INTERNATIONAL TELECOMMUNICATION UNION

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

N.10

(03/93)

MAINTENANCE OF INTERNATIONAL SOUND-PROGRAMME AND TELEVISION TRANSMISSION CIRCUITS

LIMITS FOR THE LINING-UP OF INTERNATIONAL SOUND-PROGRAMME LINKS AND CONNECTIONS

ITU-T Recommendation N.10

(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 N.10 was revised by the ITU-T Study Group IV (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 Similarly, in this reform process, the CCIR and the IFRB have been replaced by the Radiocommunication Sector.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 1993

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
Abstract		ii
Keywords		ii
1	General	1
2	Limits for the loss/frequency distortion of an international sound-programme link	1
References		6

ABSTRACT

This Recommendation gives limits for the line-up of international sound-programme links and connections using bandwidths of 5, 6.4, 7, 10 and 15 kHz carried on analogue transmission systems, and for 7 and 15 kHz carried on mixed analogue/digital or digital systems.

Keywords

Sound-programme, line-up, limits, links, circuits, connections, hypothetical reference circuit.

LIMITS FOR THE LINING-UP OF INTERNATIONAL SOUND-PROGRAMME LINKS AND CONNECTIONS

(Published 1964; revised 1968, 1972, 1976, 1980, 1984 and 1993)

1 General

This Recommendation gives limits in Tables 1 to 5 for the lining-up of international sound-programme links as defined in Recommendation N.1 [5]. These limits correspond to those for three audio sections of the hypothetical reference circuit as defined in Recommendation J.11 [1].

It is not possible at the present time to recommend limits for the sound-programme connection. However, Administrations shall endeavour to provide national sound-programme circuits to as high a standard as possible so that the performance of the sound-programme connection is not markedly different to that of the sound-programme link.

Some Administrations arrange their apparatus in an International Sound-Programme Centre (ISPC) so that at the point of interconnection the output impedance of every receive channel or circuit over the frequency band of interest is substantially lower than the input impedance of any send channel or circuit. This is the so-called constant-voltage technique. Other Administrations arrange for an impedance match at the point of interconnection and choose the value of this impedance to be equal to the design resistance of measuring instruments. This is known as the impedance-matching technique (previously referred to as the constant electromotive force technique). It should be noted that in both cases the through-level measurement results relative to the through-level at 800 Hz will be the same. Furthermore the terminated-level measurement results relative to the terminated-level at 800 Hz will also be the same value[1)].

Hence the limits recommended in the following tables are applicable regardless of the arrangement adopted by Administrations at their ISPCs.

This Recommendation is applicable to analogue, mixed analogue/digital and digital transmissions. In the case of digital transmission performance can be expected to be better than these limits. The test procedures are described in Recommendation N.21 [7].

2 Limits for the loss/frequency distortion of an international sound-programme link

The majority of international sound-programme links are in practice established with three or less circuits in series.

Many links could be established without additional equalizers but links comprising four or more circuits will probably require equalization. In this case the opportunity could again be taken to obtain as good a loss/frequency characteristic as possible.

---

1) This depends on the almost constant ratio of the impedances on the send and receive sides at the various frequencies (see 4/N.11 [6].)

TABLE 1/N.10

Limit for the lining-up of 15 kHz sound-programme links

	Item	Parameter		Unit	Limits
	1	Insertion gain	Adjustment error	dB	± 0.5
			Variation	dB	± 0.5
	2	Gain/frequency response referred to 0.8 or 1 kHz	0.04 to 0.125 kHz	dB	+ 0.5
				dB	– 2.0
			0.125 to 10 kHz	dB	± 0.5
			10 to 14 kHz	dB	± 0.5
				dB	– 2.0
			14 to 15 kHz	dB	+ 0.5
				dB	– 3.0
	3	Group delay/frequency response referred to minimum group delay	0.04 kHz	ms	55
			0.075 kHz	ms	24
			14 kHz	ms	8
			15 kHz	ms	12
	4	Weighted noise	Idle channel	dBq0ps	– 42
			Programme-modulated	dBq0ps	– 30
	5	Single tone interference level + ψ		dBm0s	– 73
	6	Disturbing modulation by power supply		dBm0s	– 45
	7	Total harmonic distortion	0.04 to 0.125 kHz	%	1.0
			0.125 to 7.5 kHz	%	0.5
	8	3rd order difference tone at 0.18 kHz		%	0.5
	9	Error in reconstitued frequency		Hz	± 1.0
	10	Intelligible crosstalk ratio	0.04 kHz	dB	50
			0.5 to 5 kHz	dB	74
			15 kHz	dB	60
	11	Error in amplitude/amplitude response		dB	± 0.5
Additional parameters for stereo transmission	12	Difference in gain between A and B channels	0.04 to 0.125 kHz	dB	1.5
			0.125 to 10 kHz	dB	0.8
			10 to 14 kHz	dB	1.5
			14 to 15 kHz	dB	3.0
	13	Phase difference between A and B channels	0.04 to 0.2 kHz	Degree	30
			0.2 to 4 kHz	Degree	15
			14 kHz	Degree	30
			15 kHz	Degree	40
	14	Intelligible crosstalk ratio A/B		dB	50
	15	Crosstalk ratio (intermodulation) A/B		dB	60

TABLE 2/N.10

Limits for the lining-up of 10 kHz sound programme links

Item	Parameter		Unit	Limits
1	Insertion gain	Adjustment error	dB	± 0.5
		Variation with time	dB	± 0.5
2	Gain/frequency response referred to 0.8 or 1 kHz	0.05 to 0.1 kHz	dB	± 1.7
			dB	– 4.3
		0.1 to 0.2 kHz	dB	+ 1.7
			dB	– 2.6
		0.2 to 6 kHz	dB	± 1.7
		6 to 8 kHz	dB	+ 1.7
			dB	– 2.6
		8 to 10 kHz	dB	+ 1.7
			dB	– 4.3
3	Group delay/frequency response referred to minimum	0.05 kHz	ms	80
		0.1 kHz	ms	20
		10 kHz	ms	8
4	Weighted noise (idle channel)[a]		dBq0ps	– 39
5	Single tone interference level + ψ[b]		dBm0s	– 71
6	Disturbing modulation by power supply		dBm0s	– 45
7	Total harmonic distortion	0.05 to 0.1 kHz	%	3
		0.1 to 10 kHz	%	2
8	3rd order difference tone at 0.18 kHz		%	2
9	Error in reconstituted frequency		Hz	± 1
10	Intelligible crosstalk ratio[c]		dB	74
11	Error in amplitude/amplitude response		dB	± 0.5

a) For circuits on carrier systems it is not always possible in absence of special precautions to meet these limits (see Annex B/J.22 [2]).

b) Or 20 dB below measured weighted noise level whichever is higher.

c) It is in some cases difficult or impossible to meet these limits (see Note 2 of A.3.8/J.22 [2]).

TABLE 3/N.10

Limits for the lining-up of 7 kHz sound programme links

Item	Parameter		Unit	Limits
1	Insertion gain	Adjustment error	dB	± 0.5
		Variation during 24 h	dB	± 0.5
2	Gain/frequency response referred to 0.8 or 1 kHz	0.05 to 0.1 kHz	dB	+ 1
			dB	– 3
		0.1 to 6.4 kHz	dB	± 1
		6.4 to 7 kHz	dB	+ 1
			dB	– 3
3	Group delay/frequency response referred to minimum	0.05 kHz	ms	80
		0.1 kHz	ms	20
		6.4 kHz	ms	5
		7 kHz	ms	10
4	Weighted noise	Idle channel	dBq0ps	– 44
		Programme-modulated	dBq0ps	– 32
5	Single tone interference level + ψ		dBm0s	– 73
6	Disturbing modulation by power supply		dBm0s	– 45
7	Total harmonic distortion	< 0.1 kHz	%	2
		0.1 to 3.5 kHz	%	1.4
8	3rd order difference tone at 0.18 kHz		%	1.4
9	Error in reconstituted frequency		Hz	± 1
10	Intelligible crosstalk ratio	0.05 kHz	dB	53
		0.5 to 3.2 kHz	dB	74
		7 kHz	dB	67
11	Error in amplitude/amplitude response		dB	± 0.5

TABLE 4/N.10

Limits for the lining-up of 6.4 kHz sound programme links

Item	Parameter		Unit	Limits
1	Insertion gain	Adjustment error	dB	± 0.5
		Variation during 24 h	dB	± 0.5
2	Gain/frequency response referred to 0.8 or 1 kHz	0.05 to 0.1 kHz	dB	+ 1
			dB	– 3
		0.1 to 5 kHz	dB	± 1
		5 to 6.4 kHz	dB	+ 1
			dB	– 3
3	Group delay/frequency response referred to minimum	0.05 kHz	ms	80
		0.1 kHz	ms	20
		5 kHz	ms	5
		6.4 kHz	ms	10
4	Maximum weighted noise level		dBq0ps	– 39
5	Single tone interference level at + ψ		dBm0s	– 73
6	Disturbing modulation by power supply		dBm0s	– 45
7	Total harmonic distortion	< 0.1 kHz	%	2
		> 0.1 kHz	%	1.4
8	3rd order difference tone at 0.18 kHz		%	1.4
9	Error in reconstituted frequency		Hz	± 1
10	Intelligible crosstalk ratio	0.05 kHz	dB	53
		0.5 to 3.2 kHz	dB	74
		6.4 kHz	dB	68
11	Error in amplitude/amplitude response		dB	± 0.5

TABLE 5/N.10

Limits for the lining-up of 5 kHz sound programme links

Item	Parameter		Unit	Limits
1	Insertion gain	Adjustment error	dB	± 0.5
		Variation during 24 h	dB	± 0.5
2	Gain/frequency response referred to 0.8 or 1 kHz	0.7 to 0.2 kHz	dB	+ 1
			dB	– 3
		0.2 to 4 kHz	dB	± 1
		4 to 5 kHz	dB	+ 1
			dB	– 3
3	Group delay/frequency response referred to minimum	0.07 kHz	ms	60
		5 kHz	ms	15
4	Maximum weighted noise level		dBq0ps	– 32
5	Single tone interference level + ψ		dBm0s	– 73
6	Disturbing modulation by power supply		dBm0s	– 45
7	Total harmonic distortion	< 0.1 kHz	%	2
		> 0.1 kHz	%	1.4
8	3rd order difference tone at 0.18 kHz		%	1.4
9	Error in reconstituted frequency		Hz	± 1
10	Intelligible crosstalk ratio	0.07 kHz	dB	57
		0.5 to 3.2 kHz	dB	74
		5 kHz	dB	70
11	Error in amplitude/amplitude response		dB	± 0.5

References

[1] CCITT Recommendation J.11 *Hypothetical reference circuits for sound-programme transmissions.*

[2] CCITT Recommendation J.22 *Performance characteristics of 10 kHz type sound-programme circuits.*

[3] CCIR Recommendation 503-3 *Performance of 7 kHz type (narrow bandwidth) sound-programme circuits.*

[4] CCIR Recommendation 505-3 *Performance characteristics of 15 kHz type sound-programme circuits.*

[5] CCITT Recommendation N.1 *Definitions for applications to international sound-programme transmission.*

[6] CCITT Recommendation N.11 *Essential transmission performance objectives for International Sound-Programme Centre (ISPC).*

[7] CCITT Recommendation N.21 *Limits and procedures for the lining-up of a sound-programme circuit.*