



**E**UROPEAN  
**T**ELECOMMUNICATION  
**S**TANDARD

**ETS 300 488**

January 1996

---

Source: ETSI TC-TE

Reference: DE/TE-04092

ICS: 33.020

**Key words:** Telephony, amplification, ISDN, PSTN, TE, PWSN

**Terminal Equipment (TE);  
Telephony for hearing impaired people;  
Characteristics of telephone sets that provide additional  
receiving amplification for the benefit of the hearing impaired**

**ETSI**

European Telecommunications Standards Institute

**ETSI Secretariat**

**Postal address:** F-06921 Sophia Antipolis CEDEX - FRANCE

**Office address:** 650 Route des Lucioles - Sophia Antipolis - Valbonne - FRANCE

**X.400:** c=fr, a=atlas, p=etsi, s=secretariat - **Internet:** secretariat@etsi.fr

Tel.: +33 92 94 42 00 - Fax: +33 93 65 47 16

\*

---

**Copyright Notification:** No part may be reproduced except as authorized by written permission. The copyright and the foregoing restriction extend to reproduction in all media.

© European Telecommunications Standards Institute 1996. All rights reserved.



## Contents

Foreword .....	5
Introduction .....	5
1 Scope .....	7
2 Normative references .....	7
3 Definitions and abbreviations .....	7
3.1 Definitions .....	7
3.2 Abbreviations .....	7
4 Sending characteristics .....	8
4.1 General .....	8
4.2 Sensitivity frequency response .....	8
4.3 Sending Loudness Rating .....	8
5 Receiving characteristics .....	8
5.1 General .....	8
5.2 Sensitivity frequency response .....	8
5.3 Receiving Loudness Rating .....	8
5.4 Restoring normal receive amplification .....	9
6 Other characteristics .....	9
6.1 Sidetone .....	9
6.2 Stability .....	9
6.2.1 Analogue and digital sets .....	9
6.2.2 Additional stability test .....	10
6.3 Echo path loss .....	10
6.3.1 Echo Return Loss (ERL) .....	10
6.3.2 Weighted Terminal Coupling Loss (TCLw) .....	10
6.4 Distortion .....	10
6.4.1 Sending .....	10
6.4.2 Receiving .....	10
6.4.3 Sidetone .....	10
6.4.4 Sending power handling capability .....	10
6.4.5 Receiving power handling capability .....	11
6.5 Noise .....	11
6.5.1 Sending .....	11
6.5.2 Receiving .....	11
6.6 Acoustic shock .....	11
7 Testing methods .....	11
7.1 Analogue telephones .....	11
7.2 Digital telephones .....	12
7.3 Summary of test methods .....	13
Annex A (normative): Packaging, labelling and user instructions .....	14
A.1 Packaging and labelling .....	14
A.2 User instructions .....	14
A.3 Product suppliers information .....	14
Annex B (informative): Bibliography .....	15

History ..... 16

## Foreword

This European Telecommunication Standard (ETS) was produced by the Terminal Equipment (TE) Technical Committee of the European Telecommunications Standards Institute (ETSI).

Transposition dates	
Date of adoption of this ETS:	12 January 1996
Date of latest announcement of this ETS (doa):	30 April 1996
Date of latest publication of new National Standard or endorsement of this ETS (dop/e):	31 October 1996
Date of withdrawal of any conflicting National Standard (dow):	31 October 1996

## Introduction

This ETS specifies the requirements for telephones with receive amplification intended to aid the hearing impaired. A significant proportion of the population is disabled by varying degrees of hearing loss, often associated with a reduction of speech discrimination ability. Amplification can only replace the lost sensitivity.

The group most likely to receive the greatest benefit from the use of a telephone with additional receive amplification are those with moderate to severe hearing losses in the range of 35 dB to 80 dB.

In setting the numerical values in this ETS, consideration has been given to the fact that the sound pressure levels at the ear during a telephone conversation can be up to 30 dB above those occurring in normal face-to-face conversation (at 1 metre distance). As hearing impaired people do not necessarily have elevated thresholds of loudness discomfort, some form of output limitation will be required. Recent work has indicated that Automatic Gain Control (AGC) may provide a better means of limitation than peak clipping. In addition, it is recognized that in order to give maximum intelligibility to some hearing impaired people, the frequency response may require shaping.

Two types of application are envisaged. Firstly, where the telephone is to be used in the main by a hearing impaired person, secondly where it will be used by persons with a range of hearing acuity. In the first case it will be advantageous to maintain the receive amplification (the level of which is selected by means of a volume control set by the hearing impaired user) when the handset is replaced. In the second, it may be preferable to arrange that the additional amplification is brought into use by the operation of a latching switch that automatically resets the gain to nominal level when the handset is replaced in its rest position. The use of voice switched attenuation, perhaps 10 dB to 12 dB, may be necessary to provide protection against instability, in particular for the first case, and could also improve the discrimination against the ambient noise received through the sidetone path.

It is estimated that with the provision of additional amplification to the levels recommended below, possibly up to 80 % of hearing impaired users would benefit even when not using their hearing aids to couple to the telephone set. If a hearing aid is worn in addition and inductive coupling is also provided, then the proportion of hearing impaired users who will be able to have satisfactory telephone conversations will increase further. It is, however, pointed out that with a high gain setting selected, the sound level and/or inductive field at the earphone may be considerably higher than normally experienced by hearing aid microphones and/or inductive pick-up coils and, on short telephone connections in particular, there is a very real possibility of overloading the input stages of the hearing aid. For this reason, this ETS permits the Receiving Loudness Rating (RLR) to be adjusted to be quieter than the requirements of the relevant terminal standard.

The inclusion of additional receiving amplification does not reduce or replace existing technical standards that apply to a handset. Additional receiving amplification may be combined with other additional functionality, such as inductive coupling or additional earpieces, provided specifically for people with special needs.

Blank page

## 1 Scope

This ETS specifies the electro-acoustic performance characteristics of telephony terminals which are intended for direct application to the ear (e.g. traditional handsets, operators' headsets) and which provide, at the earphone, additional amplification in the receiving direction compared with the Receiving Loudness Rating (RLR) specified in the relevant terminal standard.

This ETS applies to telephony terminals that can be connected to the Public Switched Telephone Network (PSTN) or the coincident S and T reference point of the basic access of the Integrated Services Digital Network (ISDN).

Hands free or loudspeaking devices and extra amplification in sending for the benefit of people having speech impairments are outside the scope of this ETS.

## 2 Normative references

This ETS incorporates by dated and undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this ETS only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

- [1] I-ETS 300 245-2: "Integrated Services Digital Network (ISDN); Technical characteristics of telephony terminals; Part 2: PCM A-law, handset telephony".
- [2] I-ETS 300 480: "Public Switched Telephone Network (PSTN); Testing specification for analogue handset telephony".

## 3 Definitions and abbreviations

### 3.1 Definitions

For the purposes of this ETS, the following definitions apply:

**additional receiving amplification:** A facility provided in a terminal whereby the gain in the receiving direction from telephone line to ear may be increased (or decreased), relative to that required by the relevant terminal standard, for the purpose of enabling the user to select, within certain limits, his/her preferred receiving loudness.

**relevant terminal standard:** A standard which would apply if the terminal concerned did not provide additional receiving amplification for the benefit of hearing impaired users.

**voice switching:** A process of automatically inserting attenuation into either the send or receive path (e.g. in order to maintain stability) controlled by the receive or send signal.

### 3.2 Abbreviations

For the purposes of this ETS, the following abbreviations apply:

AGC	Automatic Gain Control
ERL	Echo Return Loss
ISDN	Integrated Services Digital Network
LSTR	Listener Sidetone Rating
LRGP	Loudness Rating Guardring Position
MRP	Mouth Reference point
PSTN	Public Switched Telephone Network
RLR	Receiving Loudness Rating
SLR	Sending Loudness Rating
STMR	Sidetone Masking Rating
TCLw	Weighted Terminal Coupling Loss
TE	Terminal Equipment

## 4 Sending characteristics

### 4.1 General

The sending characteristics shall meet the requirements of the relevant terminal standards both with and without additional receiving amplification selected.

### 4.2 Sensitivity frequency response

When in the sending condition, the sending sensitivity frequency response shall fulfil the requirements of the relevant terminal standards, irrespective of any receiving amplification selected.

Conformance shall be checked using the test referred to in subclause 7.3, table 1.

### 4.3 Sending Loudness Rating

When in the sending condition, the Sending Loudness Rating (SLR) shall fulfil the requirements of the relevant terminal standard, irrespective of any receiving amplification selected.

Voice switching may be used in the interests of preserving stability margins and/or Terminal Coupling Loss (TCL) under difficult operating conditions.

NOTE: The switched attenuation should be the minimum necessary for the purpose, e.g. approximately equal to that required to offset any increased receiving amplification selected.

Conformance shall be checked using the test referred to in subclause 7.3, table 1.

## 5 Receiving characteristics

### 5.1 General

With no additional receiving amplification selected, the receiving characteristics shall meet the requirements of the relevant terminal standard. For products providing more than one earphone the ETS, if invoked, shall apply to at least one earphone.

### 5.2 Sensitivity frequency response

With additional amplification selected such that the RLR is within the range covered by the relevant terminal standard, the receive frequency response shall meet the requirements of that standard.

Conformance shall be checked using the test referred to in subclause 7.3, table 1.

There shall be no requirements for the case where the additional amplification selected is such that the RLR is outside of the range permitted by the relevant terminal standard.

NOTE: With additional amplification selected, under some conditions and for individual hearing impaired users it may be appropriate to provide special frequency shaping, which may be adjustable by the user. In particular, shaping could be provided to compensate for the loss of low frequencies caused by earcap leakage effects that occur with most types of telephone earphone, when coupled acoustically to a hearing aid.

### 5.3 Receiving Loudness Rating

With no additional receive amplification selected the Receiving Loudness Rating (RLR) of the relevant terminal standard shall be met.

Conformance shall be checked using the test referred to in subclause 7.3, table 1.

With the maximum additional receive amplification selected, the RLR shall be 15 dB  $\pm$  5 dB more negative (louder) than the nominal requirements of the relevant terminal standard.



It shall not be possible to set the RLR more than 15 dB more positive (quieter) than the nominal requirements of the relevant terminal standard.

NOTE 1: If additional amplification is provided in association with voice switching functions then the principles outlined in ITU-T Recommendation P.34, clause 5 are recommended. The depth of switched attenuation should be kept to a minimum in the interests of good speech quality but should be sufficient to maintain stability, return loss and TCL requirements.

NOTE 2: The possibility of setting the RLR more positively (quieter) than the requirements of the relevant terminal standard is included in order to avoid the overloading of hearing aid microphone input circuits on short telephone connections (see Introduction).

#### 5.4 Restoring normal receive amplification

##### Option A - Telephones to be used by any user

At the termination of the telephone conversation any additional amplification selected shall be cancelled and the nominal RLR values shall be restored by the action of replacing the handset, or an equivalent action.

##### Option B - Telephones to be used mainly by a hearing impaired user

For the benefit of a hearing impaired user frequently using the terminal, **if the terminal meets the requirements of subclause 6.2.2**, the option may be provided for the additional amplification selected during a telephone conversation to be locked in position.

## 6 Other characteristics

### 6.1 Sidetone

When additional amplification is not in use, sidetone levels Sidetone Masking Rating (STMR), Listener Sidetone Rating (LSTR) in accordance with the relevant terminal standard shall be provided.

Conformance shall be checked using the test referred to in subclause 7.3, table 1.

There shall be no requirements for sidetone where the additional amplification selected is such that the RLR is outside of the range permitted by the relevant terminal standard.

NOTE: With additional amplification selected it will normally only be possible to maintain recommended sidetone levels if voice switching functions are used.

### 6.2 Stability

#### 6.2.1 Analogue and digital sets

With additional amplification selected such that the RLR is within the range permitted by the relevant terminal standard, the stability requirements of that standard shall apply.

Conformance shall be checked using the relevant analogue and digital tests referred to in subclause 7.3, table 1.

## **6.2.2 Additional stability test**

(For Option B (see subclause 5.4)), the stability requirements of the relevant terminal standard shall also be met with the additional amplification set at maximum using the tests referred to in subclause 6.2.1 above, but with the physical arrangement changed from the handset lying on a flat surface to the handset hanging free in anechoic conditions as used for the TCL test of subclause 6.3.2 below.

## **6.3 Echo path loss**

### **6.3.1 Echo Return Loss (ERL)**

For an analogue terminal, with additional amplification selected such that the RLR is within the range permitted by the relevant terminal standard, the ERL requirements of that standard shall apply.

Conformance shall be checked using the test referred to in subclause 7.3, table 1.

### **6.3.2 Weighted Terminal Coupling Loss (TCLw)**

For a digital terminal with additional amplification selected such that the RLR is within the range permitted by the relevant terminal standard, the TCLw requirements of that standard shall apply.

Conformance shall be checked using the test referred to in subclause 7.3, table 1.

## **6.4 Distortion**

### **6.4.1 Sending**

The requirements of the relevant terminal standard shall apply with and without additional receiving amplification selected.

Conformance shall be checked using the test referred to in subclause 7.3, table 1.

If the terminal under test uses voice switching techniques, care shall be taken to ensure that the terminal remains in the sending state while the measurements are being made.

### **6.4.2 Receiving**

Without additional receiving amplification selected, the requirements of the relevant standard shall be met. With additional amplification selected, the requirements of the relevant terminal standard shall be met but with the test signal input level adjusted in inverse proportion to the additional amplification selected.

Conformance shall be checked using the test referred to in subclause 7.3, table 1.

### **6.4.3 Sidetone**

Without any additional amplification selected, the requirements of the relevant terminal standard shall apply.

Conformance shall be checked using the test referred to in subclause 7.3, table 1.

There shall be no requirements for sidetone where the additional amplification selected is such that the RLR is outside of the range permitted by the relevant terminal standard.

### **6.4.4 Sending power handling capability**

The requirements of the relevant terminal standard shall apply with and without additional receiving amplification selected.

Conformance shall be checked using the test referred to in subclause 7.3, table 1.

If the terminal under test uses voice switching techniques, care shall be taken to ensure that the terminal remains in the sending state while the measurements are being made.

#### **6.4.5 Receiving power handling capability**

Without any additional amplification selected, the requirements of the relevant terminal standard shall apply. With additional amplification selected, the requirements of the relevant terminal standard shall be met but with the test signal input level adjusted in inverse proportion to the additional amplification selected.

Conformance shall be checked using the test referred to in subclause 7.3, table 1.

#### **6.5 Noise**

##### **6.5.1 Sending**

The requirements of the relevant terminal standard shall be met with and without additional receiving amplification selected.

Conformance shall be checked using the test referred to in subclause 7.3, table 1.

If the terminal under test uses voice switching techniques, care shall be taken to ensure that the terminal remains in the sending state while the measurements are being made.

##### **6.5.2 Receiving**

Without additional receiving amplification selected, the requirements of the relevant standard shall be met. With additional amplification selected, the measured noise may increase (or decrease) in proportion to the additional amplification selected.

Conformance shall be checked using the test referred to in subclause 7.3, table 1.

#### **6.6 Acoustic shock**

The prevention of acoustic shock is a requirement arising from the Low Voltage Directive (73/23/EEC). In the absence of any relevant safety standard advice can be found in annex B of I-ETS 300 245-2 [1] and for analogue sets in annex A of I-ETS 300 677.

### **7 Testing methods**

Unless otherwise stated, testing for conformance to the requirements of this ETS shall be carried out with the additional amplification selected such that the RLR is within the range permitted by the relevant terminal standard and also with the maximum gain setting.

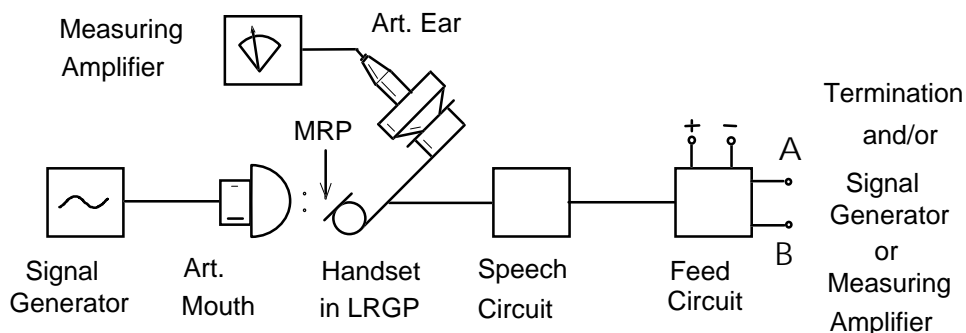
The tests referred to in subclause 7.3, table 1 specify certain test signals. Alternative signals (and subsequent analysis) may be used if the same test result is achieved or if the design of the terminal necessitates it (e.g. the use of speech-like signals is required for certain types of voice controlled terminals). Attention is drawn to annex A, clause A.3.

#### **7.1 Analogue telephones**

Except where stated otherwise, the TE shall be connected to the test arrangement shown in figure 1 and the volume control is set, initially, to the position that gives a loudness rating meeting the requirements of the relevant terminal standard.

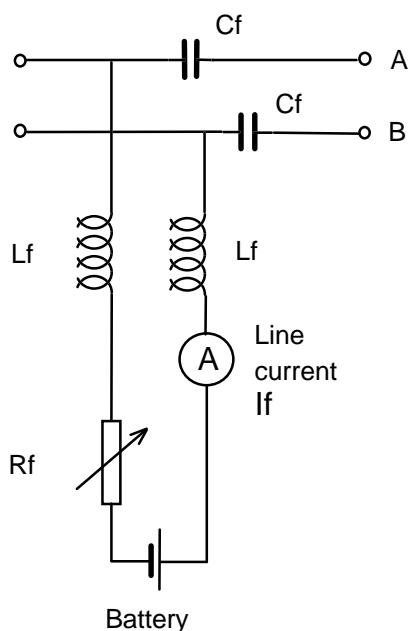
Suitable test methods are specified in I-ETS 300 480 [2] and are referred to in subclause 7.3, table 1.

Unless otherwise stated in the relevant terminal standard, measurements shall be made for various values of feeding resistance,  $R_f$  (see figure 2). A table of values for  $R_f$  is given in I-ETS 300 480 [2], table 1. The way in which  $R_f$  is varied during the tests is given in I-ETS 300 480 [2], clause 4.



NOTE: See figure 2 for details of Feed Circuit.

**Figure 1: Measurement of transmission characteristics (analogue sets)**



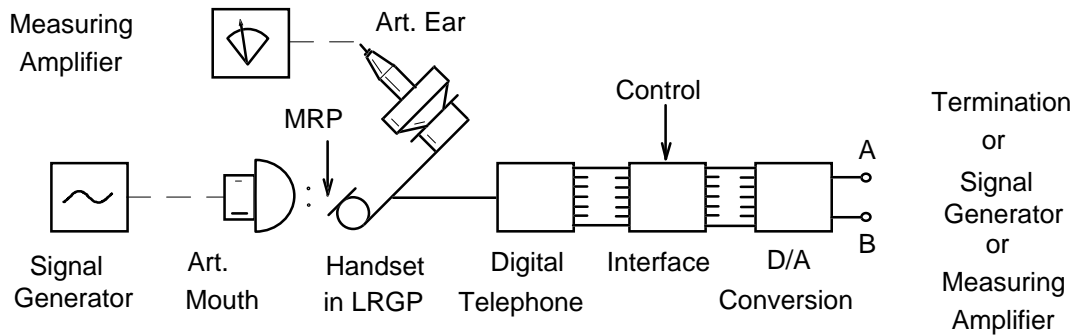
NOTE: For further information about the feed bridge above, see I-ETS 300 480 [2], clause 4.

**Figure 2: Details of the Feed Circuit**

## 7.2 Digital telephones

Figure 3 shows the general circuit arrangement for measurement of the performance of digital telephone sets. The digital TE is connected to the test arrangement shown in figure 3 and the volume control is set initially to the position that gives a loudness rating meeting the requirements of the relevant terminal standard.

Suitable test methods are specified in I-ETS 300 245-2 [1] and are referred to in subclause 7.3, table 1.



NOTE: Instead of the D/A conversion, a direct digital processing approach may be used.

**Figure 3: Measurement of transmission characteristics (digital sets)**

### 7.3 Summary of test methods

Table 1 summarizes the test methods to be used to check the performance of the terminal against the requirements of this ETS.

**Table 1: Test method summary**

Test method summary		
Parameter	Analogue sets	Digital sets
	I-ETS 300 480 [2], subclause	I-ETS 300 245-2 [1], subclause
Sending sensitivity frequency response	4.2.1.1	A.2.1.1
Sending Loudness Rating (SLR)	4.2.2.1	A.2.2.1
Receiving sensitivity frequency response	4.2.1.2	A.2.1.2
Receiving Loudness Rating (RLR)	4.2.2.2	A.2.2.2
Sidetone - STMR	4.2.3	A.2.3.1
Sidetone - LSTR		A.2.3.2
Sending Distortion	4.2.4.1	A.2.5.1
Receiving Distortion	4.2.4.2	A.2.5.2
Sidetone Distortion	4.2.4.3	A.2.5.3
Sending power handling capability	4.2.4.4	N/A
Receiving power handling capability	4.2.4.5	N/A
Sending Noise	4.2.6.1	A.2.8.1
Receiving Noise	4.2.6.2	A.2.8.2
Instability	4.2.8	N/A
Stability	N/A	A.2.4.2
Weighted Terminal Coupling Loss (TCLw)	N/A	A.2.4.1
Echo Return Loss	4.2.7	N/A
Acoustic shock	Annex B	Annex B
NOTE: N/A = Not Applicable.		

## **Annex A (normative): Packaging, labelling and user instructions**

### **A.1 Packaging and labelling**

Where the telephone instruments are suitable for use by hearing impaired people this shall be indicated by the inclusion of an agreed international symbol on the telephone sets themselves, the packaging, brochures and instruction leaflets as public signs that such facilities are available and conforms to this ETS. A general symbol for this purpose is shown in figure A.1 below. A special symbol indicating the provision of additional amplification is being developed by ETSI TC-HF.



**Figure A.1: Internationally agreed symbol to indicate availability of facilities for the hearing impaired**

### **A.2 User instructions**

Instructions which clearly describe the manner in which the instrument to be used in conjunction with hearing aids shall be provided with each instrument. The instructions shall show how the volume and any other controls on the telephone are to be used for maximum efficiency and make reference to the use of the controls on the hearing aid, particularly the switch position necessary for induction pick up (the T position) where an inductive pick up coil is provided in addition to the increased receiving amplification. If undesirable effects can occur, for example acoustic feedback, adequate warnings of the combination of conditions under which such effects can occur shall be given together with the appropriate remedial actions necessary.

### **A.3 Product suppliers information**

If the complexity of the terminal demands the use of special testing techniques in order to assess performance this shall be clearly stated together with information to enable a test house to carry out a meaningful evaluation of the product.

## **Annex B (informative): Bibliography**

For the purposes of this ETS, the following documents have been given as informative references:

- ITU-T Recommendation P.34 (1995): "Transmission characteristics of hands-free telephones".
- Council directive 73/23/EEC of 19 February 1973 on the harmonization of the laws of Member States relating to electrical equipment designed for use within certain voltage limits.
- Draft prI-ETS 300 677: "Public Switched Telephone Network (PSTN); Requirements for handset telephony".

## History

Document history			
February 1995	Public Enquiry	PE 79:	1995-02-20 to 1995-06-16
November 1995	Vote	V 91:	1995-11-06 to 1995-12-29
January 1996	First Edition		