K.7. Methods for checking the efficiency of such devices in response to short duration impulses and for longer duration disturbances, such as tones, are given in this Recommendation. A method is also given for checking that such devices do not have adverse effects on normal speech signals.

Preliminary Note – On the basis of the finding of scientific studies, several authors or organizations have proposed ear-damage risk criteria based on variations in acoustic pressure, under impulse conditions for which, parenthetically, there is no single definition. Likewise, ear-damage risk criteria have also been proposed for longer duration acoustic disturbances, such as tones. However, these criteria cannot be directly transposed to the test conditions and measurements described below. Nor could the results be cross-checked without introducing certain hypotheses that are not specified in this Recommendation, the purpose of which is merely to describe a method simple both in its application and in the analysis of the results obtained. The criteria recommended are based on experience gained in several countries about the telephone receiver quality necessary to ensure the safety of users and operators. Administrations may wish to adopt lower limiting levels to reduce user annoyance caused by acoustic disturbances, but the limiting levels should not be so low as to have adverse effects on normal speech levels.

1 Efficiency of protection against short duration impulses

In order to check whether a telephone set affords satisfactory protection against the risk of acoustic shocks due to short duration impulses, it is recommended that its characteristics be examined as follows:

- a) the entire telephone set, including the protective device, is placed in normal operating conditions as regards current supply and its position for the exchange of a call (e.g. with the handset raised);
- b) the earpiece of the handset earphone is applied in the normal way to an artificial ear conforming to Recommendation P.51 (which corresponds to IEC Publication 318);
- c) the artificial ear is electrically connected to a precision sound level meter conforming to IEC Publication 651, correctly calibrated and having the necessary circuits for measuring peak acoustic pressure levels. This equipment must be of class 2 for prototype testing, and may be of class 3 for checking mass-produced sets;
- d) electrical impulses are applied to the telephone set by a suitable assembly which enables these impulses to be superimposed on the d.c. supply without the latter short-circuiting them. These impulses are produced by a generator which conforms with Figure 1/K.17, and whose components are those described for symmetric-pair repeater tests (R_3 25 ohms, C_2 0.2 μ F, see Table 1/K.17). The test voltage is between 0 and 1.5 kV;
- e) the telephone set is also checked for self-generated acoustic impulses such as those produced by operation of the hook switch or by dialing;
- f) for both cases d) and e) above, the peak acoustic pressure level observed (maximum instantaneous value) should be below 140 dB relative to 20 μ Pa. In the long term, Administrations are recommended to limit this value to 135 dB for sets in common use.

Note – Administrations may deem it appropriate to use different limits for specific cases, for instance for the headsets used by operators.

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2 Efficiency of protection against longer duration disturbances

In order to check whether a telephone set affords satisfactory protection against the risk of acoustic hazards due to longer duration disturbances, such as tones, it is recommended that its characteristics be examined as follows:

- a) the entire telephone set, including the protective device, is placed in normal operating conditions as regards current supply and its position for the exchange of a call (e.g. with the handset raised);
- b) the earpiece of the handset earphone is applied in the normal way to an artificial ear conforming to Recommendation P.51 (which corresponds to IEC Publication 318);
- c) the artificial ear is electrically connected to a precision sound level meter conforming to IEC Publication 651, correctly calibrated to measure A-weighted sound pressure levels. This equipment must be of class 2 for prototype testing, and may be of class 3 for checking mass-produced sets;
- d) a $1000 \pm 20 \text{ Hz}^{1)}$ signwave signal is applied to the telephone set and its amplitude is increased until it reaches $10 V_{\text{rms}}$ across the set's terminals or until the steady-state acoustic output from the telephone receiver reaches its limiting value whichever occurs first;
- e) the telephone set is also checked for self-generated acoustic disturbances, such as tone dialing signals fed back to the receiver;
- f) for both cases d) and e) above, the steady-state A-weighted sound pressure level should be below 125 dBA ("slow" response).

Note 1 – Tones or other disturbances which are inherently limited to less than 0.5 s duration should be evaluated as short duration impulses under § 1. Repetitive disturbances, such as those which might be produced during automatic tone-type dialing, should be evaluated under § 2 using the sound level meter set for "slow" response averaging.

Note 2 – Administrations may deem it appropriate to use different levels for specific cases, for instance, for the headsets used by operators.

3 Effect on normal speech signals

It is recommended to check whether the strong-signal attenuation obtained by protective devices does not cause deterioration of the normal signals, e.g. by nonlinear distortion. This may be done by conducting a series of measurements using steady-state sine wave signals at a frequency of $1000 \pm 20 \text{ Hz}$ and relating to the following magnitudes:

N is an electric voltage level at the terminals of the set. N is determined by the relation:

$$N = 20 \log_{10} \frac{V_{\text{rms}}}{0.775} \quad (\text{dB})$$

where V_{rms} represents the r.m.s. value of the voltage across the terminals. The value of $V_{\text{rms}} = 0.775$ volts (-2.2 dBV) gives $N = 0$ and corresponds to a power level of 0 dBm into 600 ohms.

$P(N)$ is an acoustic pressure produced by the telephone receiver under given conditions, (this may be the pressure measured on an artificial ear in accordance with Recommendation P.51), corresponding to the application of voltage level N across the terminals of the set.

¹⁾ The ISO list of preferred frequencies includes 1000 Hz. It is a commonly used reference frequency in acoustic testing. Recommendation O.6 suggests 1020 Hz be used when testing PCM systems to avoid being at a submultiple of the 8000 Hz sampling rate. This Recommendation may need to be considered when testing digital telephones.

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$A(N)$ is an attenuation of electroacoustic efficiency in relation to its reference value determined for $N - 20$ dB. $A(N)$ is determined by the relation:

$$A(N) = 20 \log_{10} \frac{P(-20)}{P(N)} + N + 20 \quad (\text{dB})$$

$[A(N) \text{ 0 when } N - 20 \text{ dB}]$.

The values obtained for $A(N)$ must match those in Table 1/P.36 which have been obtained from measurements carried out on several types of set fitted with various protective devices.

Note 1 – It may be useful to make a few additional measurements to ensure that, at frequencies between 200 Hz and 4000 Hz, the values observed for $A(N)$ are of the same order.

Note 2 – Some sets of recent design have special features, such as electroacoustic sensitivity which depends on the conditions of d.c. current supply or on the level of the speech signals received, quite apart from the effect of the protective devices. In that case, Administrations intending to use such sets may have to adapt the above conditions, taking care nevertheless to comply with their principles.

TABLE 1/P.36

N (dB)	$A(N)$ (dB)
-20	0
-10	< 0,5
0	≤ 2

