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TELEPHONE TRANSMISSION QUALITY MEASUREMENTS RELATED TO SPEECH LOUDNESS

SUBJECTIVE TESTING METHOD FOR DETERMINATION OF LOUDNESS RATINGS IN ACCORDANCE WITH RECOMMENDATION P.76

ITU-T Recommendation P.78

(Previously "CCITT Recommendation")

FOREWORD

The ITU-T (Telecommunication Standardization Sector) is a permanent organ of the International Telecommunication Union (ITU). 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.

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The approval of Recommendations by the Members of the ITU-T is covered by the procedure laid down in WTSC Resolution No. 1 (Helsinki, March 1-12, 1993).

ITU-T Recommendation P.78 was revised by the ITU-T Study Group 12 (1993-1996) and was approved under the WTSC Resolution No. 1 procedure on the 6th of February 1996.

NOTE

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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PREFACE

This Recommendation describes a subjective testing method which has been found suitable for laboratories' purposes. Provided that the Intermediate Reference System (IRS) used complies with the requirements of Recommendation P.48 and that other requirements given in Recommendation P.76 are adhered to, the loudness ratings obtained by using the method given in this Recommendation can be used for verifying the objectively measured loudness ratings of telephone systems with special characteristics. This Recommendation, together with Recommendations P.76 and P.48, provides a definition of loudness ratings which can be used for planning.

SUMMARY

This Recommendation contains the essential particulars for defining the method for determining loudness ratings in accordance with Recommendation P.76 when use is made of subjects performing equal loudness balances. Details are included concerning the balancing method, choice of subjects, speech material, design of experiment, method of analysis and presentation of results.

The method described in this Recommendation requires both the "unknown" telephone system whose loudness rating is to be determined and the IRS to be balanced against the Fundamental Reference System NOSFER. An alternative method, in which the "unknown" is directly balanced against the IRS, is described in Annex D.

Recommendation P.78**SUBJECTIVE TESTING METHOD FOR DETERMINATION OF LOUDNESS RATINGS IN ACCORDANCE WITH RECOMMENDATION P.76***(amended at Malaga-Torremolinos, 1984; Melbourne, 1988; Helsinki, 1993 and in 1996)***1 Introduction**

To compare the calculation of loudness ratings method (see Recommendation P.79), a defined method of subjectively determining loudness ratings is required. This Recommendation deals with all aspects of a test from selection of operators to the method of analysis and finally presentation of results.

2 General

In the subjective comparisons, the Fundamental Reference System (FRS) is used (although other reference systems are permissible) as the datum for comparing the following speech paths:

- a) *Path 0* – The fundamental reference system always provides the speech path against which each of the others is balanced. NOSFER set at 25 dB is used.
- b) *Path 1* – The send end of the test (“unknown”) local telephone circuit connected through the test (“unknown”) junction and an adjustable attenuator to the receive end of the test (“unknown”) local telephone circuit. The adjustable attenuator must be inserted in such a manner that the impedance relationships between the three parts of the connection (send end, junction and receive end) are not disturbed.
- c) *Path 2* – The send end of the intermediate reference system connected through an adjustable attenuator to the receive end of the intermediate reference system.
- d) *Path 3* – The send end of the test (“unknown”) local telephone circuit connected through an adjustable attenuator to the receive end of the IRS.
- e) *Path 4* – The send end of the IRS connected through an adjustable attenuator to the receive end of the test (“unknown”) local telephone system.
- f) *Path 5* – The send end of the IRS connected through the test (“unknown”) junction and an adjustable attenuator to the receive end of the IRS. The adjustable attenuator must be inserted in such a manner that the impedance relationships between the three parts of the connection (send end, junction and receive end) are not disturbed.

In these subjective comparisons, the junction of the fundamental reference system is fixed, i.e. the level of speech sounds received via the fundamental reference system is kept constant, the loudness balance being obtained by the so-called “margin” method, and the balance attenuator being that inserted in the telephone (or IRS) path being tested.

The speaking position used with both the IRS and the test telephone sets should be as defined in Annex A/P.76.

Figure 1 shows the composition of the telephone paths to be compared. The balances should be conducted using the vocal level defined in Recommendation P.72.

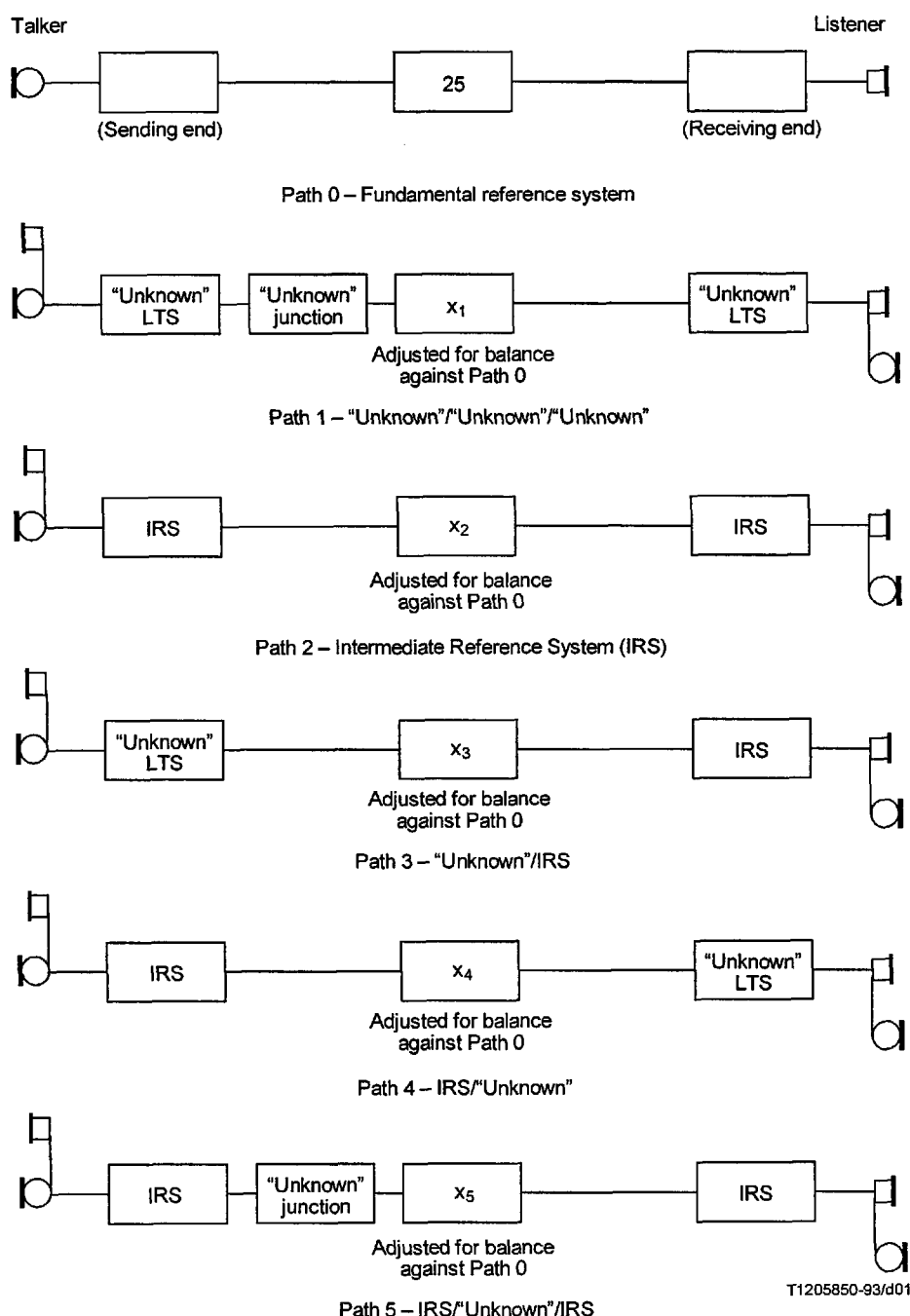


FIGURE 1/P.78
Arrangement of paths for subjective method of determination
of loudness ratings

The loudness ratings relative to the IRS as defined in Recommendation P.76 are:

- $OLR = x_2 - x_1$
- $SLR = x_2 - x_3$
- $RLR = x_2 - x_4$
- $JLR = x_2 - x_5$

It is not necessary to include all the paths indicated above in every experiment. Paths 0 and 2 are essential but addition of only 3 and 4 is sufficient to determine sending and receiving loudness ratings of a local telephone circuit. Paths 0, 2 and 5 are required to determine a junction loudness rating. Path 1 is usually required only when it is derived to verify additivity of loudness ratings, namely that:

$$\text{OLR} = \text{SLR} + \text{JLR} + \text{RLR}$$

Note should be made that the loudness rating always involves the difference between the adjustable attenuator setting x_2 for the IRS and the setting for the "unknown". Since it can be expected that the value of x_2 should remain approximately constant from one balance to the next, at least one administration has found it desirable to perform direct balances of the "unknown" against the IRS with a fixed value of x_2 . Additional information on this direct balance method may be found in Annex D.

3 Experiment design

To have confidence in results requires the correct testing procedures to be followed, coupled with the correct experiment design. The procedure should be prepared such that no ambiguity can exist.

The following points must be considered in the design:

- The experiment should be designed in such a way that all uncontrolled influences operate at random, e.g. slight day-to-day drift of subjects and/or measuring equipment.
- If more balances are required than can be comfortably completed in one day, then the experiment must be designed such that equal numbers of each type of system are completed each day.
- The operators who start a test should always be the same throughout the test [1].
- A minimum of 12 operator-pair combinations is suggested with a maximum of 20. Twelve operator-pair combinations can be arrived at from two crews of 3 (see Table 1a) or one crew of 4 and 18 operator-pair combinations can be arrived at from one crew of 6 (see Table 1b) and 20 operator-pair combinations from one crew of 5 (see Table 2a).

NOTE – One crew of 6 giving 30 operator-pair combinations (see Table 2b) produces a larger test for only slightly more precision than the previously mentioned crew sizes.

TABLE 1a/P.78

**Twelve operator-pair combinations
from two crews of three, known as
3/6 operator method**

		Operator (listener)					
		A	B	C	D	E	F
Operator (talker)	A						
	B		X	X			
	C	X		X			
	D	X	X				
	E				X	X	
	F				X		X

TABLE 1b/P.78

**Eighteen operator-pair combinations
from one crew of six, known as
3/6 operator method**

		Operator (listener)					
		A	B	C	D	E	F
Operator (talker)	A						
	B				X	X	X
	C				X	X	X
	D				X	X	X
	E	X	X	X			
	F	X	X	X			