INTERNATIONAL TELECOMMUNICATION UNION

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

Supplement 20

(Series P)

(03/93)

TELEPHONE TRANSMISSION QUALITY

OBJECTIVE ELECTRO-ACOUSTICAL MEASUREMENTS

EXAMPLES OF MEASUREMENTS OF HANDSET RECEIVE-FREQUENCY RESPONSES: DEPENDENCE ON EARCAP LEAKAGE LOSSES

Supplement 20 to

ITU-T Series P Recommendations

(Previously "CCITT Recommendations")

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.

Supplement 20 to ITU-T Series P Recommendations was prepared 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 Similarly, in this reform process, the CCIR and the IFRB have been replaced by the Radiocommunication Sector.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.

© ITU 1994

All rights reserved. No part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from the ITU.

CONTENTS

Page

1 Introduction 1
2 Examples of earcap leakage effects measured during telephone usage (real ears) 1
3 Examples of earcap leakage effects measured with artificial ears..... 1
4 References..... 4

Supplement 20

EXAMPLES OF MEASUREMENTS OF HANDSET RECEIVE-FREQUENCY RESPONSES: DEPENDENCE ON EARCAP LEAKAGE LOSSES

(Helsinki, 1993)

(referred to in Series P Recommendations)

1 Introduction

The subject of handset earcap leakage losses has been studied on and off for a quite considerable time by many organizations. The liberalization of the telecom market as well as "innovative" handset designs have now made the leakage problem more acute, i.e. in terms of customer complaints. The information given in this supplement is aimed to give some instructive examples as general information on the subject.

2 Examples of earcap leakage effects measured during telephone usage (real ears)

Figure 1 shows the Sound Pressure Level (dBSPL) measured at 20 persons' ears:

a) under normal usage;

b) when the subjects were asked to obtain a good seal by pressing the receiver hard to the ear.

The handsets were of a conventional design, i.e. using high acoustic impedance earphones, that were driven electrically with a signal having constant spectrum.

Note the large spread between individuals!

These data originate from an investigation made by Swedish Telecom in 1967 and may be found in reference [8].

Further real ear data may be found in [2], 12], [19].

3 Examples of earcap leakage effects measured with artificial ears

Figure 2 shows receive-frequency response for a modern German handset telephone, sealed on the knife edge of the CCITT Type 1/P.57 (IEC 318) artificial ear (——), on this ear modified to provide additional acoustic leak: "Swedish" (– – –) or "German" (- - -), [13]. Neither of the leaks are recommended by CCITT, however the "German" one is presently used by the German Administration for regulatory purposes.

Figure 3 shows CCITT Round Robin (RR) telephone No. 4, a conventional design having an IRS-shaped handset [14] measured on CCITT Recommendation P.57 Type 1/IEC 318 artificial ear (– – –), Type 3.2 with "low leak" (——) and Type 3.2 with "high leak" (---) artificial ears respectively. For typical RLR differences refer to [14].

Figure 4 is similar to 3 but shows results for RR telephone No. 2, using a low-acoustic impedance earphone design. It is noticeable that such a design is much less dependent on earcap leakage.

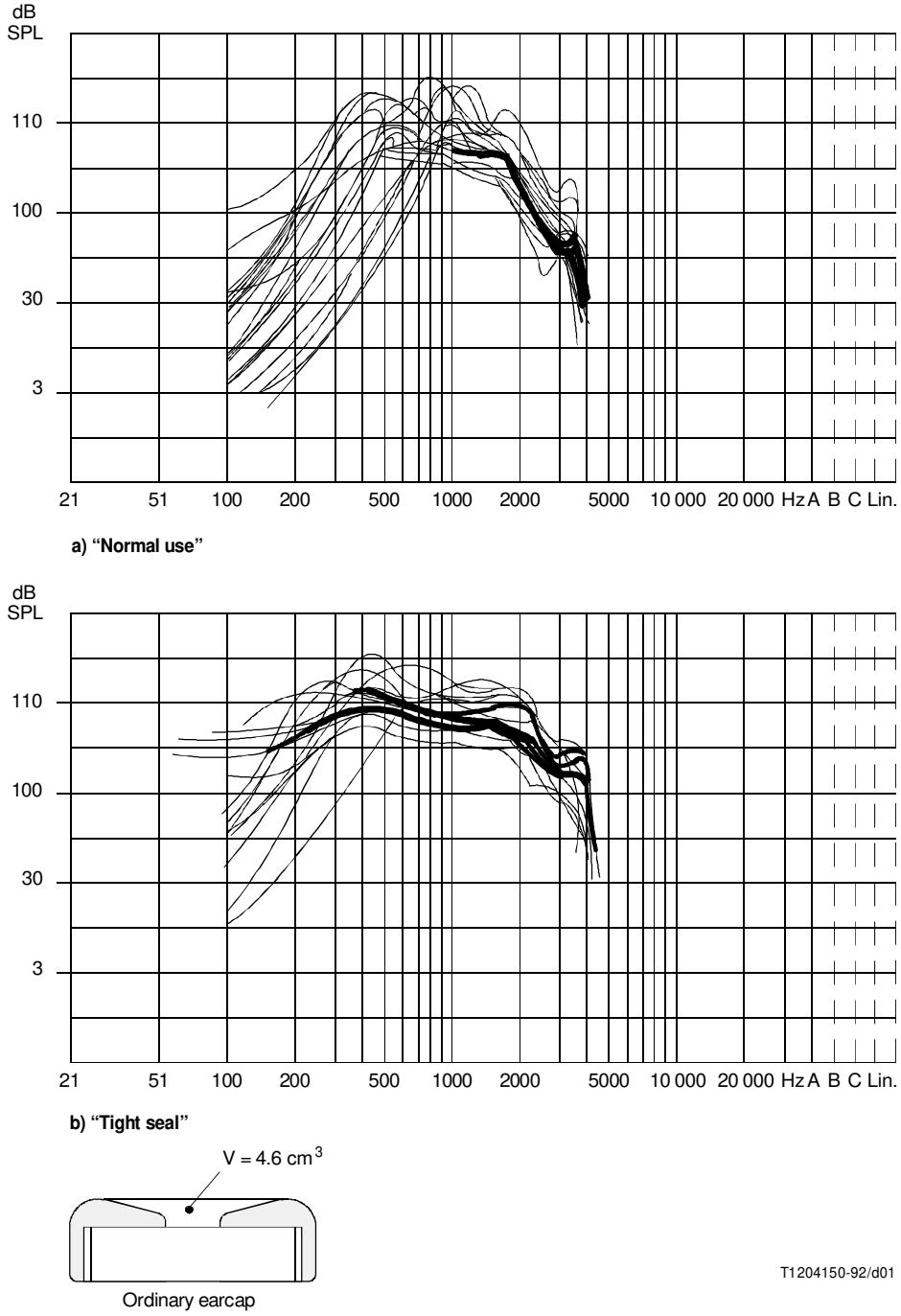

FIGURE 1

SPL measured on 20 subjects; ordinary earcap

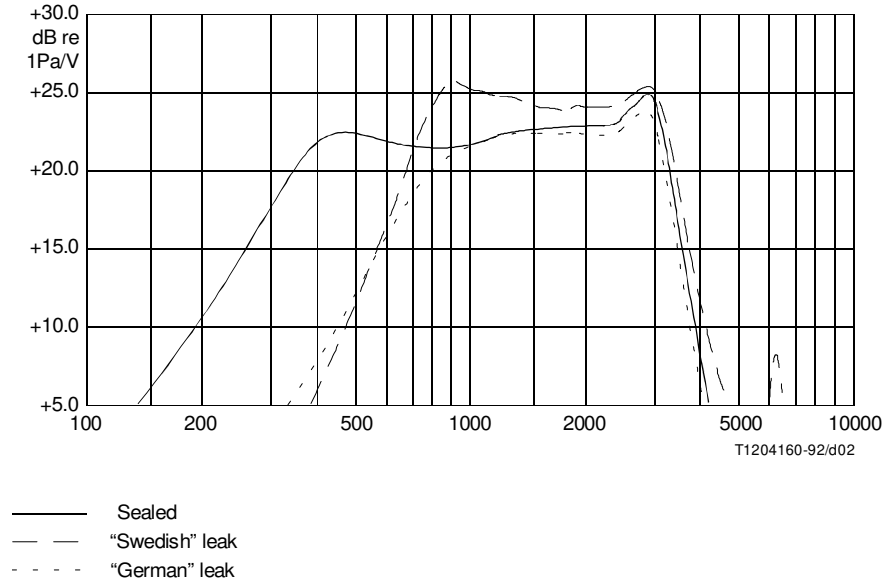

FIGURE 2

German telephone set

FIGURE 2/P.64...[D02] = 10 cm

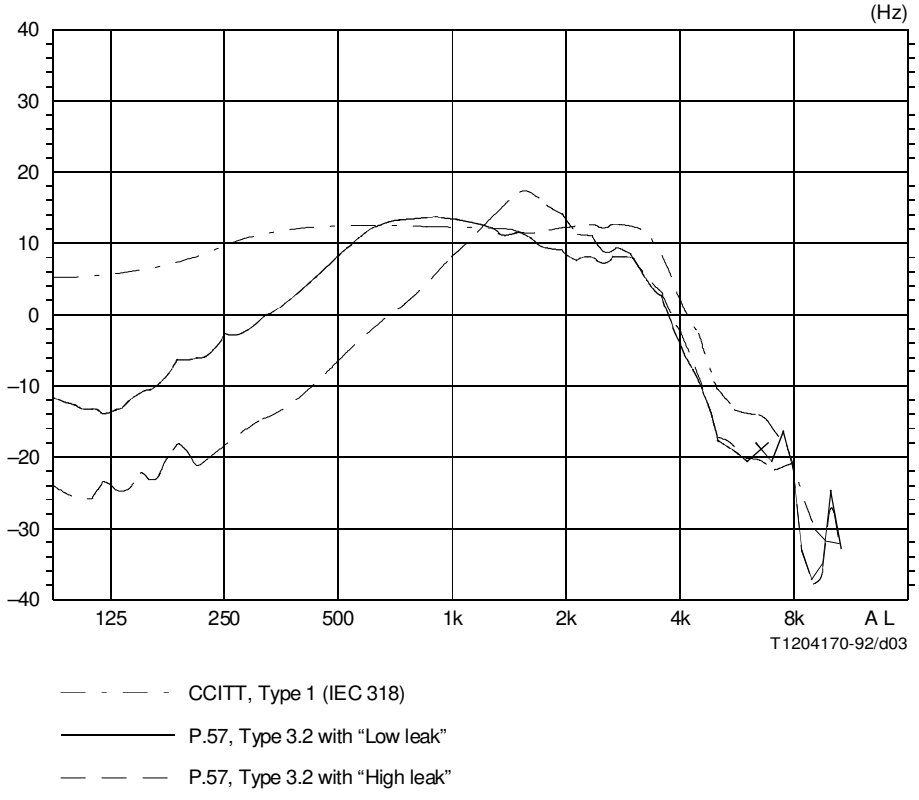

FIGURE 3

$S_{je}(f)$ RR handset phone No. 4

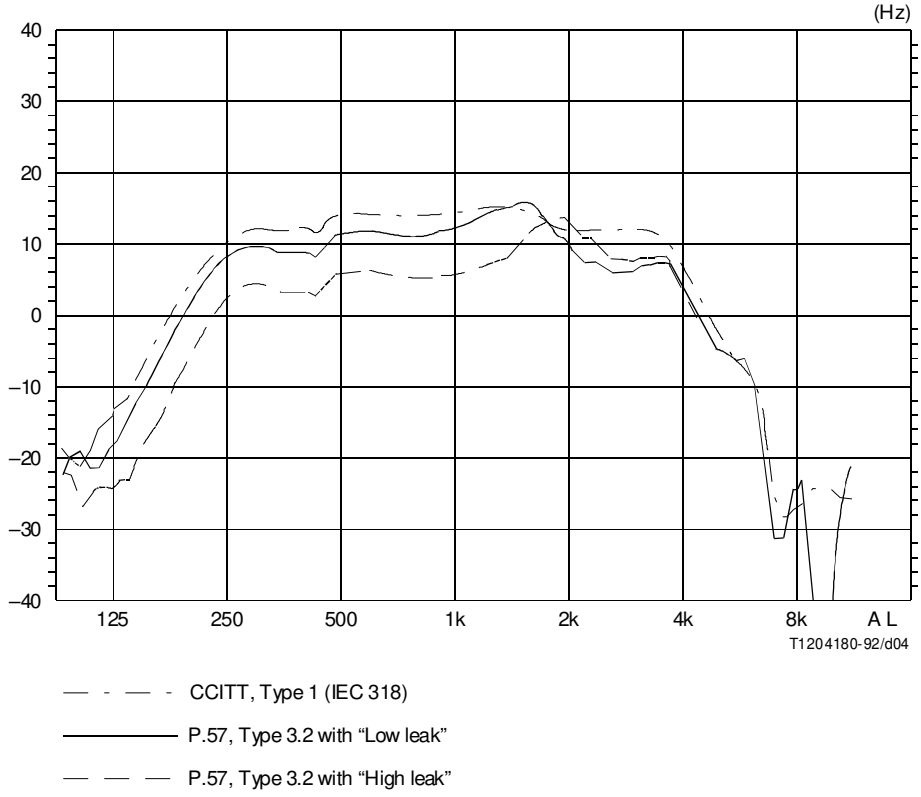

FIGURE 4

S_{je}(f) RR handset phone No. 2 (low Zg)

4 References

[1] ZWISLOCKY (J.J.): An ear like coupler for earphone calibration, Rep. *LSC-S-9. Lab. Sensory Commun.*, University de Syracuse, 1971.

[2] MODENA (G.) and REOLON, (A.): "A new artificial ear for telephone use", *J. Acoust. Soc.* Am. 65 (5), pp. 1604-1610, 1978.

[3] Brüel and Kjaer: "On the measurement of the insertion gain of telephone systems using head and torso simulators (HATS): Separation into transmit and receive characteristics and comparison with classical coupler measurements", CCITT, COM XII 224-E, Geneva, 1987.

[4] CCITT Handbook on Telephonometry, Chapter 1.4: "On the telephonic responses". In press, CCITT, Geneva.

[5] *Telecom Electroacoustics Workshop proceedings*, Naerum 1988.

[6] COM XII-15 (Special Rapporteur of Q. 12/XII): Round Robin experiment for evaluating the repeatability of measurements on pinna simulators.

[7] COM XII-38 (Germany): Leakage loss of telephone sets.

[8] COM XII-42 (Ellemtel): Suitable algorithm for LR calculation on earcap leaks.

[9] COM XII-43 (Ellemtel): Adaptor to IEC 318 for measuring earcap leaks.

[10] COM XII-49 (Brüel and Kjaer): The acoustic impedance of real and artificial ears – Implications for Sje and Le for CCITT Round Robin handset telephones.

[11] COM XII-50 (Brüel and Kjaer): Frame of reference and artificial ears for 7 kHz wideband handset receiver measurements, $S_{jd(f)}$ and $G_{jd(f)}$.

[12] COM XII-66 (Germany): Examination of the transfer function of various receiver capsules and handsets at the human hearing.

[13] COM XII-69 (Germany): Leakage loss of telephone sets: additional measurements with defined leaks.

[14] COM XII-73 (Special Rapporteur of Q. 12/XII): Report on the Round Robin experiment for evaluating the repeatability of measurements on pinna simulators, October 1990.

[15] Delayed D.52 (Brüel and Kjaer): Comments to contribution: Artificial head technique for determining the transfer functions of telecommunications equipment, October 1990.

[16] Delayed D.75 (Brüel and Kjaer): Impedance measurements of leak adaptors for the IEC 318 Artificial ear, October 1990.

[17] Delayed D.110 (Germany): Pinna simulator with a simplified mathematically describable geometry for determining the transfer functions of telephone equipment.

[18] Delayed D.98 (Germany): The behavior of telephone users in a noisy environment.

[19] Delayed D.77 (Danish Technical Univ. and Brüel and Kjaer): S_{JE} measurements on human subjects (extract), October 1990.

[20] TD 48 (Special Rapporteur of Q. 8/XII): Necessary modifcation of W-weights following the change of Artificial ear, October 1990.

[21] COM XII-R 12, page 20: Question 12/XII – Artificial mouth and ears.

[22] TD 83 (Special Rapporteur of Q. 12/XII): Draft Recommendation P.57 on the artificial ears, February 1992.

[23] TD 84 (Special Rapporteur of Q. 12/XII): Draft Recommendation P.58 – Head and torso simulator for telephonometry, February1992.