INTERNATIONAL TELECOMMUNICATION UNION

ITU-T

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TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

TELEVISION AND SOUND TRANSMISSION

ESTIMATION OF TRANSMISSION PERFORMANCE OF SOUND-PROGRAMME CIRCUITS SHORTER OR LONGER THAN THE HYPOTHETICAL REFERENCE CIRCUIT

ITU-T Recommendation J.25

(Formerly Recommendation ITU-R CMTT.605)

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 J.25 (formerly Recommendation ITU-R CMTT.605) was elaborated by the former ITU-R Study Group CMTT. See Note 1 below.

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 Similarly, in this reform process, the CCIR and the IFRB have been replaced by the Radiocommunication Sector (ITU-R).

Conforming to a joint decision by the World Telecommunication Standardization Conference (Helsinki, March 1993) and the Radiocommunication Assembly (Geneva, November 1993), the ITU-R Study Group CMTT was transferred to ITU-T as Study Group 9, except for the satellite news gathering (SNG) study area which was transferred to ITU-R Study Group 4.

2 In this Recommendation, the expression “Administration” is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

Recommendation J.25[1)]

ESTIMATION OF TRANSMISSION PERFORMANCE OF SOUND-PROGRAMME CIRCUITS SHORTER OR LONGER THAN THE HYPOTHETICAL REFERENCE CIRCUIT

(1982; revised 1986)

The CCIR

UNANIMOUSLY RECOMMENDS

that for the estimation of transmission performance of sound-programme circuits shorter or longer than the hypothetical reference circuit the following rules be applied:

Laws of addition

1. Comments on the use of the laws of addition

The definition of a circuit in terms of a single multiple of the hypothetical reference circuit is impossible if the number of audio-to-audio sections and the length of the circuit differ from those of the hypothetical reference circuit by different ratios, i.e. if $n/3 \neq L/l$ where

n : number of audio-to-audio sections,

L : length of the circuit,

l : 2500 km.

In such cases two definitions of the circuit in terms of the hypothetical reference circuit should be used, one for those parameters primarily a function of the circuit configuration, and a second for those parameters (e.g. continuous random noise) primarily a function of the length of the circuit.

2. Law pertaining to circuit configuration

For the first definition of the circuit in terms of the hypothetical reference circuit use the following equation for all parameters in Table II except for "continuous random noise".

Let D_3 : design objective or the parameter derived therefrom and indicated in Table II, permitted value for three homogeneous sections of the hypothetical reference circuit,

and D_n : performance, or the parameter mentioned above, to be estimated for n sections.

The following expressions apply:

– for absolute values and logarithmic deviations:

$$D_n = D_3(n/3)^{1/h} \quad (1)$$

– for absolute levels:

$$D_n = D_3 + \frac{20}{h} \log(n/3) \quad (2)$$

– for logarithmic ratios:

$$D_n = D_3 - \frac{20}{h} \log(n/3) \quad (3)$$

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1) Formerly Recommendation ITU-R CMTT.605.

h has the value 1, 3/2 or 2 in accordance with Table II: $h = 1$ gives linear or arithmetic law of addition, $h = 3/2$ gives the "three-halves power" law of addition and $h = 2$ gives the quadratic (r.m.s.) law of addition.

Calculated values of $\left(\frac{n}{3}\right)^{1/h}$ and $\frac{20}{h} \log \left(\frac{n}{3}\right)$ are given in Table I.

3. Law pertaining to circuit length

For the second definition of the circuit in terms of the hypothetical reference circuit use the following equation for "continuous random noise levels" only. When distance is considered the law of addition becomes:

$$D_n = D_3 - \frac{20}{h} \log(L/l) \qquad (4)$$

where D_n, D_3, L and l are as defined in § 1 and § 2. If $l < 280$ km, set $l = 280$ km in (4).

Note – The values calculated as per this Recommendation provide only indications of the probable performance. They should be used with caution when studying the design of equipment, because the laws of addition are not precisely known for every type of impairment. Further studies are necessary, especially to cover the case of mixed analogue-and-digital circuits.

TABLE I

n	Formula (1) $\left(\frac{n}{3}\right)^{1/h}$			Formulas (2) and (3) $\frac{20}{h} \log \left(\frac{n}{3}\right)$		
	$h = 1$	$h = 3/2$	$h = 2$	$h = 1$	$h = 3/2$	$h = 2$
1	0.33	0.48	0.58	−9.5 dB	−6.4 dB	−4.8 dB
2	0.67	0.76	0.82	−3.5	−2.3	−1.8
3	1.00	1.00	1.00	0.0	0.0	0.0
4	1.33	1.21	1.15	2.5	1.7	1.2
5	1.67	1.41	1.29	4.4	3.0	2.2
6	2.00	1.59	1.41	6.0	4.0	3.0
7	2.33	1.76	1.53	7.4	4.9	3.7
8	2.67	1.92	1.63	8.5	5.7	4.3
9	3.00	2.08	1.73	9.5	6.4	4.8
10	3.33	2.23	1.83	10.5	7.0	5.2
11	3.67	2.38	1.91	11.3	7.5	5.6
12	4.00	2.52	2.00	12.0	8.0	6.0
13	4.33	2.66	2.08	12.7	8.5	6.4
14	4.67	2.79	2.16	13.4	8.9	6.7
15	5.00	2.92	2.24	14.0	9.3	7.0

TABLE II

	Parameter	D_3 expressed in	Applicable formula	h (tentative value)
Parameters relevant to mono and stereo circuits	Insertion gain (1.0 kHz)			
	Adjustment error	dB	1	2
	Variation during 24 h	dB	1	2
	Gain/frequency response	dB	1	3/2
	Group delay/frequency response referred to minimum	ms	1	1
	Maximum weighted noise level	dBq0ps	4	2
	Single tone interference level	dBm0	2	3/2
	Ratio of disturbing modulation by power supply to reference signal	dB	3	3/2
	Non-linear distortion	%	1	3/2
	Error in reconstituted frequency	Hz	1	3/2
	Intelligible crosstalk ratio	dB	3	3/2
	Error in amplitude/amplitude response	dB	1	3/2
Additional parameters relevant to stereo circuits	Difference in gain between A and B channels	dB	1	(1)
	Phase difference between A and B channels	degree	1	(1)
	Intelligible crosstalk ratio between A and B channels	dB	3	3/2
	Non-linear crosstalk ratio between A and B channels	dB	3	3/2

(1) Some administrations have found $h = 3/2$ appropriate. Tests conducted in Japan [CCIR, 1978-82], however, showed better agreement with quadratic law of addition ($h = 2$) than 3/2 law of addition.

REFERENCES

CCIR Documents

[1978-82]: CMTT/233 (Japan).