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TRANSMISSION SYSTEMS AND MEDIA GENERAL CHARACTERISTICS OF NATIONAL SYSTEMS FORMING PART OF INTERNATIONAL CONNECTIONS

INFLUENCE OF NATIONAL SYSTEMS ON STABILITY AND TALKER ECHO IN INTERNATIONAL CONNECTIONS

ITU-T Recommendation G.122

(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 G.122 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 Similarly, in this reform process, the CCIR and the IFRB have been replaced by the Radiocommunication Sector.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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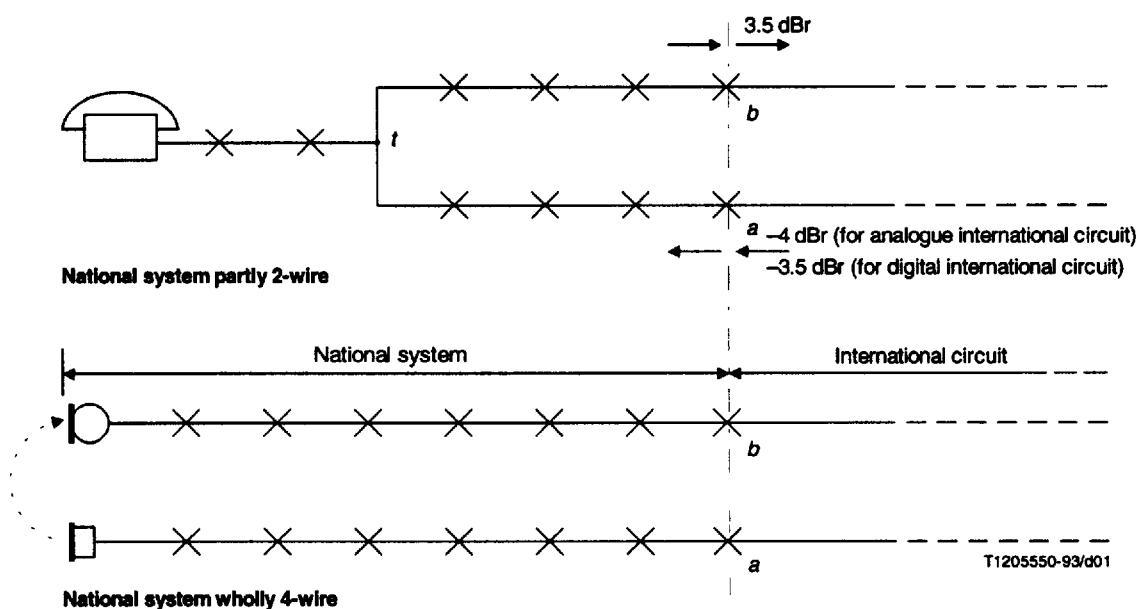
Recommendation G.122**INFLUENCE OF NATIONAL SYSTEMS ON STABILITY AND TALKER ECHO IN INTERNATIONAL CONNECTIONS**

(Geneva, 1964; amended at Mar del Plata, 1968; Geneva, 1972, 1976 and 1980;
Malaga-Torremolinos, 1984; Melbourne, 1988 and Helsinki, 1993)

1 Introduction

The information provided in this Recommendation applies to all national systems.

Representations of a national system which extend up to the virtual analogue switching points are shown in Figure 1.



NOTE – a , b are the virtual analogue switching points of the international circuit.

FIGURE 1/G.122

National system representation and virtual analogue switching point definition

The transmission loss introduced between a and b by the national system, referred to as the loss ($a-b$), is important from three points of view:

- it contributes to the margin that the international connection has against oscillation during the setting-up and clearing-down of the connection. A minimum loss over the band 0-4 kHz is the characteristic value;
- it contributes to the margin of stability during a communication. Again, a minimum loss in the band 0-4 kHz is the characteristic value, but in this case the subscribers' apparatus (telephone, modem, etc.) are assumed to be connected and in the operating condition;
- it contributes to the control of echoes and, in respect of the subjective effect of talker echo, a weighted sum of the loss ($a-b$) over the band 300-3400 Hz is the characteristic value.

In addition, echoes circulating in any of the 4-wire loops in the national system or in the international 4-wire chain, give rise to listener echo, which can affect voice-band analogue data transmission.

The requirements stated in this Recommendation represent network performance objectives.

2 Loss (*a-b*) to avoid instability during set-up, clear-down and changes in a connection

2.1 Instability should be avoided during all normal conditions of set-up, clear-down and other changes in the composition (e.g. call-transfer) of a complete connection. To ensure adequate stability of international connections, the distribution (taken over many actual calls) of the loss (*a-b*) during the worst situation should be such that the risk of a loss (*a-b*) of 0 dB or less does not exceed 6 in 1000 calls when using the calculation method applied in 2.2. This requirement should be observed at any frequency in the band 0 to 4 kHz.

NOTES

1 The signalling and switching systems have an influence on the loss (*a-b*) under set-up and clear-down conditions. For example, in some systems 4-wire registers control the set-up and do not establish the 4-wire path until the answer signal is successfully received. In others, circuits are released immediately if busy conditions are encountered. In these circumstances the risk of oscillation does not arise.

2 Recommendation Q.32 gives information on methods of securing an adequate loss (*a-b*) of an incoming national system before the called-subscriber answers (i.e. while ringing tone is transmitted) or if busy or number unobtainable conditions are encountered.

3 If there are no such arrangements as described in Notes 1 or 2 above then, in general, it would be safe to assume that there is no balance return loss provided by the called local telephone circuit (if 2-wire). In this case the necessary loss (*a-b*) must be provided by the transmission losses in the national system.

4 The stability of international telephone connections at frequencies outside the band of effectively transmitted frequencies (i.e. below 300 Hz and above 3400 Hz) is governed by the following transmission losses at the frequencies of interest:

- the balance return loss at the terminating units;
- the transmission losses of the terminating units;
- the transmission losses of the 4-wire circuits.

5 Conditions which only last for a few tens of milliseconds can be left out of consideration because in such a short time oscillations cannot build up to a significant level.

2.2 The limit recommended in 2.1 may be met, for instance, by imposing the following simultaneous conditions on the national network:

- 1) The sum of the nominal transmission losses in both directions of transmission *a-b* and *t-b* measured between the 2-wire input of the terminating set *t*, and one or other of the virtual switching points on the international circuit, *a* or *b* should not be less than $(4 + n)$ dB, where *n* is the number of analogue or mixed analogue-digital 4-wire circuits in the national chain.
- 2) The stability balance return loss at the terminating set *t*, should have a value not less than 2 dB for the terminal conditions encountered during normal operation.
- 3) The standard deviation of variations of transmission loss of a circuit should not exceed 1 dB (see 3/G.151).

In a calculation to verify if these values are acceptable, it may be assumed that (see [1]):

- there is no significant difference between nominal and mean value of the transmission losses of circuits;
- variations of losses for both directions of transmission of the same circuit are fully correlated;
- distributions are Gaussian.

For the loss (*a-b*), it then results:

Mean value: $2 + 4 + n = 6 + n$ dB

Standard deviation: $\sqrt{4n}$ dB

With $n = 4$ the mean value becomes 10 dB and the standard deviation 4 dB, resulting in a probability for values lower than 0 dB of $6 \cdot 10^{-3}$.