INTERNATIONAL TELECOMMUNICATION UNION

CCITT

THE INTERNATIONAL
TELEGRAPH AND TELEPHONE
CONSULTATIVE COMMITTEE

BLUE BOOK

VOLUME IV – FASCICLE IV.3

MAINTENANCE OF INTERNATIONAL SOUND-PROGRAMME AND TELEVISION TRANSMISSION CIRCUITS

SERIES N RECOMMENDATIONS

IXTH PLENARY ASSEMBLY
MELBOURNE, 14-25 NOVEMBER 1988

Geneva 1989

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Part I – Series N Recommendations

Maintenance of international sound-programme and television transmission circuits

PRELIMINARY NOTES

1 The Questions entrusted to each Study Group for the Study Period 1989-1992 can be found in Contribution No. 1 to that Study Group.

2 The list of Supplements in the Contents includes some which are not published in the *Blue Book*. Reference information for these Supplements can be found on the page indicated in the Contents.

3 In this Fascicle, the expression "Administration" is used for shortness to indicate both a telecommunication Administration and a recognized private operating agency.

PART I

Series N Recommendations

MAINTENANCE OF INTERNATIONAL SOUND-PROGRAMME AND TELEVISION TRANSMISSION CIRCUITS

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SECTION 1

INTERNATIONAL SOUND-PROGRAMME TRANSMISSION

1.1 International sound-programme transmissions – Definitions

Recommendation N.1

DEFINITIONS FOR APPLICATION TO INTERNATIONAL SOUND-PROGRAMME TRANSMISSIONS[1),2)]

The following definitions apply to the maintenance of international sound-programme transmissions. Other definitions are used for other purposes, e.g., an international sound-programme link and international multiple destination sound-programme link as defined in §§ 11 and 12 respectively below, are within the definition of an international sound-programme circuit as defined by the CMTT.

Note 1 – It is intended that the definitions given in Recommendations N.1 and N.51 should remain identical, so far as is practical, by use of only simultaneous amendments.

Note 2 – A sound-programme circuit section, circuit, link or connection is considered to be permanent for maintenance purposes if it is always available for use when required, whether or not it is continuously in use. Such a circuit may be used for the purposes of occasional transmission, that is, transmissions of short duration, e.g. less than 24 hours, or it may be used for a long duration, i.e. one day or more. A permanent sound-programme connection between broadcasting organizations' premises may be used at any time, except only for periods of maintenance as agreed between the Administrations and broadcasting organizations concerned.

A sound-programme circuit section, circuit, link or connection is considered to be temporary for maintenance purposes when it has no existence outside the period of transmission (including line-up and testing time) for which it is required.

1 international sound-programme transmission

The transmission of sound signals over the international telecommunication network for the purpose of interchanging sound-programme material between broadcasting organizations in different countries.

2 broadcasting organization

A broadcasting organization is an organization which is concerned with either or both sound and television broadcasting. Most of the customers ordering facilities for sound-programme and television transmission are broadcasting organizations; for convenience, the term broadcasting organization is used to denote the activity of any user or customer and, where so used, it is equally applicable to any other customer requiring sound-programme or television transmissions.

---

1) Definitions in this Recommendation apply both to analogue and digital systems.

2) Annex A to this Recommendation gives definitions for units of measurements for sound-programme transmissions.

3 broadcasting organization (send)

The broadcasting organization at the sending end of an international sound-programme transmission.

4 broadcasting organization (receive)

The broadcasting organization at the receiving end of an international sound-programme transmission.

5 international sound-programme centre (ISPC)

A centre at which at least one international sound-programme circuit (see § 9) terminates and in which international sound-programme connections (see § 13) can be made up by the interconnection of international and national sound-programme circuits.

The responsibility of an ISPC is given in Recommendation N.5.

6 national sound-programme centre (NSPC)

A centre at which two or more national sound-programme circuits terminate and at which national sound-programme circuits may be interconnected.

7 sound-programme circuit section

The unidirectional national or international sound-programme transmission path between two stations at which the programme is accessible at audio frequencies. The transmission path may be established via terrestrial or single destination satellite routing. (See Note 2 above and Figures 1/N.1 and 3/N.1.)

8 international multiple destination sound-programme circuit section

The unidirectional sound-programme transmission path from one frontier station to two or more of the frontier stations at which interconnection is made at audio frequencies. (See Note 2 above and Figure 4/N.1.)

9 international sound-programme circuit

The transmission path between two ISPCs which comprises one or more sound-programme circuit sections (national or international), together with any necessary audio equipment. The transmission path may be established via terrestrial or single destination satellite routing. (See Note 2 above and Figures 1/N.1 and 3/N.1.)

10 international multiple destination sound-programme circuit

The unidirectional transmission path from one ISPC to two or more other ISPCs comprising sound-programme circuit sections (national or international) one of which is an international multiple destination circuit section, together with any necessary audio equipment. (See Note 2 above and Figure 4/N.1.)

11 international sound-programme link

The unidirectional transmission path between the ISPCs of the two terminal countries involved in an international sound-programme transmission. The international sound-programme link comprises one or more international sound-programme circuits (see Figures 1/N.1 and 3/N.1 below) interconnected at intermediate ISPCs. It can also include national sound-programme circuits in transit countries. (See Note 2 above and Figure 2/N.1.)

12 international multiple destination sound-programme link

The unidirectional transmission path between the ISPCs of the terminal countries involved in an international multiple destination sound-programme transmission. The international multiple destination sound-programme link comprises international sound-programme circuits, one of which is an international multiple destination sound-programme circuit. (See Note 2 above and Figure 5/N.1.)

13 international sound-programme connection

The unidirectional transmission path between the broadcasting organization (send) and the broadcasting organization (receive) comprising the international sound-programme link extended at its two ends over national sound-programme circuits to the broadcasting organization. (See Note 2 above and Figure 2/N.1.)

14 international multiple destination sound-programme connection

The unidirectional transmission path between the broadcasting organization (send) and two or more broadcasting organizations (receive) comprising the international multiple destination sound-programme link extended at its ends over national sound-programme circuits to the broadcasting organizations. (See Note 2 above and Figure 5/N.1.)

15 send reference station

The transmit sub-control station of an international multiple destination sound-programme circuit section (see § 8), circuit (see § 10) or link (see § 12). (See Figures 4/N.1 and 5/N.1.)

16 effectively transmitted signals in sound-programme transmission

For sound-programme *transmission*, a signal at a particular frequency is said to be effectively transmitted if the nominal overall loss at that frequency does not exceed the nominal overall loss at 800 Hz by more than 4.3 dB. This should not be confused with the analogous definition concerning telephone circuits given in the Recommendation cited in [1].

For sound-programme *circuits*, the overall loss (relative to that at 800 Hz) defining effectively transmitted frequency is 1.4 dB, i.e. about one third of the allowance.

17 types of sound-programme circuit[3]

The various types of international sound-programme circuit or sections of such circuits should be referred to by quoting the top nominal frequency, in kHz, effectively transmitted.

Example: 10-kHz sound-programme circuit.

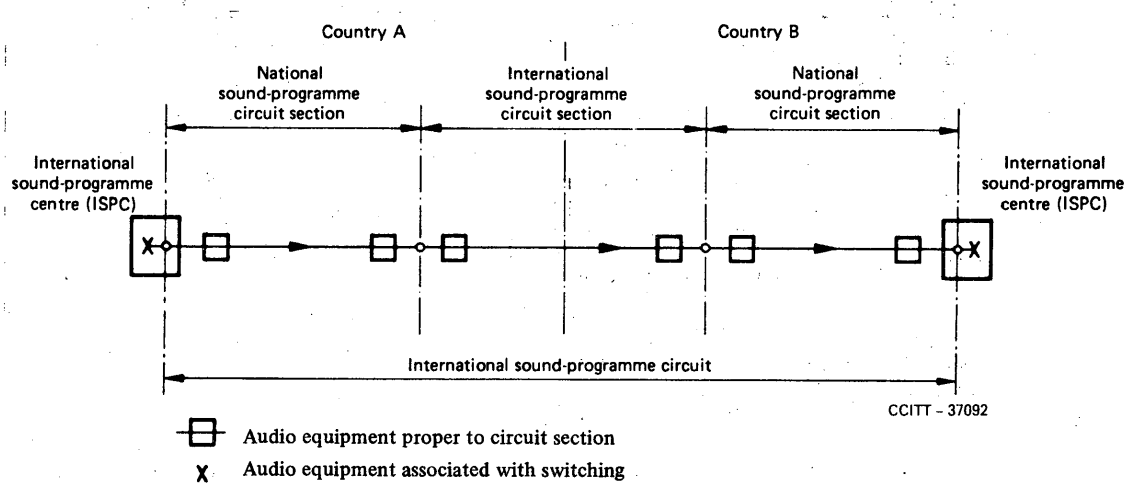
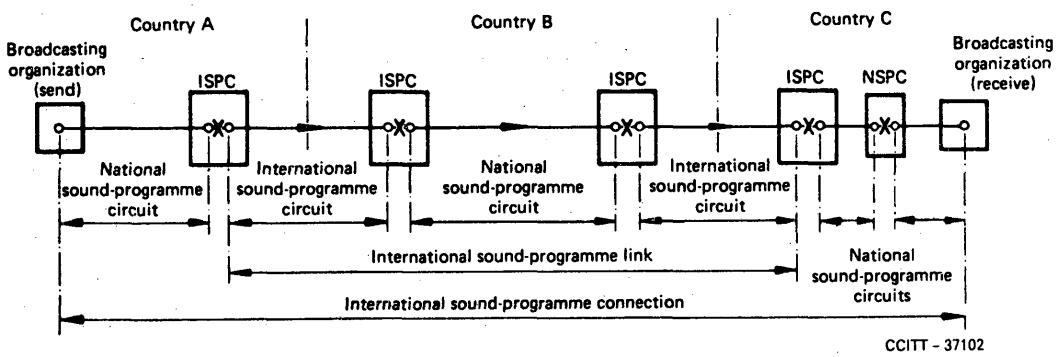


FIGURE 1/N.1

An international sound-programme circuit composed of two national and one international sound-programme circuit-sections

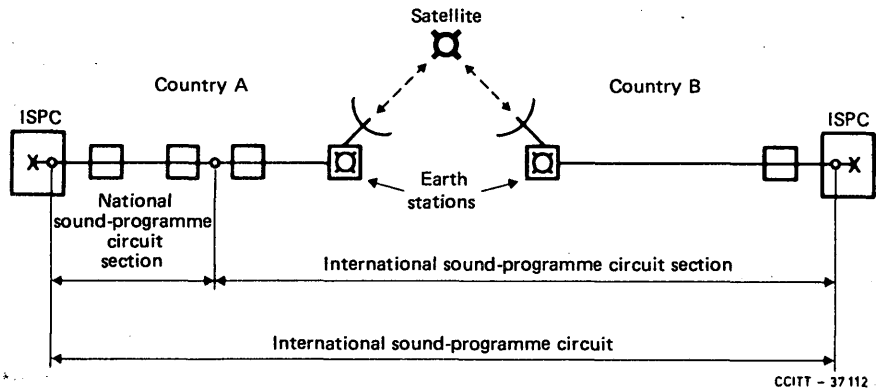
[3] To reduce problems in ordering and charging for sound-programme circuits, Study Group II has a classification of circuits based on their approximate bandwidth (see the Recommendation cited in [2]).



X Audio equipment associated with switching

FIGURE 2/N.1

An international sound-programme link composed of international and national sound-programme circuits and extended on a national sound-programme circuit at each end to form an international sound-programme connection



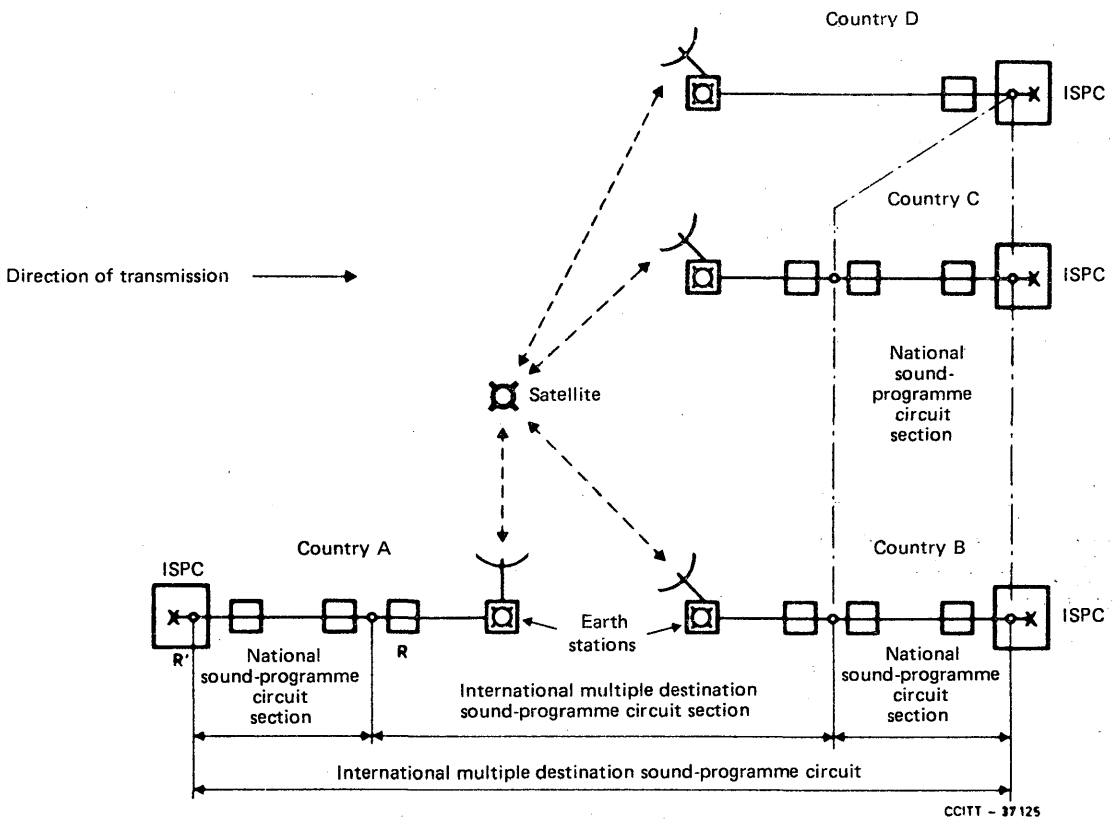
Audio-equipment proper to the circuit section

X Audio equipment associated with switching

ISPC International sound-programme centre

FIGURE 3/N.1

Single-destination international sound-programme circuit routed via a communication satellite system



Audio equipment proper to a circuit section

X Audio equipment associated with switching

ISPC International sound-programme centre

R *Send reference* station for the multiple destination international sound-programme circuit section

R' *Send reference* station for the multiple destination international sound-programme circuit

FIGURE 4/N.1

International multiple destination sound-programme circuit routed via a communication satellite system

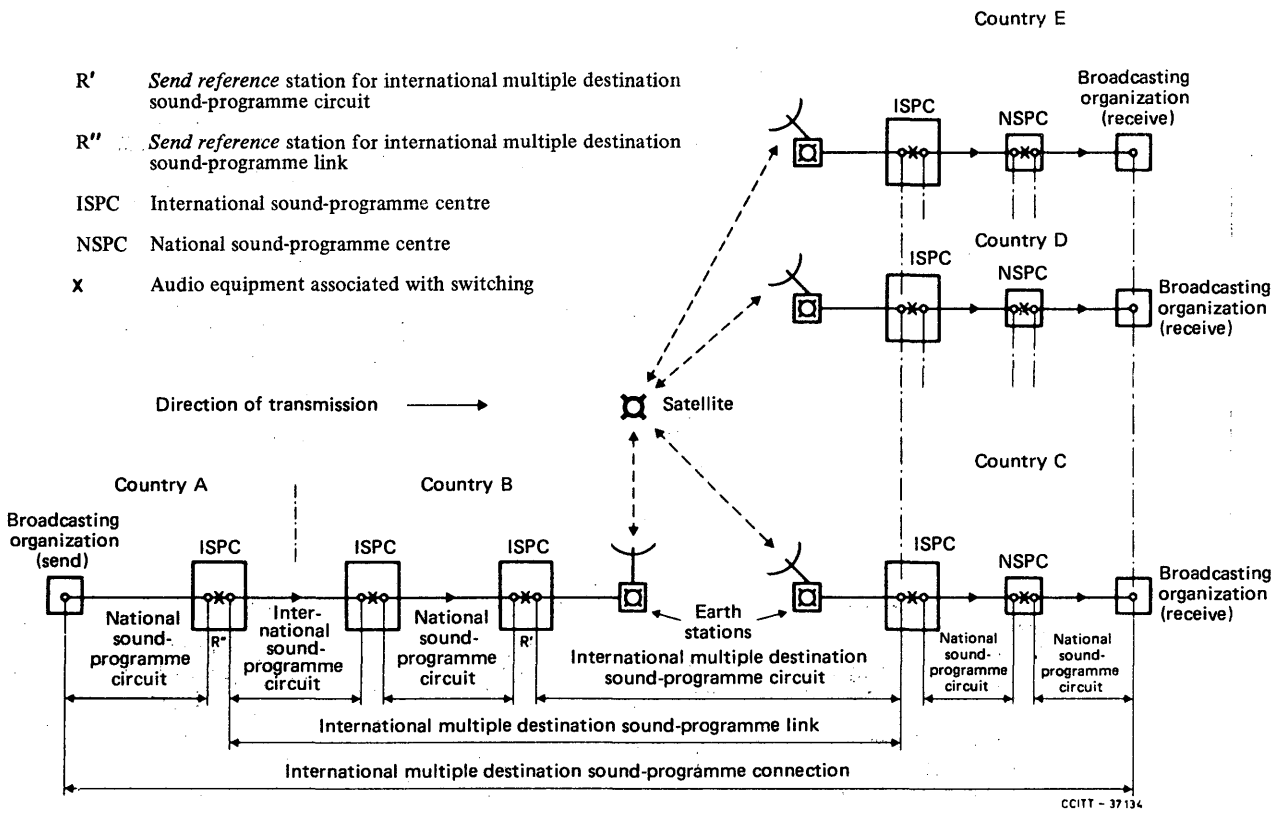


FIGURE 5/N.1

International multiple destination sound-programme link extended to form a connection routed via a communication satellite system

ANNEX A[4]

(to Recommendation N.1)

Level and loss units used for sound-programme and television transmission

A.1 *Use of dB units in N Recommendations*

This Recommendation gives the quantities and units for sound-programme transmissions used in N Recommendations and is in accordance with existing Recommendations [3], [4].

A.2 *Units used*

A.2.1 **absolute power level (dBm)**

As a general rule, the dBm unit applies to the absolute power level. The unit is based on the ratio between measured power and the reference power of 1 mW.

$$L_m = 10 \log \frac{P}{P_0} \text{ dBm} = 10 \log \frac{(U^2/Z)}{(U_0^2/Z_0)} \text{ dBm} = \left(20 \log \frac{U}{U_0} - 10 \log \frac{Z}{Z_0}\right) \text{ dBm}$$

Absolute power level = Absolute voltage level + Impedance correction

Absolute voltage levels, for which terminal impedance is not defined, are more rarely used. As a correction, power level may be calculated for impedances other than 600 ohms, with respect to 1 mW.

The power level thus calculated would be equal to that measured in a correctly terminated system.

A.2.2 **relative level (dBr)**

The relative power level of a point in a transmission system is the nominal power gain at the reference frequency from a reference point to the point considered. The same consideration is used for the relative voltage level in a transmission system based on voltage levels.

Relative levels can be used to compare two or more points of a network with respect to power (or voltage). One point of a network is usually defined as the reference point at 0 dBr, from which other measurement points are derived.

For sound-programme circuits, the zero relative level is located at the injection point, i.e. usually at the transmission point of a sound-programme circuit.

A.2.3 **absolute zero power level (dBm0) (load level[5])**

In a transmission system based on power levels the absolute power level or load level (L_{m0}) with respect to 1 mW is referred to a point of zero relative level. That means that the absolute power level (L_m) minus the relative power level (L_r) will be

$$L_{m0} = L_m - L_r$$

This level indication is independent of the relative power level at the measurement point considered. For a given signal the load level is nominally the same along a transmission line. For this indication it is necessary to know to what extent the power at the zero relative point is greater or less than the reference power.

[4] It is intended that the text contained in this annex will be further studied and refined as necessary.

[5] The term "load level" is used provisionally and is subject to further consideration.

A.2.4 *Relation between quantities and units*

There is a fixed relation between level quantities and units, namely:

Absolute power level = relative power level + absolute zero power level (load level)

$$L_m = L_r + L_{m0}$$

Therefore, for the level units: a dBm = b dBr + c dBm0.

When indications are given concerning the line signal, the absolute zero power level (load level) (dBm0) is given, at which, at the relative zero point, the absolute power level coincides with the relative power level.

$$L_m = L_{m0}, \text{ for } L_r = 0$$

In order to simplify the specification of the level of a circuit or a system, it is most appropriate to specify the absolute power level which coincides with the relative zero power level. Thus this absolute power level and the absolute zero power level (load level) are the same.

A.2.5 *Weighted level*

Power level of disturbing signals are as a rule expressed in the same units as those defined above. For noise measurements made by a weighting filter (psophometric measurements), a "p" (for "pondéré" = weighted) is added to the units, e.g., dbm0p, dBmp.

A "q" indicates a quasi-peak value where the "m" is replaced by a "q" which, for instance, in dBm gives dBq.

A.2.6 *Extra indications*

Sound-programme transmission level units are indicated by an extra "s" (s for sound): dBrs, dBm0s, dBm0ps, dBq0pS.

Extra indications for units should be used whenever they facilitate understanding so as to prevent confusion when differing measurement techniques, weighting filters or meters are used.

A.3 *Various measuring instruments*

Absolute power level (in dBm) is obtained if a measurement is made on a terminated line.

Various measurement instruments provide measurements related to a (freely) preselected relative level value. The measurement will then directly express the absolute zero power level (load level).

A.4 *Practical problems*

There is a wide range of measuring instruments used at different measurement points, so that differences are always bound to appear. A state which every Administration is prepared to define is the permitted maximum level (PML). Despite different relative power levels, depending on the systems, a direct relation can now be indicated between the value of the level to be measured and the PML in dB. If, for instance, a signal of 21 dB below the PML is transmitted as a measurement signal, it must also be received as a signal 21 dB below PML, independently of local relative levels, which may differ according to systems and Administrations.

References

[1] CCITT Recommendation *General performance objectives applicable to all modern international circuits and national extension circuits*, Vol. III, Rec. G.151, Note 1, § 1.

[2] CCITT Recommendation *Occasional provision of circuits for International sound- and television-programme transmissions*, Vol. II, Rec. D.180, § 3.

[3] CCITT Recommendation *Use of the decibel and neper in telecommunications*, Vol. I, Rec. B.12.

[4] CCIR Recommendation *Use of the decibel and neper in telecommunications*, Vol. XIII, Rec. 574, ITU, Geneva, 1986.

Recommendation N.2

DIFFERENT TYPES OF SOUND-PROGRAMME CIRCUIT[1]

The characteristics of the various types of international sound-programme circuit defined in Recommendations J.21 [1], J.22 [2] and J.23 [3] are as follows:

15 kHz;

10 kHz;

5, 6.4 and 7 kHz.

From the point of view of sound-programme transmission ordinary telephone circuits are generally considered to be suitable only for the transmission of speech. It should be noted that the limits of the loss/frequency distortion cannot be guaranteed to be better than the limits shown in Recommendation M.580 [4].

When a telephone circuit is used for a sound-programme transmission the terminating sets and the signalling equipment must be disconnected to avoid echo effects and false operation of the signal receiver.

When a telephone circuit is used for a sound-programme transmission, a point of zero relative level of the telephone circuit must coincide with a point of zero relative level on the sound-programme circuit. (However, see § 2 of Recommendation N.15 in which it is pointed out that a 6-dB loss should be introduced in order to reduce the mean power level delivered to the telephone circuit system).

References

[1] CCITT Recommendation *Performance characteristics of 15 kHz type sound-programme circuits*, Vol. III, Rec. J.21.

[2] CCITT Recommendation *Performance characteristics of 10 kHz type sound-programme circuits*, Red Book, Vol. III, Rec. J.22, ITU, Geneva, 1984.

[3] CCITT Recommendation *Performance characteristics of narrow-bandwidth sound-programme circuits*, Vol. III, Rec. J.23.

[4] CCITT Recommendation *Setting up and lining up an international circuit for public telephony*, Vol. IV, Rec. M.580.

Recommendation N.3

CONTROL CIRCUITS

1 Definition of control circuit

A control circuit is a telephone-type circuit between the point of origin of the programme and the point where it terminates (recording equipment, studio, switching centre, transmitter, etc.) used by a broadcasting organization for the supervision and coordination of a sound or television transmission.

More than one control circuit may be used in association with the different programme connections involved in a single transmission, such as:

a) the *television* connection;

b) the *international sound* connection (for supervising the programme effects circuit provided for transmitting, for example, the background noises of a programme);

c) the *commentary* connection (for supervising the sound-programme circuit transmitting a commentary in a given language);

d) the *complete programme* connection (for supervising the sound-programme circuit transmitting the whole of the sound part of a programme).

[1] This Recommendation applies also to 7 kHz and 15 kHz digital sound-programme circuits.

2 Provision of control circuits for sound-programme and television transmission [1)]

The conditions governing the provisions and lease of control circuits for sound-programme and television transmissions are given in Recommendation D.180 [1].

Reference

[1] CCITT Recommendation *Occasional provision of circuits for International* sound- and television-programme *transmissions*, Vol. II, Rec. D.180.

Recommendation N.4

DEFINITION AND DURATION OF THE LINE-UP PERIOD AND THE PREPARATORY PERIOD

For each international sound-programme transmission a distinction is made between:

– **line-up period**

The period during which the Administrations line up the international sound-programme link before handing it over to the broadcasting organizations; and

– **preparatory period**

The period during which these broadcasting organizations do their own adjustments, tests and other work before the sound-programme transmission itself commences.

1 Line-up period

1.1 *Duration*

In principle, the duration of the line-up period should be 15 minutes. However, in the case of sound-programme transmissions involving more than two countries, the duration may be increased. On the other hand, in certain cases, by agreement between the Administrations concerned, the duration may be less than 15 minutes, provided the line-up is properly carried out. This may be possible, for example, when there are two successive international sound-programme transmissions on the same route and the second involves extending the international sound-programme link already laid up for the first.

Note – In the case of multiple destination transmissions the line-up period can have a longer duration, to be fixed by agreement between the Administrations concerned, e.g., on the order of 25 to 30 minutes.

At the end of the line-up period the international sound-programme link and the control circuits are handed over to the broadcasting organizations at the booked time.

2 Preparatory period

2.1 *Beginning and duration*

When the tests during the line-up period are completed, the *international sound-programme link* is not made available to the broadcasting organizations at the two ends until the time fixed for the beginning of the preparatory period. The chargeable time for the sound-programme transmission commences at the beginning of the preparatory period. The duration of the preparatory period – i.e. the time between handing over the international sound-programme link to the broadcasting organizations and the moment when the programme properly begins – is chosen in each case by the broadcasting organizations so that they can carry out all the tests and adjustments necessary before proceeding with the sound-programme transmission.

[1)] The CCITT has noted the fact that broadcasting organizations use a tone having a frequency of 1900 Hz ± 6 Hz and a level not exceeding −10 dBm0, for their signalling purposes on control circuits. Under the conditions of use specified in the CCITT Recommendations for control circuits, the CCITT has no objections to the use of this tone.

Recommendation N.5

SOUND-PROGRAMME CONTROL, SUB-CONTROL AND SEND REFERENCE STATIONS

1 Responsibilities of control and sub-control stations

1.1 For a unidirectional international sound-programme circuit, the receiving end terminal ISPC is normally the control station. The other terminal ISPC is a terminal sub-control station. The functions of the control and sub-control stations are the same as for ordinary telephone circuits. (See Recommendations M.80 [1] and M.90 [2].)

Note – In the case of a reversible sound-programme circuit, setting-up reference measurements and maintenance measurements are carried out for each direction of transmission.

1.2 The international sound-programme link is in all cases the sole responsibility of the telephone Administrations. If the international sound-programme link passes through one or more transit countries, an intermediate sub-control station is also designated for each transit country.

1.3 The national sound-programme circuits at the ends of the link may be the responsibility of either the Administrations or the broadcasting organizations or the two together depending on local arrangements in each particular country.

1.4 The receiving ISPC stations on multiple destination sound-programme circuits or links act as control stations for the circuit or link in accordance with Recommendations M.80 [1] and M.90 [2]. In this case the following additional responsibilities should apply:

a) reporting to the appropriate send reference station (see § 2) the results of measurements made on the circuit and link and the quality assessments observed on the link;

b) reporting fault conditions to the circuit or link send reference station (see § 2).

1.5 The intermediate ISPCs are intermediate sub-control stations for the international sound-programme link.

1.6 The ISPC or the repeater station at the sending end (country A in Figures 2/N.1 and 5/N.1) is a terminal sub-control station for the international sound-programme connection. When a send reference station (see § 2) is associated with a multiple destination communications-satellite link, it has the following responsibilities:

a) coordination of lining up the multiple-destination sound-programme circuit sections, circuits and links, respectively;

b) keeping a record of the measurements made during the lining-up period of the circuit section, circuit or link, and recording the quality assessments observed at control stations during the lining-up of the link;

c) relevant maintenance action for the sub-control and control stations at the request of one of these stations.

However, the choice of the station nominated as the terminal sub-control station is left to the discretion of the Administration concerned.

1.7 Exchange of contact point information on sound-programme transmission should be made in accordance with Recommendation M.93 [3].

2 Send reference stations

Sound-programme transmissions provided on a multiple destination basis using a communication satellite system, differ from those using only terrestrial facilities in that the common transmitting path extends through the transmitting earth station to the satellite. The receiving paths extend from the satellite through the receiving earth stations concerned to the terminal ISPC control stations.

Operations on the common path of the connection affect all receiving stations, whereas on any of the other paths the operations affect only the one receiving terminal station involved. These distinctive features of a multiple destination sound-programme transmission provided in the above manner require the assistance of certain stations designated as send reference stations.

Send reference stations are situated along the common path of the sound-programme circuit or link and are identified as follows:

a) a sub-control station located at the transmitting terminal of the circuit section containing the space segment;

b) the terminal sub-control stations for the circuit and link containing the space segment.

Figure 4/N.1 shows the basic composition for a multiple destination sound-programme circuit routed via a communication satellite system. The send reference stations are shown as R and R′ for the multiple destination circuit section and circuit respectively.

Figure 5/N.1 shows the basic composition for a multiple destination sound-programme link and connection routed via a communication satellite system. The send reference stations are shown as R′ and R″ for the multiple destination circuit and link respectively.

References

[1] CCITT Recommendation *Control stations*, Vol. IV, Rec. M.80.

[2] CCITT Recommendation *Sub-control stations*, Vol. IV, Rec. M.90.

[3] CCITT Recommendation *Exchange of contact point information for the maintenance of international services and the international network*, Vol. IV, Rec. M.93.

1.2 Setting-up, lining-up and monitoring the international sound-programme links and connections

It is assumed that the international sound-programme connection is as shown in Figure 2/N.1. It is also assumed that the various sound-programme circuits to be interconnected to constitute the international sound-programme link are circuits established and maintained as given in Subsection 1.3 below.

Recommendation N.10

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

1 General

This Recommendation gives limits in Tables 1/N.10 to 5/N.10 for the lining-up of international sound-programme links as defined in Recommendation N.1. These limits correspond to those for three audio sections of the hypothetical reference circuit as defined in CCIR Recommendation 502 [1] for 5 kHz, 6.4 kHz, 7 kHz and 10 kHz type sound-programme circuits, but correspond to four audio sections for 15-kHz type sound-programme circuits except for noise limits, which correspond to three audio sections [2][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.

[1] Wider tolerance limits are recommended for 15-kHz type sound-programme circuits because of performance limitation of commercial equipment.

Some Administrations arrange their apparatus in an 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 [2].

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

The test procedures are described in Recommendation N.21. The limits for 15 kHz and 7 kHz circuits are applicable both for analogue and digital transmissions.

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.

[2] This depends on the almost constant ratio of the impedances on the send and receive sides at the various frequencies. (See § 4 of Recommendation N.11.)

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	±0.6
		Variation during 24 h	dB	±0.6
2	Gain/frequency response referred to 0.8 or 1 kHz	0.04 to 0.125 kHz	dB	+0.6
			dB	−2.4
		0.125 to 10 kHz	dB	±0.6
		10 to 14 kHz	dB	+0.6
			dB	−2.4
		14 to 15 kHz	dB	+0.6
			dB	−3.6
3	Group delay/frequency response referred to minimum	0.04 kHz	ms	73
		0.075 kHz	ms	32
		14 kHz	ms	11
		15 kHz	ms	16
4	Weighted noise	Idle channel	dBq0ps	−42
		Programme-modulated	dBq0ps	−30
5	Single tone interference level + ψ		dBm0s	−71
6	Disturbing modulation by power supply		dB	−43
7	Total harmonic distortion	0.04 to 0.125 kHz	%	1.2
		0.125 to 7.5 kHz	%	0.6
8	3rd order difference tone at 0.18 kHz		%	0.6
9	Error in reconstituted frequency		Hz	±1.2
10	Intelligible crosstalk ratio	0.04 kHz	dB	48
		0.5 to 5 kHz	dB	72
		15 kHz	dB	58
11	Error in amplitude/amplitude response		dB	±0.6

TABLE 1/N.10 *(cont.)*

	Item	Parameter		Unit	Limits
Additional parameters for stereo transmission	12	Difference in gain between A and B channels	0.04 to 0.125 kHz	dB	1.8
			0.125 to 10 kHz	dB	1
			10 to 14 kHz	dB	1.8
			14 to 15 kHz	dB	3.6
	13	Phase difference between A and B channels	0.04 to 0.2 kHz	degree	36
			0.2 to 4 kHz	degree	18
			14 kHz	degree	36
			15 kHz	degree	48
	14	Intelligible crosstalk ratio A/B		dB	48
	15	Crosstalk ratio (intermodulation) A/B		dB	58

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		dB	−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 II to CCIR Recommendation 504 [3]).

[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 § 3.8, Note 2, in the Annex I to CCIR Recommendation 504 [3]).

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		dB	−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		dB	−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		dB	−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] CCIR Recommendation *Hypothetical reference circuits for sound-programme transmissions*, Vol. XII, Rec. 502, ITU, Geneva, 1986.

[2] CCIR Recommendation *Estimation of transmission performance of sound-programme circuits shorter or longer than the hypothetical reference circuit*, Vol. XII, Rec. 605, ITU, Geneva, 1986.

[3] CCIR Recommendation *Performance characteristics of 10 kHz type sound-programme circuits*, Vol. XII, Rec. 504, ITU, Geneva, 1982.

Recommendation N.11

ESSENTIAL TRANSMISSION PERFORMANCE OBJECTIVES FOR INTERNATIONAL SOUND-PROGRAMME CENTRES (ISPC)

1 Transmission level at interconnection points

Levels at interconnection points must be such that a signal level of 0 dBm0 on the incoming circuit gives rise to a signal level of 0 dBm0 on the outgoing circuit. A nominal relative level of +6 dBr is recommended at interconnection points (see also Figure 3/J.13 [1] and Recommendation J.14, § 1 [2]).

2 Balance with respect to earth

The balance with respect to earth (measured by the method defined in [3]) of nominally balanced apparatus should be at least 60 dB in order to give an adequate suppression against longitudinal interference induced by power supplies, alarm circuits, etc.

3 Access points

There should be a well-defined circuit access point associated with the input to a sound-programme circuit at which the transmission test levels at all frequencies over the band are nominally the same. This access point may be the interconnection point or separated therefrom by distortion-free loss or gain. A well-defined circuit access point should also be associated with the output of a sound-programme circuit.

The nominal relative level at each access point will be chosen by each Administration, bearing in mind the dynamic range of their testing and transmission apparatus.

Measurements on a sound-programme circuit should be made between such circuit access points.

Administrations may also find it convenient to arrange for sound-programme circuit sections to be equipped with similar access points. International sound-programme circuit sections which can be connected to a variety of other circuit sections should always be equipped with such access points.

4 Interconnection of sound-programme circuits

4.1 *Constant voltage technique*

If the modulus of the output impedance of any source is not greater than one hundredth of the modulus of the lowest impedance that can be connected to it (bearing in mind that it is possible to connect two or more loads in parallel) then the change in level due to change of load will be negligibly small (less than 0.1 dB approximately).

4.2 *Impedance matching technique*

If the return loss versus the nominal design resistance of the measuring instruments of the impedance presented by incoming and outgoing circuits to the points where they are interconnected is at least 26 dB over the range 50 Hz to 10 or 15 kHz, the error due to mismatch will be insignificant, assuming that the impedance of testing apparatus has at least 30-dB return loss versus the nominal design resistance, which can be, for example, 600 ohms non-reactive.

4.3 *Digital technique*

The interconnection of digital sound-programme circuits will be made by preference with the aid of a digital interface presenting the following characteristics:

- plesiochronous or synchronous operation
- bit rate of 384 kbit/s, 1544 kbit/s or 2048 kbit/s
- 384 kbit/s to carry either one 15 kHz or two 7 kHz sound-programme signals.

*Interface for other bit rates, namely to provide for 15 kHz monophonic and stereophonic circuits with linear coding and for 7 kHz monophonic sound-programme circuits with companded coding are the subject of further study.

References

[1] CCITT Recommendation *Definitions for international sound-programme circuits*, Vol. III, Rec. J.13.

[2] CCITT Recommendation *Relative levels and impedances on an international sound-programme connection*, Vol. III, Rec. J.14.

[3] CCITT Recommendation *Transmission aspects of unbalance about earth* Vol. III, Rec. G.117.

Recommendation N.12

MEASUREMENTS TO BE MADE DURING THE LINE-UP PERIOD THAT PRECEDES A SOUND-PROGRAMME TRANSMISSION

After the connection of the various circuits to form the international sound-programme link (conforming to the level diagrams of these circuits) it is necessary to verify, by means of an automatic measuring equipment (see Recommendations O.31 [1], O.32 [2] and O.33 [3]) or by measurements at individual frequencies, that the received level at the distant incoming terminal ISPC is at the correct value (see Recommendation N.10) at the following frequencies:

for an international sound-programme link composed entirely of 15-kHz sound-programme circuits	40, 800 and 15 000 Hz
for an international sound-programme link composed entirely of 10-kHz sound-programme circuits	50, 800 and 10 000 Hz
for an international sound-programme link comprising at least one 7 kHz sound-programme circuit	50, 800 and 7 000 Hz
for an international sound-programme link comprising at least one 6.4-kHz sound-programme circuit	50, 800 and 6 400 Hz
for an international sound-programme link comprising at least one 5 kHz sound-programme circuit	100, 800 and 5 000 Hz
for an international sound-programme link comprising at least one ordinary telephone circuit	300, 800 and 3 400 Hz[1]

The send level during these measurements should be −12 dBm0.

In the case of 15-kHz sound-programme links forming a stereophonic pair, it is necessary to verify the interchannel parameter limits specified in Table 4/N.10.

A measurement of other parameters such as nonlinear distortion and noise should be measured on all links and the results recorded. At the present time the limits cannot be specified.

The national sound-programme circuits should be so adjusted that, when they are connected to the international sound-programme link, the level diagrams of the international sound-programme circuits are respected. In this regard, a useful and quick method which Administrations could use to verify the correct alignment of sound-programme links is given in Annex A of Recommendation N.13.

Any necessary adjustments having been made, the national circuits are connected to the international sound-programme link at the terminal ISPCs. This is the end of the line-up period and the beginning of the preparatory period and is the instant when the complete connection is placed at the disposal of the broadcasting organizations.

The latter then proceed to measure and adjust as necessary.

References

[1] CCITT Recommendation *Automatic measuring equipment for sound-programme circuits*, Vol. IV, Rec. O.31.

[2] CCITT Recommendation *Automatic measuring equipment for stereophonic pairs of sound-programme circuits*, Vol. IV, Rec. O.32.

[3] CCITT Recommendation *Automatic equipment for rapidly measuring stereophonic pairs and monophonic sound-programme circuits, links and connections*, Vol. IV, Rec. O.33.

[1] Or the frequency appropriate to the telephone-type circuit used.

Recommendation N.13

MEASUREMENTS TO BE MADE BY THE BROADCASTING ORGANIZATIONS DURING THE PREPARATORY PERIOD

After the broadcasting organizations have taken possession of the international sound-programme connection, they make measurements on the complete connection in the band of frequencies effectively transmitted, from the point where the programme is picked up to the point where the programme is received.

The broadcasting organizations should, for their measurements, send from the origin of the international sound-programme connection a sinusoidal signal at the reference frequency (800 or 1000 Hz) only, whose maximum amplitude is 9 dB below that of the maximum instantaneous voltage that should never be exceeded at this point in the course of a sound-programme transmission.

The duration of the period during which the signal at this level is sent should be kept as short as possible, for example, of the order of 30 seconds. If necessary, the ISPCs should verify that the received level at the access point on the international sound-programme circuit is equivalent to 0 dBm0.

When it is necessary, either for purposes of fault location or to maintain a watch on the continuity of the circuit, to send a continuous tone, or when making measurements at other frequencies than the reference frequency, the amplitude at the origin of the international sound-programme connection should be 21 dB below the voltage that should never be exceeded at this point during the course of a sound-programme transmission. Under these circumstances the level at the access point on the international sound-programme circuit is equivalent to -12 dBm0.

During the preparatory period a useful signal which can be used for the alignment of sound-programme connections is that shown in Figure A-1/N.13. The definitions and its method of use are given in Annex A of this Recommendation. A suitable automatic measuring equipment for this purpose is specified in Recommendation O.33 [1].

Note – The numerical values given above ensure that during the sound-programme transmission the peak voltage at a zero relative level point will not exceed that of a sinusoidal signal having an r.m.s. value of 2.2 volts.

The reason for sending the reference frequency only for short durations during this final line-up, at a voltage 9 dB below the peak voltage is that it is not desirable to subject carrier systems to overloading by continuously transmitting a test signal corresponding to the peak voltage reached only momentarily during the transmission of an actual programme.

ANNEX A[1]

(to Recommendation N.13)

Signals for the alignment of international sound-programme connections

A.1 *Definitions*

A.1.1 **source identification**

An announcement should be used to identify the originating point of the test signals and should be preferably as short as possible. It is suggested that such an announcement contain at least the following information:

- name of originating organization;
- location;
- country.

The sound programme signal should be controlled by the sending broadcaster so that the amplitudes of the peaks only rarely exceed the peak amplitude of the permitted maximum (sine-wave test) signal.

[1] Based on CCIR Recommendation 661 [2].

A.1.2 *Test signal and level definitions*

A.1.2.1 **alignment signal (AS)**

Sine-wave signal at 1020 Hz at a level of 0 dBm0s, which is used to align the international sound-programme connection.

A.1.2.2 **measurement signal (MS)**

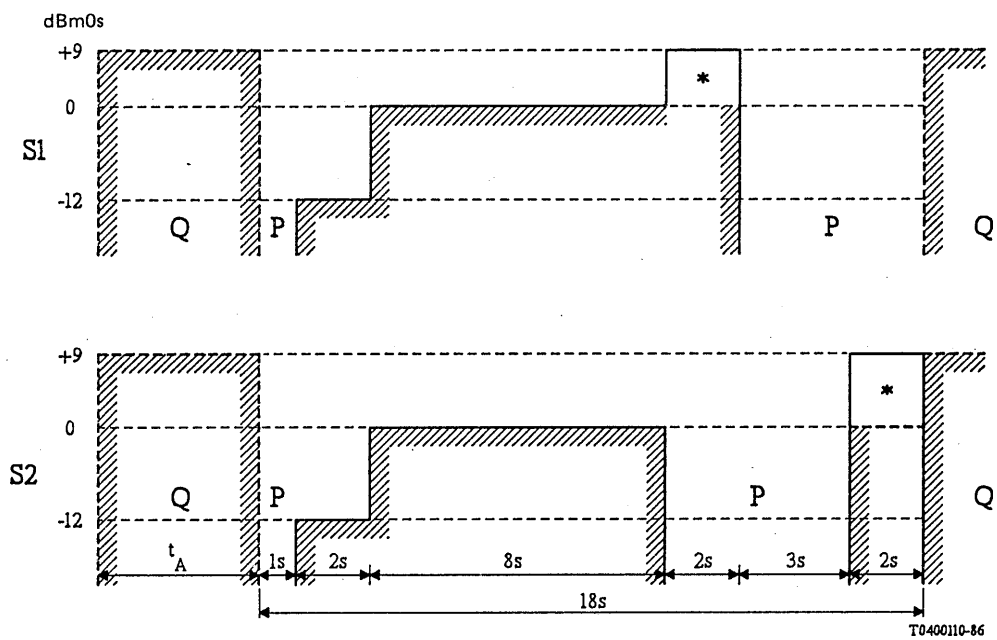
Sine-wave signal at 1020 Hz at a level 12 dB below the alignment signal level, which should be used for long-term measurements and measurements at all frequencies.

A.1.2.3 **permitted maximum signal (PMS)**

Sine-wave signal at 1020 Hz, 9 dB above the alignment signal level, equivalent to the permitted maximum programme-signal level.

A.2 *Test signal format*

A.2.1 A three-level sinusoidal test signal at a reference frequency of 1 kHz should be used to check the alignment of international sound programme connection. These three levels should be combined with the source identification and be repeated cyclically as specified in the format shown in Figure A-1/N.13 for monophonic and stereophonic connections.



Cycle duration t_A + 18 s
Q Station announcement
S1 Left stereo information or monophonic information
S2 Right stereo information
P Signal pause
t_A Duration of the station announcement
* Refer to § A.2.2

Note – t_A varies depending on the length of the message.

FIGURE A-1/N.13

Format for the three-level test signal for sound-programme connections

A.2.2 Provisionally, the portion of the test signal designated at +9 dBm0s in Figure A-1/N.13 will be replaced by a signal at 0 dBm0s. The resulting two-level test signal is required until all transmission systems are capable of carrying sinusoidal signals at +9 dBm0s without producing excessive channel loading or crosstalk into other channels.

A.2.3 Some organizations may not have automatically generated test levels as defined in §§ A.2.1 and A.2.2. In these cases, the alignment level of 0 dBm0s at 1020 Hz should be used for the alignment of international sound programme connections.

A.3 *Measurement methods*

The fundamental concept of the test signals is to provide organizations with accurate and well defined levels. These levels are intended to provide rapid identification of level errors as well as to allow operational personnel sufficient time to make the necessary level adjustments at the appropriate points in the international sound programme connection. Alignment of the connection is made by adjusting the alignment signal to the appropriate point on the programme level meter. Identification of left and right channels is provided as shown in Figure A-1/N.13.

References

[1] CCITT Recommendation *Automatic equipment for rapidly measuring stereophonic pairs and monophonic sound-programme circuits, links and connections,* Vol. IV, Rec. O.33.

[2] CCIR Recommendation *Signals for the alignment of international sound-programme connections,* Vol. XII, Rec. 661, ITU, Geneva, 1986.

Recommendation N.15

MAXIMUM PERMISSIBLE POWER DURING AN INTERNATIONAL SOUND-PROGRAMME TRANSMISSION

General

To check that the maximum power transmitted during a sound-programme transmission does not exceed the limits allowed by Administrations, it is recommended that broadcasting organizations and the terminal ISPCs of the international sound-programme connection should use volume-meters or peak programme meters, the same type of meter being used for preference by both the telephone Administration and the broadcasting organization of a country.

Since the international sound-programme connection is accurately adjusted before it is made available to the broadcasting organizations, there will be no danger of overloading the amplifiers during the sound-programme transmission if care is taken not to exceed the permissible limit at the sending end of the international sound-programme connection.

Hence, this check can be done only by the broadcasting organization and the ISPC of the transmitting country, and a check made further down the line would not seem to be very effective.

If so desired, monitoring equipment (volume-meters, peak-indicators) can be connected at the receiving end of the international sound-programme link and of the international sound-programme connection to obtain information about the general nature of the transmission. In this case, monitoring equipment at the two locations in the incoming country will have to be of the same type, but there is no need for the same kind of monitoring equipment to be used in both outgoing country and incoming country.

1 Maximum level permitted on sound-programme circuits

The peak power permitted on a sound-programme circuit should not exceed +9 dBm at a point of zero relative level on the sound-programme circuit.

(This corresponds to a peak voltage of 3.1 volts when measured as a 600-ohm through-level at a zero through relative level point. The r.m.s. value of the sinusoidal signal with this peak value is 2.2 volts).

If a transmission system overload is identified as being due to sound-programme transmission on 6.4 kHz or 10 kHz sound-programme circuits, the level at the zero relative point should be reduced by 3 dB to achieve an accompanying reduction in peak power, in accordance with Recommendation J.22, § A.2 [1].

2 Maximum level permitted on an international telephone circuit used to carry a sound-programme transmission

The power permitted on the international telephone circuit carrying a sound-programme transmission should not exceed +3 dBm at a point of zero relative level on the international telephone circuit. To allow the +9 dBm0 peak level permitted on a sound-programme circuit a 6 dB loss should be introduced at a point before the international telephone circuit enters a carrier system. At the receiving side a corresponding amplification of 6 dB at the end of the telephone circuit should be provided.

This reduction is necessary to avoid overloading on the carrier's system. Reasons for the possible overload are:

a) Commentary circuits are used in one direction only in comparison to a normal telephone connection. This leads to an increase of the mean power level.

b) In most cases the broadcasting authorities use better quality microphones compared with normal telephone sets.

Experience has shown that an attenuation of 6 dB is the most suitable value for this purpose.

Reference

[1] CCITT Recommendation *Performance characteristics of 10 kHz type sound-programme circuits*, Red Book, Vol. III, Rec. J.22, ITU, Geneva, 1984.

Recommendation N.16

IDENTIFICATION SIGNAL

At times during the preparatory period when no test transmission is taking place and during pauses when no programme transmission is taking place it is very desirable for broadcasting organizations to arrange that their studios and transmitting stations send *identification signals* over the international sound-programme connection and over the control circuits whilst they are not in use to indicate that the circuits are connected. During the preparatory period, particularly, the identification signal will serve to show for which sound-programme transmission the circuit is to be used.

This identification signal will not be broadcast, so that it will not be heard by listeners, but will be transmitted from end to end of the international sound-programme connection, from the programme origin to the destination.

The level of the identification signal applied to a sound-programme connection should not exceed a mean absolute power level of −15 dBm0.

Recommendation N.17

MONITORING THE TRANSMISSION

The transmission may be monitored in the terminal ISPCs by means of loudspeakers and/or apparatus with a visual display (peak programme meters, vu-meters, oscilloscopes, etc.). The means for monitoring the transmission should allow both visible and audible indications.

Digital sound-programme circuits established on 2048 kbit/s systems include a sound-programme signalling channel, allowing the exchange of service information, for example:

- transmission timing,
- identification signal,
- type of sound-programme circuit carried.

These will be decoded by appropriate devices to determine the elements for charging as required in Recommendation N.18.

Recommendation N.18

MONITORING FOR CHARGING PURPOSES, RELEASING

The monitoring of an international sound-programme transmission for charging purposes is carried out at the terminal ISPC of the international sound-programme link.

The technical staff of the designated ISPCs should come to an arrangement among themselves so that at the end of the sound-programme transmission they have accurate knowledge of:

a) the time of handing over the sound-programme link to the broadcasting organization (beginning of chargeable duration);

b) the time at which the sound-programme link is released by the broadcasting organization (end of chargeable duration);

c) where appropriate, the times and duration of every interruption or incident which may have occurred (in order to allow the operating services to determine whether a rebate is due, and if so, its amount).

The times of the beginning and of the end of the chargeable duration, as well as the times of occurrence and duration of any breakdowns which may occur, are entered on a daily report. This daily report is sent on the same day to the service responsible for coordinating all the details necessary for the establishment of the international accounts.

The conditions governing charging for sound-programme circuits and control circuits are given in Recommendation D.180 [1].

Reference

[1] CCITT Recommendation *Occasional provision of circuits for International sound- and television-programme transmissions*, Vol. II, Rec. D.180.

1.3 Lining-up and maintenance of international sound-programme circuits

Recommendation N.21

LIMITS AND PROCEDURES FOR THE LINING-UP OF A SOUND-PROGRAMME CIRCUIT

1 General

This Reçommendation gives limits in Tables 1/N.21 to 5/N.21 for the lining-up of an international sound-programme circuit as defined in Recommendation N.1. These limits correspond to those for one audio section of the hypothetical reference circuit as defined in CCIR Recommendation 502 [1] for 5 kHz, 6.4 kHz, 7 kHz and 10 kHz sound-programme circuits, but correspond to two audio sections[1)] for 15 kHz type sound-programme circuits except for noise limits which correspond to one audio section.

It is recommended to use an automatic measuring equipment (see Recommendations O.31 [3], O.32 [4] and O.33 [5]). If no such equipment is available, measurements shall normally be restricted to loss/frequency distortion and weighted noise. For stereophonic pairs, the parameters Nos. 12, 13, 14 and 15 of Table 1/N.21 shall also be measured.

The limits for 15 kHz and 7 kHz circuits are applicable both for analogue and digital transmissions.

[1)] The limits derived for one audio to audio section for sound-programme circuits of 15 kHz nominal bandwidth calculated in accordance with CCIR Recommendation 605 [2] are not met by the technical specification of available equipment in use on the international network.

2 Limits for the loss/frequency distortion of the component parts of an international sound-programme circuit

The limits are expressed in terms of the received level relative to the value of the received level at 1020 Hz.[2] [6]. Some remarks with regard to the impedance at the points of interconnection are given in the introduction to Recommendation N.10.

International sound-programme circuits set up between ISPCs in any particular continent should usually be routed on a single group link (which includes only one circuit section, that is, one equipment for modulation from audio-frequencies and one for demodulation to audio-frequencies). Long international sound-programme circuits between ISPCs in different continents should not comprise more than three circuit sections.

Sound-programme circuits such as those associated with television transmissions using communication satellite systems are normally provided on a temporary basis. The international sound-programme circuit section is established via the satellite link(s) each time it is required for service. It should be noted that the group carrying the sound-programme circuit may terminate either at the earth station or at an international terminal repeater station.

The possible combination of group-terminals and the number of group-sections required for sound-programme circuits established by satellite link(s) are such that it may not be possible to meet the group-link limits without group-link equalization for each sound-programme circuit set up.

To avoid this situation, it may become necessary to tighten the limits for the loss at all frequencies and for the loss at the approximate mid-band frequency of the national and satellite group-sections.

3 Lining-up procedures

When each national section of the international sound-programme circuit and each section crossing a frontier has been equalized for loss/frequency distortion and, where necessary, for phase/frequency distortion, so as to meet CCITT Recommendations, these various sections are interconnected to form the complete international sound-programme circuit.

When agreement has been reached between two countries, operating via a communication satellite, to provide sound-programme circuits on a temporary basis, it is necessary to carry out an initial line-up of the sound-programme circuit using the same satellite and terrestrial facilities as will be used each time a sound-programme transmission is required.

In the case of international multiple destination sound-programme circuits, the number and location of all destinations is known only at the time of a transmission booking. The lining-up can therefore be carried out only after the booking details are known and must be carried out prior to the transmission.

The individual basic groups will have been set up and lined up for single destination sound-programme circuit requirements. When these are formed into a multiple-destination group, only pilot levels need be checked. The send reference station for the multiple destination group will coordinate this work in accordance with Recommendation M.460 [8].

3.1 *Measurement of received level* [6]

A test signal of 1020 Hz is applied to the sending end of the international sound-programme circuit at a level equivalent to −12 dBm0. The level is measured at the receiving end of the circuit (output of last amplifier) and is adjusted to the nominal value appropriate to the ISPC (for example, −6 dBm).

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[2] For further information about the choice of test signal frequency, refer to Recommendation O.6 [7].

An automatic measuring equipment [3], [4], [5], may then be used to trace the curve of received level with frequency at the receiving end of the circuit. If no such equipment is available, individual measurements must be made at the terminal ISPC and at the frontier section at the following frequencies:

- for a 10-kHz circuit: 50, 80, 100, 200, 500, 800, 1000, 2000, 3200, 5000, 6000, 8500, 10 000 Hz; and if considered useful: 30, 40, 11 000, 12 000 and 15 000 Hz:
- for a 6.4-kHz circuit: 50, 80, 100, 200, 500, 800, 1000, 2000, 3200, 5000 and 6400 Hz.[3)]

The equalizers are adjusted to bring the curve within CCITT limits, which are given above.

3.2 *Measurement of group-delay distortion* [6]

If necessary, the group-delay distortion/frequency characteristic is plotted for the whole international sound-programme circuit.

3.3 *Measurement of circuit noise*

When, after all necessary adjustments, the international sound-programme circuit meets the CCITT Recommendations, noise measurements are made.

These should consist of the weighted noise reading using a meter and network conforming to Recommendation O.41 [10] or CCIR Recommendation 468 [11] or a combination of these.

The noise limits given in the tables of this Recommendation are for circuits of 840 km maximum length. For longer circuits appropriate limits may be calculated from the formula given in CCIR Recommendation 605 [2].

3.4 *Measurement of nonlinearity distortion*

For circuits routed entirely on audio pairs and not equipped with pre-emphasis equipment the nonlinearity distortion is measured at the end of the international sound-programme circuit by sending, for a few seconds, a sinusoidal signal at an appropriate frequency in the band to be transmitted at a level of +9 dBm0.

For a circuit which includes at least one carrier section no measurement of nonlinearity distortion should be made. However, if, in very exceptional cases, it should be essential, in order to provide service on such a circuit, to carry out a check of nonlinearity distortion, for example, to locate a fault, the frequency of the sent signal should not exceed 1020 Hz at +9 dBm0 and the period for which the tone is connected should be as short as possible – that is, not more than about four seconds. However the best procedure would be to use a suitable automatic measuring equipment if such is available (see Recommendation O.31 [3], [4], [5]).

The total harmonic-distortion coefficient for the sound-programme hypothetical reference-circuit (2500 km) must not exceed 4% (harmonic margin 28 dB) at any frequency[4)] within the transmitted band. For shorter and for less complex circuits, the distortion should be less.

Moreover, since end-to-end measurements of nonlinearity distortion on circuits routed on carrier systems might give rise to serious disturbance to transmission on other channels, especially if the group is transmitted on a transistorized carrier system, it is permitted to make only local measurements of non-linearity distortion on terminal modulating and demodulating equipments. For example, a sound-programme circuit modulating and demodulating equipment could be connected back-to-back via a suitable network (and suitable amplifiers if necessary) and the measurement made on the resulting complete assembly.

3.5 *Additional mesurements*

In addition to the measurements specified above, the following parameters may be measured at the discretion of the Administrations concerned. Such measurements may be particularly useful when a faulty condition is suspected.

[3)] Administrations are invited to propose measuring frequencies for 5 kHz circuits, 7 kHz circuits, and 15 kHz circuits. ISO standard No. 266 [9] should be taken into account.

[4)] The European Broadcasting Union has stated that many of its members have expressed the opinion that for a circuit 1500 km long, acceptable limits for nonlinearity distortion would be:

40 dB at fundamental frequencies above 100 Hz,
34 dB at fundamental frequencies of 100 Hz and below.

3.5.1 *Interference caused by power supply sources*

When a sinusoidal test signal is transmitted over a sound-programme circuit at a level of 0 dBmO the level of the strongest unwanted modulation component should not exceed −45 dBmO.

3.5.2 *Frequency error*

The frequency error introduced by a sound programme circuit must not exceed the following limits:

7 kHz, 115 kHz ± 1 Hz

5 kHz, 6.4 kHz, 10 kHz ± 2 Hz

3.6 *Application of a simulated sound-programme test signal*

CCIR Recommendation 571 [12] specifies a simulated sound-programme test equipment which can be used for measuring interference in other channels.

3.7 *Single tone-interference level*

Where this parameter is concerned, the characteristic of the weighting filter according to CCIR Recommendation 468 [11] has to be taken into account by using the correction factor ψ. The latter, which can be determined from Figure 1/N.21 (identical with Figure 1b of CCIR Recommendation 468 [11] is to be subtracted from the numerical values of the tables. To exclude the effect of random noise, selective measurement is needed.

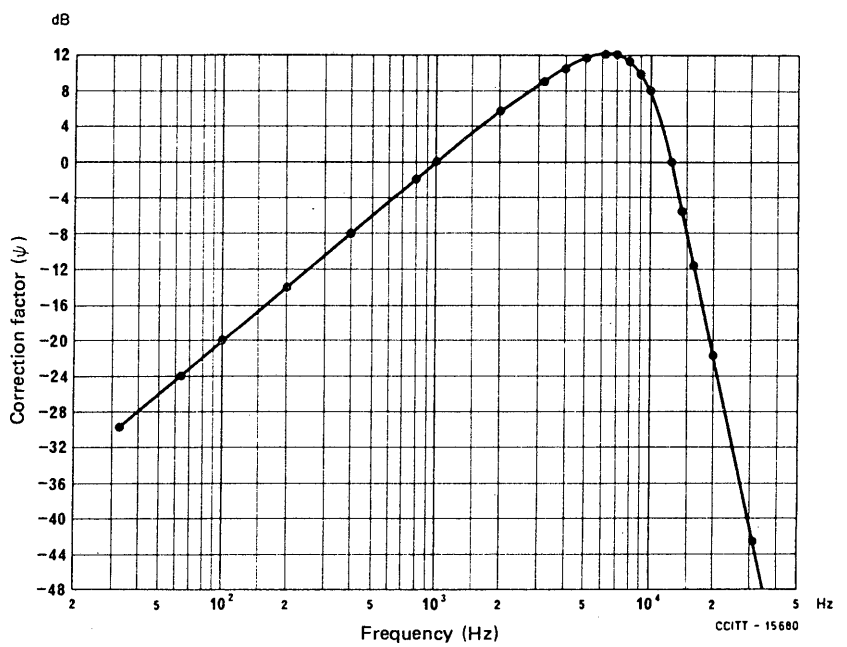

FIGURE 1/N.21

Correction factor ψ, for single-tone interference level

3.8 *Measurement of stereophonic pairs*

The quality criteria given refer to those of Recommendations O.32 [4] and O.33 [5]. The limits can be easily measured with the aid of such equipments. If other measuring means are used, attention is drawn to the fact that the frequencies of 10, 11.92 and 14 kHz should be avoided because of possible stop filters which may be inserted in the transmission equipment concerned for reducing carrier leaks.

3.9 *Record of results*

The final measurements made under the above headings when the circuit has been lined up are reference measurements and should be carefully recorded.

TABLE 1/N.21

Limits for the lining-up of 15 kHz sound-programme circuits

Item	Parameter		Unit	Limits
1	Insertion gain	Adjustment error	dB	±0.4
		Variation during 24 h	dB	±0.4
2	Gain/frequency response referred to 0.8 or 1 kHz	0.04 to 0.125 kHz	dB	+0.4
			dB	−1.5
		0.125 to 10 kHz	dB	±0.4
		10 to 14 kHz	dB	+0.4
			dB	−1.5
		14 to 15 kHz	dB	+0.4
			dB	−2.3
3	Group delay/frequency response referred to minimum	0.04 kHz	ms	37
		0.075 kHz	ms	16
		14 kHz	ms	5.4
		15 kHz	ms	8
4	Weighted noise	Idle channel	dBq0ps	−47
		Programme-modulated	dBq0ps	−35
5	Single tone interference level + ψ		dBm0s	−75
6	Disturbing modulation by power supply		dB	−47
7	Total harmonic distortion	0.04 to 0.125 kHz	%	0.8
		0.125 to 7.5 kHz	%	0.4

TABLE 1/N.21 *(cont.)*

	Item	Parameter		Unit	Limits
	8	3rd order difference tone at 0.18 kHz		%	0.4
	9	Error in reconstituted frequency		Hz	±0.8
	10	Intelligible crosstalk ratio	0.04 kHz	dB	52
			0.5 to 5 kHz	dB	76
			15 kHz	dB	62
	11	Error in amplitude/amplitude response		dB	±0.4
Additional parameters for stereo transmission	12	Difference in gain between A and B channels	0.04 to 0.125 kHz	dB	1.1
			0.125 to 10 kHz	dB	0.6
			10 to 14 kHz	dB	1.1
			14 to 15 kHz	dB	2.3
	13	Phase difference between A and B channels	0.04 to 0.2 kHz	degree	23
			0.2 to 4 kHz	degree	11
			14 kHz	degree	23
			15 kHz	degree	30
	14	Intelligible crosstalk ratio A/B		dB	52
	15	Crosstalk ratio (intermodulation) A/B		dB	62

TABLE 2/N.21

Limits for the lining-up of 10 kHz international sound-programme circuits

Item	Parameter		Unit	Limits
1	Insertion gain	Adjustment error	dB	±0.3
		Variation with time	dB	±0.3
2	Gain/frequency response referred to 0.8 or 1 kHz	0.05 to 0.1 kHz	dB	+0.8
			dB	−2.1
		0.1 to 0.2 kHz	dB	+0.8
			dB	−1.2
		0.2 to 6 kHz	dB	±0.8
		6 to 8.5 kHz	dB	+0.8
			dB	−1.2
		8.5 to 10 kHz	dB	+0.8
			dB	−2.1
3	Group delay/frequency response referred to minimum	0.05 kHz	ms	26
		0.1 kHz	ms	6.6
		10 kHz	ms	2.4
4	Weighted noise (Idle channel) [a]		dBq0ps	−44
5	Single tone interference level + ψ [b]		dBm0s	−75
6	Disturbing modulation by power supply		dB	−51
7	Total harmonic distortion	0.05 to 0.1 kHz	%	1.4
		0.1 to 10 kHz	%	1
8	3rd order difference tone at 0.18 kHz		%	1
9	Error in reconstituted frequency		Hz	±0.5
10	Intelligible crosstalk ratio [c]		dB	80
11	Error in amplitude/amplitude response		dB	±0.2

[a] For circuits on carrier systems, it is not always possible, in absence of special precautions, to meet these limits (see Annex II to CCIR Recommendation 504 [13]).

[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 § 3.8, Note 2, in Annex I to CCIR Recommendation 504 [13]).

TABLE 3/N.21

Limits for the lining-up of 7 kHz international sound-programme circuits

Item	Parameter		Unit	Limits
1	Insertion gain	Adjustment error	dB	±0.3
		Variation during 24 h	dB	±0.3
2	Gain/frequency response referred to 0.8 or 1 kHz	0.05 to 0.1 kHz	dB	+0.5
			dB	−1.4
		0.1 to 6.4 kHz	dB	±0.5
		6.4 to 7 kHz	dB	+0.5
			dB	−1.4
3	Group delay/frequency response referred to minimum	0.05 kHz	ms	26
		0.1 kHz	ms	6.6
		6.4 kHz	ms	1.7
		7 kHz	ms	3.3
4	Weighted noise	Idle channel	dBq0ps	−49
		Programme-modulated	dBq0ps	−37
5	Single tone interference level + ψ		dBm0s	−79
6	Disturbing modulation by power supply		dB	−51
7	Total harmonic distortion	<0.1 kHz	%	1
		0.1 to 3.5 kHz	%	0.7
8	3rd order difference tone at 0.18 kHz		%	0.7
9	Error in reconstituted frequency		Hz	±0.5
10	Intelligible crosstalk ratio	0.05 kHz	dB	59
		0.05 to 3.2 kHz	dB	80
		7 kHz	dB	73
11	Error in amplitude/amplitude response		dB	±0.2

TABLE 4/N.21

Limits for the lining-up of 6.4 kHz international sound-programme circuits

Item	Parameter		Unit	Limits
1	Insertion gain	Adjustment error	dB	±0.3
		Variation during 24 h	dB	±0.3
2	Gain/frequency response referred to 0.8 or 1 kHz	0.05 to 0.1 kHz	dB	+0.5
			dB	−1.4
		0.1 to 5 kHz	dB	±0.5
		5 to 6.4 kHz	dB	+0.5
			dB	−1.4
3	Group delay/frequency response referred to minimum	0.05 kHz	ms	26
		0.1 kHz	ms	6.6
		5 kHz	ms	1.7
		6.4 kHz	ms	3.3
4	Maximum weighted noise level		dBq0ps	−44
5	Single tone interference level + ψ		dBm0s	−79
6	Disturbing modulation by power supply		dB	−51
7	Total harmonic distortion	<0.1 kHz	%	1
		>0.1 kHz	%	0.7
8	3rd order difference tone at 0.18 kHz		%	0.7
9	Error in reconstituted frequency		Hz	±0.5
10	Intelligible crosstalk ratio	0.05 kHz	dB	59
		0.5 to 3.2 kHz	dB	80
		6.4 kHz	dB	74
11	Error in amplitude/amplitude response		dB	±0.2

TABLE 5/N.21

Limits for the lining-up of 5 kHz international sound-programme circuits

Item	Parameter		Unit	Limits
1	Insertion gain	Adjustment error	dB	±0.3
		Variation during 24 h	dB	±0.3
2	Gain/frequency response referred to 0.8 or 1 kHz	0.07 to 0.2 kHz	dB	+0.5
			dB	−1.4
		0.2 to 4 kHz	dB	±0.5
		4 to 5 kHz	dB	+0.5
			dB	−1.4
3	Group delay/frequency response referred to minimum	0.07 kHz	ms	20
		5 kHz	ms	5
4	Maximum weighted noise level		dBq0ps	−37
5	Single tone interference level + ψ		dBm0s	−79
6	Disturbing modulation by power supply		dB	−51
7	Total harmonic distortion	<0.1 kHz	%	1
		>0.1 kHz	%	0.7
8	3rd order difference tone at 0.18 kHz		%	0.7
9	Error in reconstituted frequency		Hz	±0.5
10	Intelligible crosstalk ratio	0.07 kHz	dB	63
		0.5 to 3.2 kHz	dB	80
		5 kHz	dB	76
11	Error in amplitude/amplitude response		dB	±0.2

References

[1] CCIR Recommendation *Hypothetical reference circuits for sound-programme transmissions*, Vol. XII, Rec. 502, ITU, Geneva, 1986.

[2] CCIR Recommendation *Estimation of transmission performance of sound-programme circuits shorter or longer than the hypothetical reference circuit*, Vol. XII, Rec. 605, ITU, Geneva, 1986.

[3] CCITT Recommendation *Automatic measuring equipment for sound-programme circuits*, Vol. IV, Rec. O.31.

[4] CCITT Recommendation *Automatic measuring equipment for stereophonic pairs of sound-programme circuits*, Vol. IV, Rec. O.32.

[5] CCITT Recommendation *Automatic equipment for rapidly measuring stereophonic pairs and monophonic sound-programme circuits, links and connections*, Vol. IV, Rec. O.33.

[6] CCIR Report *Relative values of sound-programme signal levels established with the VU meter and with a peak-programme meter*, Vol. XII, Rep. 820, Geneva, 1986.

[7] CCITT Recommendation *1020 Hz reference test frequency*, Vol. IV, Rec. O.6.

[8] CCITT Recommendation *Bringing international group, supergroup, etc., links into service*, Vol. IV, Rec. M.460.

[9] ISO Standard No. 266 *Acoustics-preferred frequencies for measurements.*

[10] CCITT Recommendation *Psophometers (apparatuses for the objective measurements of circuit noise)*, Vol. IV, Rec. O.41.

[11] CCIR Recommendation *Measurement of audio-frequency noise voltage level in sound broadcasting*, Vol. X, Rec. 468, ITU, Geneva, 1986.

[12] CCIR Recommendation *A conventional test signal simulating sound-programme signals for measuring interference in other channels*, Vol. XII, Rec. 571, ITU, Geneva, 1986.

[13] CCIR Recommendation *Performance characteristics of 10 kHz type sound-programme circuits*, Vol. XII, Rec. 504, ITU, Geneva, 1982.

Recommendation N.23

MAINTENANCE MEASUREMENTS TO BE MADE ON INTERNATIONAL SOUND-PROGRAMME CIRCUITS

1 General

In Tables 1/N.23 to 5/N.23 maintenance limits for international sound-programme circuits are specified. If these limits are exceeded, the control station [1] for the circuit should decide the appropriate action to be taken to bring the circuit back within these limits.

2 Routine measurements

Routine measurements should be made every six months and the circuit realigned to meet the limits given in Recommendation N.21. The control station should agree with other stations, the date and time of routine measurements and the parameters to be included. It is recommended to use an automatic measuring equipment (see Recommendations O.31 [1], O.32 [2], O.33 [3]). The test procedures and frequencies to be used are detailed in Recommendation N.21. If no automatic measuring equipment is available, measurements shall normally be restricted to loss/frequency distortion and weighted noise. For the stereophonic pairs, the parameters Nos. 12, 13, 14 and 15 of Table 1/N.23 shall also be measured.

3 Release of circuit for routine measurements

Even if there is a general understanding with a renter of a permanently leased circuit on the time when routine tests are to be carried out, the ISPC should always confirm with the renter that the circuit can be released for these tests.

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[1] For the functions and responsibilities of the circuit control stations see Recommendation N.5.

TABLE 1/N.23

Limits for international 15 kHz sound-programme circuits

Item	Parameter		Unit	Limits
1	Insertion gain	Adjustment error	dB	±0.5
		Variation during 24 h	dB	±0.5
2	Loss/frequency distortion referred to 0.8 or 1 kHz	0.04 to 0.125 kHz	dB	+0.5
			dB	−2
		0.125 to 10 kHz	dB	±0.5
		10 to 14 kHz	dB	+0.5
			dB	−2
		14 to 15 kHz	dB	+0.5
			dB	−3
3	Group delay/frequency response referred to minimum	0.04 kHz	ms	55
		0.075 kHz	ms	24
		14 kHz	ms	8
		15 kHz	ms	12
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		dB	−45
7	Total harmonic distortion	0.04 to 0.125 kHz	%	1
		0.125 to 7.5 kHz	%	0.5
8	3rd order difference tone at 0.18 kHz		%	0.5
9	Error in reconstituted frequency		Hz	±1
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

TABLE 1/N.23 *(cont.)*

	Item	Parameter		Unit	Limits
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
	13	Phase difference between A and B channels	0.04 to 0.125 kHz	degree	30
			0.02 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

Note – The limits given in this table are applicable both for analogue and digital transmissions.

TABLE 2/N.23

Limits for international 10 kHz sound-programme circuits

Item	Parameter		Unit	Limits
1	Insertion gain	Adjustment error	dB	±0.4
		Variation with time	dB	±0.4
2	Loss/frequency distortion referred to 0.8 or 1 kHz	0.05 to 0.1 kHz	dB	+1.3
			dB	−3.3
		0.1 to 0.2 kHz	dB	+1.3
			dB	−2
		0.2 to 6 kHz	dB	±1.3
		6 to 8.5 kHz	dB	+1.3
			dB	−2
		8.5 to 10 kHz	dB	+1.3
			dB	−3.3
3	Group delay/frequency response referred to minimum	0.05 kHz	ms	54
		0.1 kHz	ms	13
		10 kHz	ms	5.4
4	Weighted noise (Idle channel) [a]		dBq0ps	−41
5	Single tone interference level + ψ [b]		dBm0s	−73
6	Disturbing modulation by power supply		dB	−47
7	Total harmonic distortion	0.05 to 0.1 kHz	%	2.3
		0.1 to 10 kHz	%	1.5
8	3rd order difference tone at 0.18 kHz		%	1.5
9	Error in reconstituted frequency		Hz	±0.8
10	Intelligible crosstalk ratio [c]		dB	76
11	Error in amplitude/amplitude response		dB	±0.4

[a] For circuits on carrier systems, it is not always possible in absence of special precautions, to meet these limits (see Annex II to CCIR Recommendation 504 [4]).

[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 § 3.8, Note 2, in the Annex I to CCIR Recommendation 504 [4]).

TABLE 3/N.23

Limits for international 7 kHz sound-programme circuits

Item	Parameter		Unit	Limits
1	Insertion gain	Adjustment error	dB	±0.4
		Variation during 24 h	dB	±0.4
2	Loss/frequency distortion referred to 0.8 or 1 kHz	0.05 to 0.1 kHz	dB	+0.8
			dB	−2.3
		0.1 to 6.4 kHz	dB	±0.8
		6.4 to 7 kHz	dB	+0.8
			dB	−2.3
3	Group delay/frequency response referred to minimum	0.05 kHz	ms	54
		0.1 kHz	ms	13
		6.4 kHz	ms	3.4
		7 kHz	ms	6.7
4	Weighted noise	Idle channel	dBq0ps	−46
		Programme-modulated	dBq0ps	−34
5	Single tone interference level + ψ		dBm0s	−75
6	Disturbing modulation by power supply		dB	−47
7	Total harmonic distortion	<0.1 kHz	%	1.5
		0.1 to 3.5 kHz	%	1.1
8	3rd order difference tone at 0.18 kHz		%	1.1
9	Error in reconstituted frequency		Hz	±0.8
10	Intelligible crosstalk ratio	0.05 kHz	dB	55
		0.05 to 3.2 kHz	dB	76
		7 kHz	dB	69
11	Error in amplitude/amplitude response		dB	±0.4

Note – The limits given in this table are applicable both for analogue and digital transmissions.

TABLE 4/N.23

Limits for international 6.4 kHz sound-programme circuits

Item	Parameter		Unit	Limits
1	Insertion gain	Adjustment error	dB	±0.4
		Variation during 24 h	dB	±0.4
2	Loss/frequency distortion referred to 0.8 or 1 kHz	0.05 to 0.1 kHz	dB	+0.8
			dB	−2.3
		0.1 to 5 kHz	dB	±0.8
		5 to 6.4 kHz	dB	+0.8
			dB	−2.3
3	Group delay/frequency response referred to minimum	0.05 kHz	ms	54
		0.1 kHz	ms	13
		5 kHz	ms	3.4
		6.4 kHz	ms	6.7
4	Maximum weighted noise level		dBq0ps	−41
5	Single tone interference level + ψ		dBm0s	−75
6	Disturbing modulation by power supply		dB	−47
7	Total harmonic distortion	<0.1 kHz	%	1.5
		>0.1 kHz	%	1.1
8	3rd order difference tone at 0.18 kHz		%	1.1
9	Error in reconstituted frequency		Hz	±0.8
10	Intelligible crosstalk ratio	0.05 kHz	dB	55
		0.05 to 3.2 kHz	dB	76
		6.4 kHz	dB	70
11	Error in amplitude/amplitude response		dB	±0.4

TABLE 5/N.23

Limits for international 5 kHz sound-programme circuits

Item	Parameter		Unit	Limits
1	Insertion gain	Adjustment error	dB	±0.4
		Variation during 24 h	dB	±0.4
2	Loss/frequency distortion referred to 0.8 or 1 kHz	0.07 to 0.2 kHz	dB	+0.8
			dB	−2.3
		0.2 to 4 kHz	dB	±0.8
		4 to 5 kHz	dB	+0.8
			dB	−2.3
3	Group delay/frequency response referred to minimum	0.07 kHz	ms	40
		5 kHz	ms	10
4	Maximum weighted noise level		dBq0ps	−34
5	Single tone interference level + ψ		dBm0s	−75
6	Disturbing modulation by power supply		dB	−47
7	Total harmonic distortion	<0.1 kHz	%	1.5
		>0.1 kHz	%	1.1
8	3rd order difference tone at 0.18 kHz		%	1.1
9	Error in reconstituted frequency		Hz	±0.8
10	Intelligible crosstalk ratio	0.07 kHz	dB	59
		0.05 to 3.2 kHz	dB	76
		5 kHz	dB	72
11	Error in amplitude/amplitude response		dB	±0.4

References

[1] CCITT Recommendation *Automatic measuring equipment for sound-programme circuits*, Vol. IV, Rec. O.31.

[2 CCITT Recommendation *Automatic measuring equipment for stereophonic pairs of sound-programme circuits*, Vol. IV, Rec. O.32.

[3] CCITT Recommendation *Automatic equipment for rapidly measuring stereophonic pairs and monophonic sound-programme circuits, links and connections*, Vol. IV, Rec. O.33.

[4] CCIR Recommendation *Performance characteristics of 10 kHz type sound-programme circuits*, Vol. XII, Recommendation 504, ITU, Geneva, 1982.

SECTION 2[1)]

INTERNATIONAL TELEVISION TRANSMISSIONS

2.1 International television transmissions – Definitions and responsibilities

Recommendation N.51

DEFINITIONS FOR APPLICATION TO INTERNATIONAL TELEVISION TRANSMISSIONS

The following definitions apply to the maintenance of international television transmissions. Other definitions are used for other purposes, e.g. an international television link and international multiple destination television link as defined in §§ 11 and 12 respectively below, are within the definition of an international television circuit as defined by the CMTT.

Note 1 – It is intended that the definitions given in Recommendations N.1 and N.51 should remain identical, so far as is practical, by use of only simultaneous amendments.

Note 2 – A television circuit section, circuit, link or connection is considered to be permanent for maintenance purposes if it is always available for use when required, whether or not it is continuously in use. Such a circuit may be used for the purposes of occasional transmission, i.e. transmissions of short duration (e.g. less than 24 hours) or it may be used for a long duration, i.e. one day or more. A permanent television connection between broadcasting organizations' premises may be used at any time, except only for periods of maintenance as agreed between the Administrations and broadcasting organizations concerned.

A television circuit section, circuit, link or connection is considered to be temporary for maintenance purposes when it has no existence outside the period of transmission (including line-up and testing time) for which it is required.

1 international television transmission

The transmission of video signals over the international telecommunication network for the purpose of interchanging television material between broadcasting organizations in different countries.

2 broadcasting organization

A broadcasting organization is an organization which is concerned with either or both sound and television broadcasting. Most of the customers ordering facilities for sound-programme and television transmission are broadcasting organizations; for convenience, the term broadcasting organization is used to denote the activity of any user or customer and, where so used, it is equally applicable to any other customer requiring sound-programme or television transmissions.

[1)] In general, for CCIR Recommendations concerning television, see CCIR Vol. XII, ITU, Geneva, 1986.

3 broadcasting organization (send)

The broadcasting organization at the sending end of an international television transmission.

4 broadcasting organization (receive)

The broadcasting organization at the receiving end of an international television transmission.

5 international television centre (ITC)

A centre at which at least one international television circuit (see § 9) terminates and in which international television connections (see § 13) can be made up by the interconnection of international and national television circuits.

6 national television centre (NTC)

A centre at which two or more national television circuits terminate and at which national television circuits may be interconnected.

7 television circuit section

The unidirectional national or international television transmission path between two stations at which the programme is accessible at video frequencies. The transmission path may be established via terrestrial or single destination satellite routing. (See Note 2 above and Figures 1/N.51 and 3/N.51.)

8 international multiple destination television circuit section

The unidirectional television transmission path from one frontier station to two or more of the frontier stations at which interconnection is made at video frequencies. (See Note 2 above and Figure 4/N.51.)

9 international television circuit

The transmission path between two ITCs which comprises one or more television circuit sections (national or international) together with any necessary video equipment. The transmission path may be established via terrestrial or single destination satellite routing. (See Note 2 above and Figures 1/N.51 and 3/N.51.)

10 international multiple destination television circuit

The unidirectional transmission path from one ITC to two or more other ITCs comprising television circuit sections (national or international) one of which is an international multiple destination circuit section, together with any necessary video equipment. (See Note 2 above and Figure 4/N.51.)

11 international television link

The unidirectional transmission path between the ITCs of the two terminal countries involved in an international television transmission. The international television link comprises one or more international television circuits (see Figures 1/N.51 and 3/N.51) interconnected at intermediate ITCs. It can also include national television circuits in transit countries. (See Note 2 above and Figure 2/N.51.)

12 international multiple destination television link

The unidirectional transmission path between the ITCs of the terminal countries involved in an international multiple destination television transmission. The international multiple destination television link comprises international television circuits, one of which is an international multiple destination television circuit. (See Note 2 above and Figure 5/N.51.)

13 international television connection

The unidirectional transmission path between the broadcasting organization (send) and the broadcasting organization (receive) comprising the international television link extended at its two ends over national television circuits to the broadcasting organization. (See Note 2 above and Figure 2/N.51.)

14 international multiple destination television connection

The unidirectional transmission path between the broadcasting organization (send) and two or more broadcasting organizations (receive) comprising the international multiple destination television link extended at its end over national television circuits to the broadcasting organizations. (See Note 2 above and Figure 5/N.51.)

15 send reference station

The transmit sub-control station of an international multiple destination television circuit section (see § 8), circuit (see § 10) or link (see § 12). (See Figures 4/N.51 and 5/N.51.)

16 programme originator

A customer at a transmitting country needing up-linking of a transmission to television receive-only stations (TVROs) not related to an ITC (see Figure 6/N.51).

17 international satellite transmission centre (ISTC)

A centre at a transmitting country responsible for the national extension and up-link to satellite. This term is applicable only for transmission to TVROs not related to an ITC (see Figure 6/N.51).

18 television receive-only station (TVRO)

An earth station which is used only for reception (see Figure 6/N.51). In this respect the term is used to denote any TVRO whose owner is authorized to receive the programme material.

19 fault reporting centre (FRC)

A centre at a receiving country dealing with enquiries and fault reports concerning transmission to TVROs not related to an ITC. (See Figure 6/N.51.)

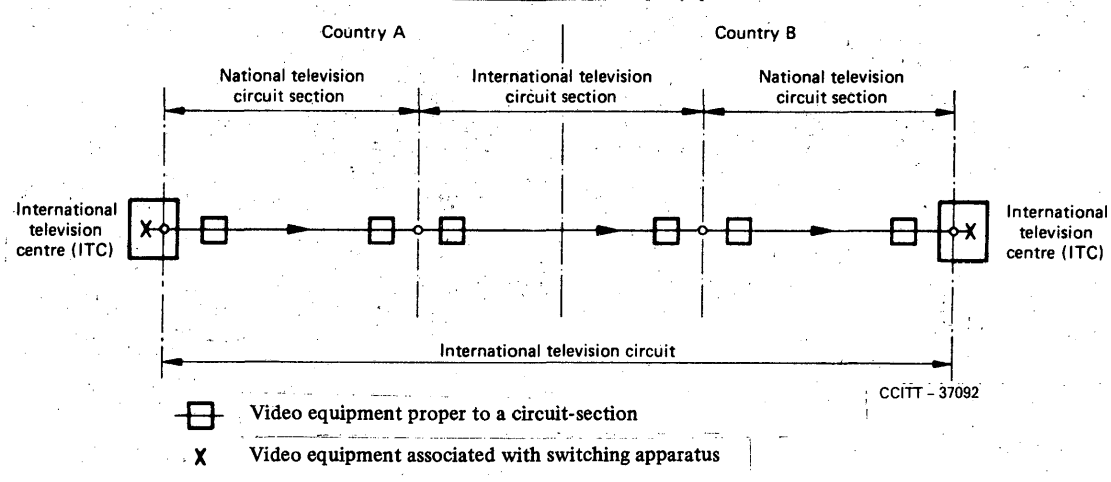
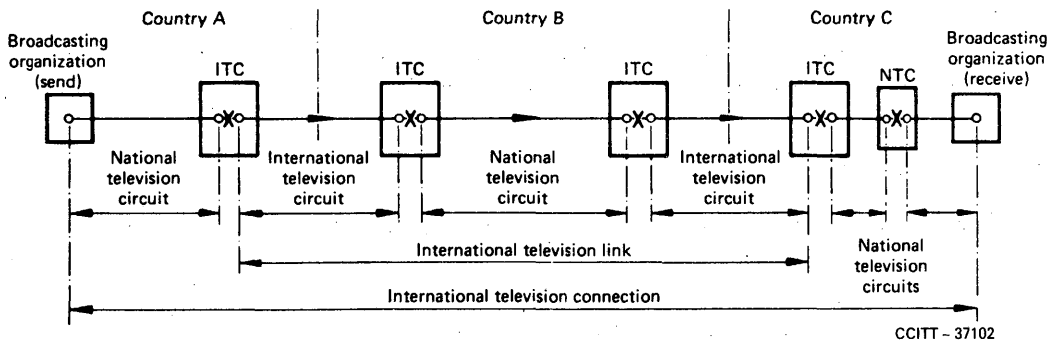


FIGURE 1/N.51

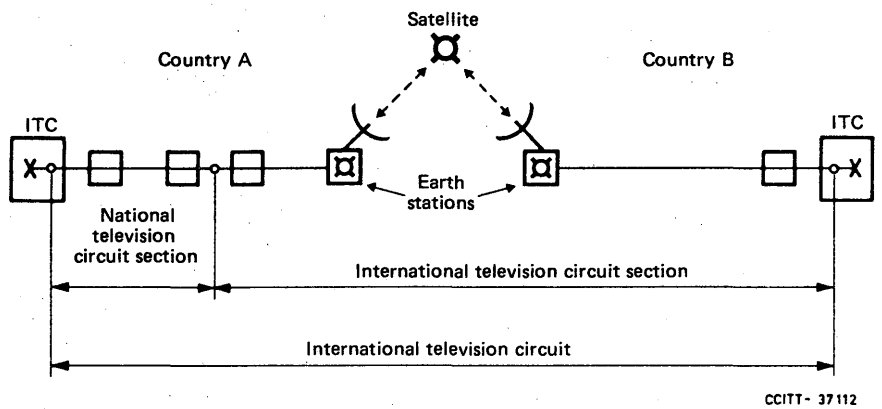
An international television circuit composed of two national and one international television circuit sections



X Video equipment associated with switching apparatus

FIGURE 2/N.51

An international television link composed of international and national television circuits and extended on national television circuits at each end to form an international television connection



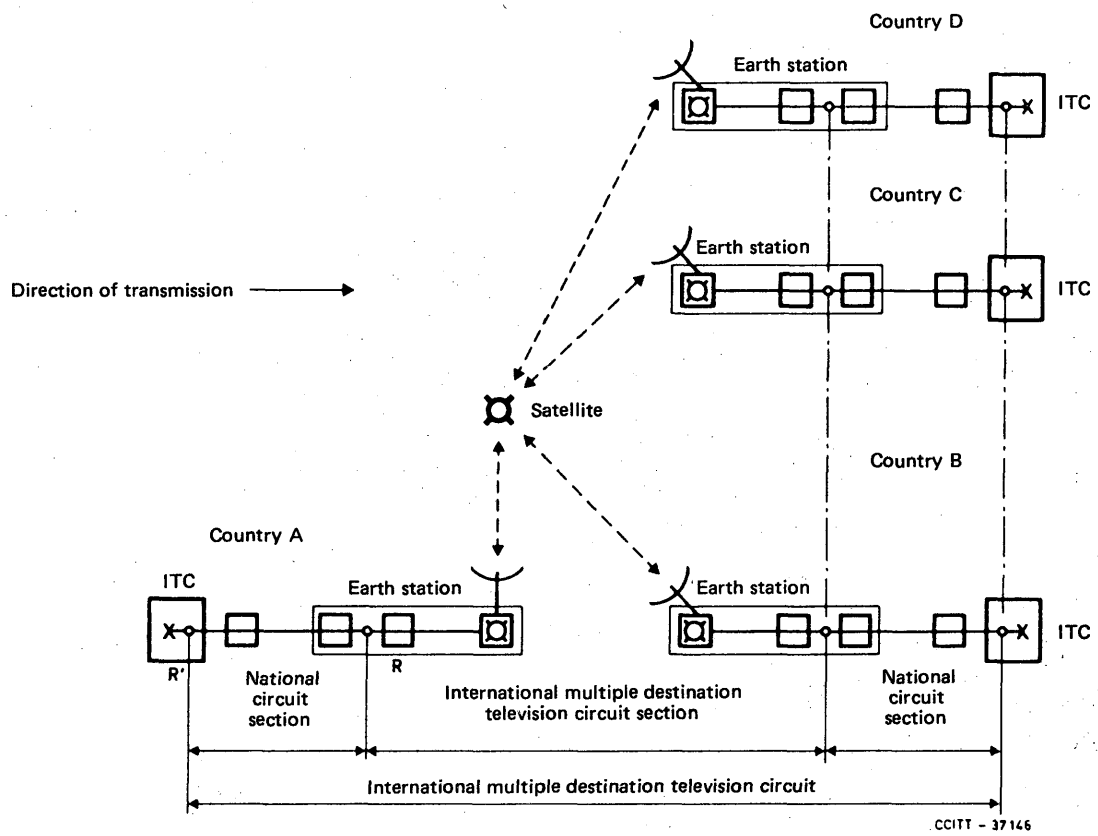
Video equipment proper to a circuit section

X Video equipment associated with switching apparatus

ITC International television centre

FIGURE 3/N.51

Single destination international television circuit routed via a communications satellite



Video equipment proper to a circuit section

X Video equipment associated with switching apparatus

ITC International television centre

R *Send reference* station for international multiple destination circuit section

R' *Send reference* station for international multiple destination circuit

FIGURE 4/N.51

International multiple destination television circuit comprising an international multiple destination satellite circuit section and national terrestrial circuit sections

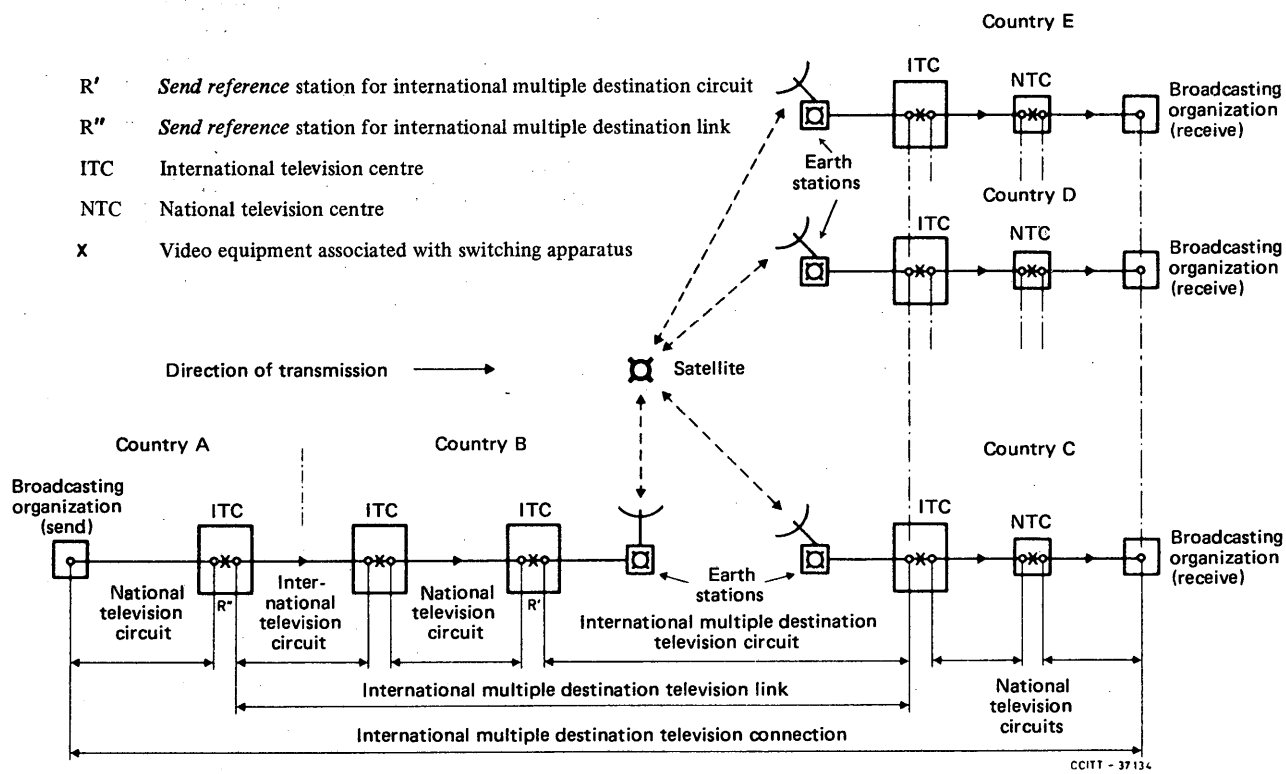
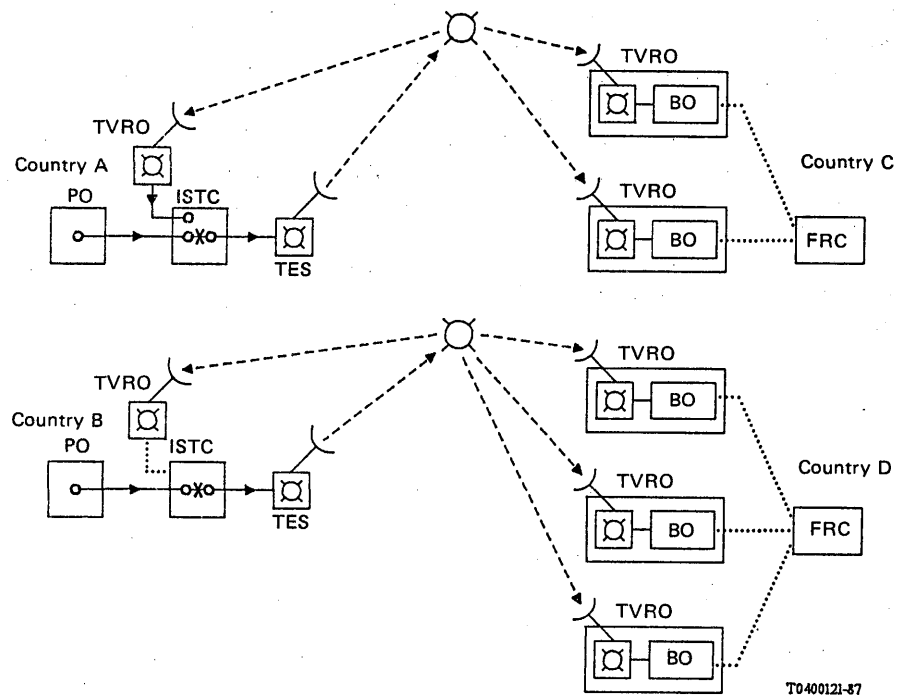


FIGURE 5/N.51

An international multiple destination television link composed of an international multiple destination television circuit and national and international television circuits extended on national circuits at each end to form an international multiple destination television connection



PO Programme originator
ISTC International Satellite Transmission Centre
TES Transmitting earth station
TVRO Television receive only station
BO Broadcasting organization
FRC Fault Reporting Centre
X Video equipment associated with switching apparatus

FIGURE 6/N.51

An international multiple destination television connection for TVROs not related to an ITC

Recommendation N.52

MULTIPLE DESTINATION TELEVISION TRANSMISSIONS AND COORDINATION CENTRES

A multiple destination television transmission occurs when the same signals are transmitted to more than one broadcasting organization.

If the branching point of the signals is at the origin of the programme or in the national co-ordination centre or in the ITC of the originating country, each undirectional path to a receiving broadcasting organization is considered to be an individual television connection.

Otherwise, the term *derived television transmission* is used. Such transmissions are characterized by the use of branching points in the national coordination centres and/or the ITCs of countries other than the originating country. The branching points will be sub-control stations. The telecommunications Administrations concerned should agree on the choice of a control station. Recommendation N.55 details the duties of the control and sub-control stations.

For such television transmissions, the broadcasting organizations will normally designate an international coordination centre, *for each region concerned*, to perform the following functions in its region:

- coordinate the requests made by the broadcasting organizations wishing to participate in the transmission concerned;
- make all necessary enquiries as to the availability of television circuits for use by broadcasting organizations;
- draw up the plan of the network of television- and sound-programme circuits required for the transmission in question;
- ensure that the television transmission proceeds normally over the international television connections;
- locate, by means of enquiries to the national coordination centres (or another international coordination centre), the faulty connection(s) in the event of breakdown or complaints concerning the transmission;
- arrange via the national coordination centres (or another international coordination centre) for any fault to be reported to the receiving ITC and, where possible, the replacement of any faulty circuit by the ITCs concerned.

Recommendation N.54

DEFINITION AND DURATION OF THE LINE-UP PERIOD AND THE PREPARATORY PERIOD

1 Definition

For each international television transmission a distinction is made between:

- **line-up period**

  The period during which the telecommunication Administrations line up the international television link before handing it over to the broadcasting organizations; and

- **preparatory period**

  The period during which the broadcasting organizations carry out their own adjustments, tests, etc., before the television transmission itself commences.

  The exact time at which the preparatory period begins (point *H* on Figure 1/N.54) is determined by the broadcasting organizations.

2 Line-up period

It is provisionally recommended that, in principle, the duration of the line-up period should nominally be 30 minutes, subdivided into two periods, for the operations described below (see Figure 1/N.54).

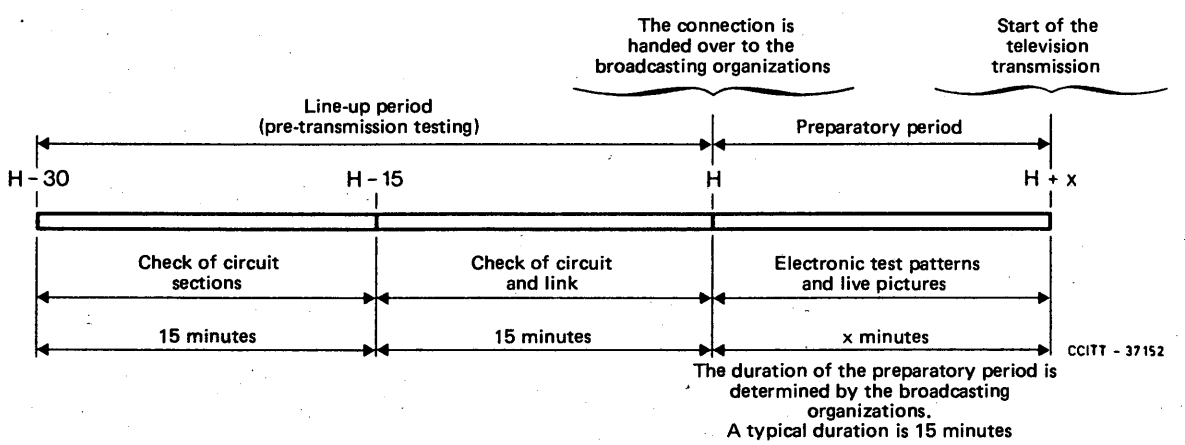


FIGURE 1/N.54

Time allocation in the line-up period and the preparatory period in the case of television transmissions

H −30 to H −15: Concurrent lining-up of the national and international circuit sections that will be used to constitute the international television circuit. The international circuit sections may or may not include a communications satellite. The tests to be made are those given in Recommendation N.62. Tests between the earth stations of a communications satellite circuit section are not the responsibility of the CCITT but these tests also should be completed by time *H −15*.

H −15 to H: Interconnection of the circuit sections to be used, confirmation that the international television circuit is continuous between the terminal ITCs and overall tests between the control ITC and the sub-control ITC. The tests to be made are those given in Recommendation N.62[1].

The above periods *H −30 to H −15* and *H −15 to H* are indicated for guidance only. Their duration is based on an estimate of the time necessary to perform the tests in Recommendation N.62 with a reasonable allowance for adjustments. No allowance is included for the removal of fault conditions on the circuit sections or on the complete circuit link.

These periods also assume a configuration of the international television circuit[2] consisting of one international circuit section extended at each end by one national circuit section. In the case of television transmissions involving more than two countries, either or both of the nominal periods *H −30 to H −15* and *H −15 to H* may have to be increased. On the other hand, in particular cases, either or both of these nominal periods may be reduced, by agreement between the Administrations concerned, provided the line-up is properly carried out. This may be possible, for example, when there are two successive international television transmissions on the same route, and the second involves extending the international television circuit or link already lined-up for the first.

During the last few minutes of the nominal period *H −15 to H*, when the above tests have been completed, the control and sub-control ITCs[3] should put the link through to the broadcasting organization at each end and should confirm that the complete connection is continuous. It should be verified that the link[2] satisfactory for transmitting the programme, and that the quality and level are acceptable.

By agreement between the telecommunication Administration and the sending broadcasting organization, it might be desirable, during these last few minutes before the end of the line-up period, to transmit live pictures. This would be of particular use when adjusting standards converters. The transmission of live pictures during the line-up period does not, however, alter the telecommunication Administrations' responsibility with regard to the quality of transmission required. This responsibility begins only at time *H*, when the line-up period ends and the preparatory (service) period begins, and when the link is handed over to the broadcasting organizations.

3 Preparatory period

No definite duration is recommended by the CCITT for the preparatory period. This duration is determined by the broadcasting organizations, but a typical duration is 15 minutes. During this period, the tests to be made are also left to the discretion of the broadcasting organizations, but they must not be such as to depart from CCITT recommendations in respect of signal level (see Recommendations N.60 and N.63). The broadcasting organizations may, on occasion, omit the preparatory period and begin the actual transmission at time *H*.

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[1] See the comment in Recommendation N.62 concerning the difficulties involved in making overall tests on circuits that include a standards converter.

[2] According to the definitions given in Recommendation N.51 in this particular case, the international television circuit is also an international television link.

[3] See Recommendation N.55 for definition of control and sub-control ITCs.

Recommendation N.55

ORGANIZATION, RESPONSIBILITIES AND FUNCTIONS OF CONTROL AND SUB-CONTROL ITCs AND CONTROL AND SUB-CONTROL STATIONS FOR INTERNATIONAL TELEVISION CONNECTIONS, LINKS, CIRCUITS AND CIRCUIT SECTIONS

1 Organization

1.1 The international television link is in all cases the sole responsibility of the telecommunication Administrations involved.

1.2 The national television circuits at the ends of the link may be the responsibility of either the telecommunication Administration or the broadcasting organization or the two together, depending on local arrangements in each particular country.

1.3 The ITC at the receiving end (country C in Figure 2/N.51) is normally the control station for both the international television link and the international television connection and is referred to as the control ITC. The choice of the station which is to have this function is left to the discretion of the Administration concerned.

1.4 The intermediate ITCs, where the international circuit appears at video frequencies, are sub-control stations for the international television link and are referred to as intermediate sub-control ITCs.

1.5 Circuit sections, including satellite sections, also have control and sub-control stations. From the standpoint of overall control arrangements for an international television link, a station controlling a circuit section is referred to herein as an intermediate sub-control station.

1.6 The ITC at the sending end (country A in Figure 2/N.51) is normally the sub-control station for both the international television link and the international television connection. It is also referred to as the terminal sub-control ITC. However, the choice of the station which is to have this function is left to the discretion of the Administration concerned.

2 Responsibilities

2.1 The control ITC is responsible to the broadcasting organization (receive) for the satisfactory performance of the overall international television connection. When an international television connection does not include a satellite section, the control ITC should exert control through intermediate sub-control ITCs, and stations, on that portion of the international television connection extending from the terminal sub-control ITC to the broadcasting organization (receive). When an international television connection does include a satellite section, the control ITC should exert control through intermediate sub-control ITCs, and stations, on that portion of the international television connection extending from the transmitting earth station to the broadcasting organization (receive).

2.2 When an international television connection does not include a satellite section, control of that portion of the international television connection extending from the broadcasting organization (send) to the terminal sub-control ITC should be exerted through the terminal sub-control ITC. When an international television connection does include a satellite section, control of that portion of the international television connection extending from the broadcasting organization (send) to the transmitting earth station should be exerted through the terminal sub-control ITC. In each case, the terminal sub-control ITC is, in turn, responsible for the satisfactory performance of that portion of the connection over which the terminal sub-control ITC has control responsibility; the terminal sub-control ITC should coordinate the activities of any intermediate sub-control ITCs, and stations, both prior to and during the transmission, thus assisting the control ITC and keeping that office informed of developments.

2.3 The receive earth station is the control station for the satellite circuit section. Reference to the control station for the satellite circuit section is intended to apply to the station, or portion of the station, manned by personnel of the satellite operator.

2.4 Any intermediate sub-control ITCs, and other intermediate sub-control stations, are responsible for the satisfactory performance of their respective circuits and circuit sections. In the operation of an international television connection, any sub-control ITCs and stations which are intermediate are responsible to either the terminal sub-control ITC or the control ITC, depending upon their location in the overall connection.

3 Functions

3.1 All stations which are designated as control and sub-control stations on an international television connection should perform the following functions:

- ensure that sections under each respective control are conditioned for service and connected into the international television connection at the appropriate time;
- time the start and conclusion of the transmission in accordance with § 5 below;
- keep complete and accurate records of all station activities pertaining to the international television transmission. This should include timing and recording service impairment observed or reported, and taking corrective action under the direction of the control or terminal sub-control ITC;
- prepare and forward prescribed reports.

3.2 Control and terminal sub-control ITCs on an international television connection should perform the following additional functions:

- verify the scheduling of the television transmission and the availability of information necessary to furnish it;
- perform and coordinate, as required, prescribed pre-transmission line-up tests;
- check the satisfactory receipt, by the broadcasting organization (receive), of the test programme originated by the broadcasting organization (send);
- ensure that the international television connection is handed over to the broadcasting organizations at the scheduled time.

3.3 In order to perform the above functions satisfactorily it is essential that adequate and direct communications be available between terminal ITCs during the line-up and service periods. It is preferable that such communications be provided by direct service circuits (as those specified in Recommendation M.100 [1]), the requirement for television being analogous to the requirements for the service circuits of the telephone and telex networks. In those instances where permanent direct service circuits are not provided and the television service is of an infrequent nature, it will be the responsibility of the control ITC to initiate action for the provision of an adequate means of communications. Use of the public telephone network or telex network should be encouraged in such instances.

4 Pre-transmission procedures

4.1 At some time prior to the scheduled start of television transmission, preferably the day before but not less than two hours prior to the start of service, the control ITC should contact the terminal sub-control ITC and the appropriate intermediate sub-control ITCs or stations, over which it exercises control and confirm that they have the transmission schedule and sufficient information to furnish the service. Similarly, the terminal sub-control ITC should contact the intermediate sub-control ITCs or stations over which it exercises control to verify their readiness.

4.2 The control and sub-control ITCs should initiate circuit section line-up tests for which they are directly responsible. The tests should be completed far enough in advance of the scheduled time at which the connection is to be handed over to the broadcasting organization (point *H* in Figure 1/N.54) to assure completion by that time of the operations given in § 4.3. During this same period the control station for any satellite circuit section should perform line-up tests as prescribed by the responsible authority. The tests recommended for terrestrial circuit sections and ITC-to-ITC links are those detailed in Recommendation N.62.

4.3 Immediately upon conclusion of the circuit section tests, the control ITC, with the cooperation of the terminal sub-control ITC, should verify that the international television link is continuous between these terminal ITCs and should then proceed to perform overall line-up tests as detailed in Recommendation N.62.

4.4 Upon completion of the overall tests, and if possible 2 or 3 minutes prior to the scheduled start of the transmission from the broadcasting organization (send), the control and sub-control ITCs should establish the connection to the broadcasting organizations and check the test programme between them. Checking the test programme consists of verifying the satisfactory receipt, from the standpoints of quality and level, by the broadcasting organization (receive) of test material originated by the broadcasting organization (send). The sub-control ITC should request this transmission of test material from the broadcasting organization (send), as necessary, and should verify that the material is of suitable quality and level at its location. The control ITC should also check for suitable quality and level at its location. After it is determined that the test programme check is satisfactory, the connection should be handed over to the broadcasting organizations.

5 Timing the international television transmission

5.1 The control ITC and terminal sub-control ITC of the international television connection should record the times of start and conclusion of the transmission, in Coordinated Universal Time (UTC).

5.2 The starting time-of-day of the service may be the scheduled time shown on the service order, or the time at which the broadcasting organizations commence to use the service, whichever is earlier. If the connection is not ready for use on schedule, and is handed over to the broadcasting organizations after the scheduled time of start shown on the service order, then the start of service is the time-of-day at which the connection is handed over to the broadcasting organizations.

5.3 The concluding time of the service is the time at which the connection is released by the broadcasting organization (receive) (end of chargeable duration – sometimes called the *Good-night time*).

The conditions for the provision and lease of circuits for television transmissions are given in Recommendation D.180 [2].

6 Monitoring

6.1 The control ITC should monitor in connection with the pre-transmission check of test television programmes and continuously thereafter until the conclusion of the transmission. Continuous monitoring at other stations is not required, except as directed by their respective Administrations, and as required to discharge their responsibilities with regard to fault location.

7 Fault location and handling

7.1 The control and sub-control ITCs and stations are responsible for recording times-of-day and details of service impairments observed and/or reported to them and for initiating corrective actions. However, except when the impairment has rendered the programme unusable, no action which would interrupt the transmission path should be taken except at the direction of the control ITC.

7.2 Although composed of a variety of national and/or international circuits and circuit sections, an overall international television connection without a satellite section may be divided into two segments:

a) the terrestrial facilities between the broadcasting organization (send) and the terminal sub-control ITC;

b) the terrestrial facilities between the terminal sub-control ITC and the broadcasting organization (receive).

When an overall international television connection includes a satellite section the connection may be divided into three major segments:

i) the terrestrial facilities between the broadcasting organization (send) and the transmitting earth station;

ii) the satellite circuit section between earth stations;

iii) the terrestrial facilities between the receiving earth station and the broadcasting organization (receive).

7.3 Faults encountered during service will be observed by the broadcasting organization (receive) and reported to the control ITC or observed by the control ITC, or both.

7.4 Normal fault sectionalization for an overall connection without a satellite section, should be as follows:

- The control ITC shall immediately check the television signal at its location to determine if the fault lies between the broadcasting organization (receive) and the control ITC. If the signal is satisfactory at the control ITC, further sectionalization is carried out by the control ITC, directly or via sub-control stations should they exist, between the control ITC and the broadcasting organization (receive).
- If the signal is unsatisfactory as it appears incoming to the control ITC, the control ITC shall determine from the terminal sub-control ITC whether the signal is satisfactory as it arrives at the terminal sub-control ITC. If the signal incoming to the terminal sub-control ITC is unsatisfactory, the terminal sub-control ITC shall further sectionalize the fault between the broadcasting organization (send) and the terminal sub-control ITC. Such sectionalization shall begin by checking the television signal at its source.
- If the signal incoming to the terminal sub-control ITC is satisfactory, the control ITC should further sectionalize the fault via the appropriate intermediate sub-control ITCs, or stations, and take whatever corrective action is indicated.

7.5 Normal fault sectionalization for an overall international connection containing a satellite section, should be as follows:

- The control ITC shall immediately check the television signal at its location to determine if the fault lies between the broadcasting organization (receive) and the control ITC. If the signal is satisfactory at the control ITC, further sectionalization is carried out by the control ITC, directly or via sub-control stations should they exist, between the control ITC and the broadcasting organization (receive).
- If the signal is unsatisfactory as it appears incoming to the control ITC, the control ITC shall determine from the terminal sub-control ITC whether the signal is satisfactory as it arrives at the terminal sub-control ITC. If the signal incoming to the terminal sub-control ITC is unsatisfactory, the terminal sub-control ITC shall further sectionalize the fault between the broadcasting organization (send) and the terminal sub-control ITC. Such sectionalization shall begin by checking the television signal at its source.
- If the signal incoming to the terminal sub-control ITC is satisfactory, the terminal sub-control ITC should contact the transmitting earth station to determine if the signal is unsatisfactory incoming to that station; simultaneously, the control ITC should contact the receiving earth station to determine if the signal is satisfactory incoming to the receiving earth station.
- If the fault is located between the terminal sub-control ITC and the transmitting earth station, the terminal sub-control ITC shall contact the appropriate intermediate sub-control ITCs or stations, to further sectionalize the fault and take whatever corrective action is indicated.
- If the fault is located in the satellite circuit section, the control ITC should request the receiving earth station (satellite section control) to take corrective action.
- If the fault is located between the receiving earth station and the control ITC, the control ITC should contact the appropriate intermediate sub-control ITCs or stations, to further sectionalize the fault and take whatever corrective action is indicated.

7.6 Intermediate sub-control ITCs and stations should keep the ITCs, to which they are subordinate in the provision of the television service, informed of the status of the fault investigation. Similarly, the control ITC should keep the broadcasting organization (receive) informed. In so doing these stations and ITCs should exchange times-of-day at which faults are encountered, and should attempt to reconcile any differences.

8 Record keeping and monitoring for charging purposes

8.1 The several telecommunication Administrations will prescribe the reports required from their respective stations and the distribution to be made of these reports. To a considerable extent, however, the subject content of these reports will be essentially the same. The following paragraphs will suggest the records of television transmissions to be kept by the stations, and to some extent the information from which the prescribed reports can be prepared.

8.2 The reports prepared by the control ITC normally will provide the information from which bills rendered to the broadcasting organizations will be prepared, including any credit allowances for any transmission interruptions or other serious impairments experienced. Usually a carefully kept and detailed log record in itself will constitute a satisfactory source for this purpose.

8.3 The terminal sub-control ITC and the intermediate sub-control ITCs and stations should also keep detailed log records of their activities in connection with each television transmission. Thus, whether or not these stations are required by their Administrations to submit reports, any needed information will be available to satisfy inquiries or investigations which may arise subsequent to transmissions.

8.4 The following paragraphs suggest the nature and extent of the log record detail. Times-of-day should be shown to the second, in UTC; the record should be kept chronologically from the beginning of service preparations to the final exchange of times-of-day and comments. Abbreviations and condensations should be used carefully and discreetly; initials or names should identify the recorder.

8.5 Record exchanges and discussions with other stations and with broadcasting organizations. These records should include initials, names or other identification of the individuals contacted.

8.6 Record the results of pre-transmission tests, including the test programme check.

8.7 The technical staff of the designated ITC should come to an agreement among themselves so that at the end of the television transmission they have accurate knowledge of:

a) the time of handing over the television link to the broadcasting organization (beginning of chargeable duration);

b) the time at which the television link is released by the broadcasting organization (end of chargeable duration);

c) where appropriate, the times and duration of every interruption or incident which may have occurred (in order that the operating services can determine whether a rebate is due and, if so, its amount).

The times of the beginning and of the end of the chargeable duration, as well as the time of occurrence and duration of any breakdowns which may occur, are entered on a daily report. This daily report is sent on the same day to the service responsible for coordinating all the details necessary for the establishment of the international accounts.

8.8 In recording the times of programme start and conclusion, indicate when agreement is reached with other stations or with broadcasting organizations with respect to these times. Where discrepancies cannot be reconciled, record the differing times with suitable identification of each.

8.9 For any period of impairment, record the time it began, its duration, the time it was reported, and the nature and degree of the impairment, and note whether in the opinion of the broadcasting organization the programme was rendered unusable.

8.10 Record the quality assessment of the overall transmission given by the broadcasting organization (receive), using the quality assessment scale (see Recommendation N.64 for Impairment and Quality Scales).

8.11 The log record of each station at which the transmission was monitored continuously should include the assessment of the overall transmission by the attendant at that station using the quality assessment scale.

9 Responsibilities of control and sub-control stations for multiple destination transmissions

9.1 International multiple destination transmissions on communications satellite systems differ in a number of respects from those routed on terrestrial systems. A common transmitting path extends from the terminal ITC sub-control station through the transmitting earth station to a satellite repeater and separate receiving paths extend from the satellite repeater through the applicable receiving earth station to a number of terminal ITC control stations (Figure 5/N.51). Operations on the common path will affect transmission to all the receiving stations whereas operations on any receiving path will only affect transmission to the terminal ITC control station on the particular path concerned. To coordinate the setting-up, lining-up and maintenance of a multiple destination transmission on a communications satellite system, it is recommended that a send reference station be designated for each multiple destination circuit section, circuit and link.

The responsibilities of a send reference station are given in § 9.2 below. The additional responsibilities and functions of control stations for a multiple destination television transmission are contained in § 9.3 below.

9.2 *Send reference stations*

i) The send reference station for a multiple destination television circuit section is the intermediate circuit sub-control station, at the transmitting earth station (R in Figure 4/N.51).

ii) The send reference station for a multiple destination television circuit and link is the terminal sub-control station for the circuit and link respectively (R′ and R″ in Figure 5/N.51).

In addition to the normal control and sub-control station responsibilities specified in this Recommendation, stations designated as send reference stations are required to perform the following functions:

a) coordinate the setting-up, and lining-up, of the multiple destination circuit section, circuit or link;

b) coordinate maintenance action on the multiple destination circuit section, circuit or link when requested by the control stations;

c) keep records of measurements made during the initial line-up of the multiple destination circuit section, circuit or link and incidents reported by the control stations during transmissions.

9.3 *Additional responsibilities of control stations*

In addition to the control station responsibilties in §§ 1 to 8 above, the control stations of multiple destination circuit sections, circuits or links, having a designated send reference station should perform the following functions:

a) report to the appropriate send reference station the results of line-up measurements made on the multiple destination circuit section, circuit or link;

b) report any incidents observed during transmissions to the appropriate send reference station.

c) cooperate with the appropriate send reference station in locating fault conditions.

10 International television transmissions for television receive-only stations (TVROs) not related to an ITC

For international television transmissions for TVROs not related to an ITC (see Figure 6/N.51), a fault reporting centre (FRC) should perform the following functions:

- Deal with enquiries concerning service performance and fault reports.
- Deal with general enquiries from other TVROs/FRCs.
- Make contact with the ISTC (see below) in the originating country for fault reporting and general service liaison.

In an originating country the Administration concerned should nominate an international satellite transmission centre (ISTC) for every transmitted service. Where possible, all services transmitted by an Administration shall be handled by the same ISTC.

The ISTC should perform the following functions:

- To be a contact point for FRCs and for the programme originators making enquiries concerned with service continuity.
- To liaise with the transmitting earth station and any intermediate sub-control station for fault investigations and technical coordination.
- To monitor transmissions from programme originators' premises and to have the capability to monitor the transmission from the satellite.

In the case where programme material is received by TVROs in the country of origination, the ISTC and the FRC should be co-located where possible and the duties combined.

References

[1] CCITT Recommendation *Service circuits*, Vol. IV, Rec. M.100.

[2] CCITT Recommendation *Occasional provision of circuits for international sound- and television-programme transmissions*, Vol. II, Rec. D.180.

2.2 Lining-up and monitoring of an international television connection

It is assumed that the international television connection is as shown in Figures 2/N.51, 5/N.51 and 6/N.51 and that such a connection is provided by the interconnection of permanently and/or occasionally established television circuits.

Recommendation N.60

NOMINAL AMPLITUDE OF VIDEO SIGNALS AT VIDEO INTERCONNECTION POINTS

At video interconnection points, the nominal amplitude of the picture signal, measured from the blanking level to the white level should be 0.7 V (0.714 V for system M signals), while the nominal amplitude of the synchronizing pulses should be 0.3 V (0.286 V for system M signals), so that the nominal peak-to-peak amplitude of a monochrome video signal should be 1.0 V. The addition of colour information results in an increase in the overall amplitude of the video signal. The magnitude of this increase depends upon the colour system employed, but should not exceed 25% (i.e. nominal amplitude of composite colour video signal $\leqslant$ 1.25 V). Figure 1/N.60 shows the waveform of a video signal.

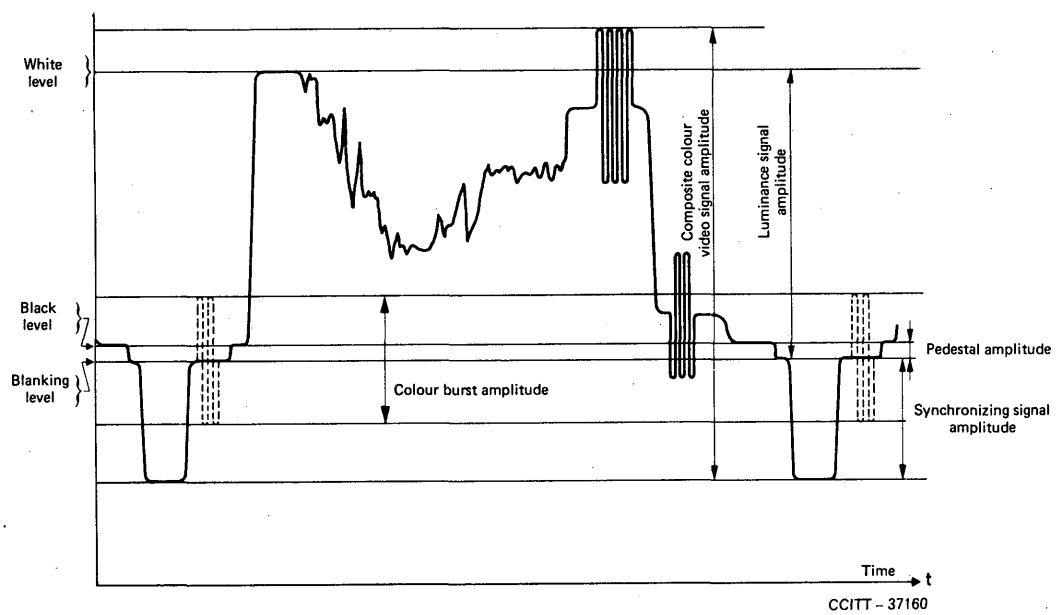


FIGURE 1/N.60

Waveform of one line of video signal

Recommendation N.61

MEASUREMENTS TO BE MADE BEFORE THE LINE-UP PERIOD THAT PRECEDES A TELEVISION TRANSMISSION

The national television circuits should be so adjusted that, when they are connected to the international television link, the amplitude of the video signals at the video interconnection points is in accordance with Recommendation N.60.

Recommendation N.62

TESTS TO BE MADE DURING THE LINE-UP PERIOD THAT PRECEDES A TELEVISION TRANSMISSION

1 Introduction

International television circuits or national sections of such circuits may be provided either by Administrations or broadcasting organizations; both types of entities establish ITCs to carry out the functions given in Recommendation N.55. One of those functions is to test the international television circuits/links before they are handed over to the broadcasting organizations for programme transmission.

International television circuits are:

- circuits with terrestrial sections only
- circuits comprising a satellite section with national circuit sections between each earth station and the ITC in the same country.

Figure 1/N.62 shows an example of an IMDTC (International Multiple Destination Television Connection), using circuits of both types.

2 Test signal source identification

All full field test signals as described in this Recommendation should be superimposed with an identification which includes the point of origin and the name of the sending authority. It may be transmitted either in monochrome or in colour according to preference or to suit the technical requirements of the particular test signal being transmitted. If the local language of the originating station is not an internationally recognized language then the idendification should be displayed not only in the local language of the station concerned but also in one of the internationally recognized languages.

3 Test procedure

In accordance with Recommendation N.54, lining-up and testing of the national and international circuit sections should take place between $H - 30$ and $H - 15$ min, where H is the time at which the circuit should be handed over to the broadcasting organization. In practice, these tests normally take place:

- between ITCs and earth stations
- between earth stations
- between ITCs in adjacent countries linked by terrestrial circuits.

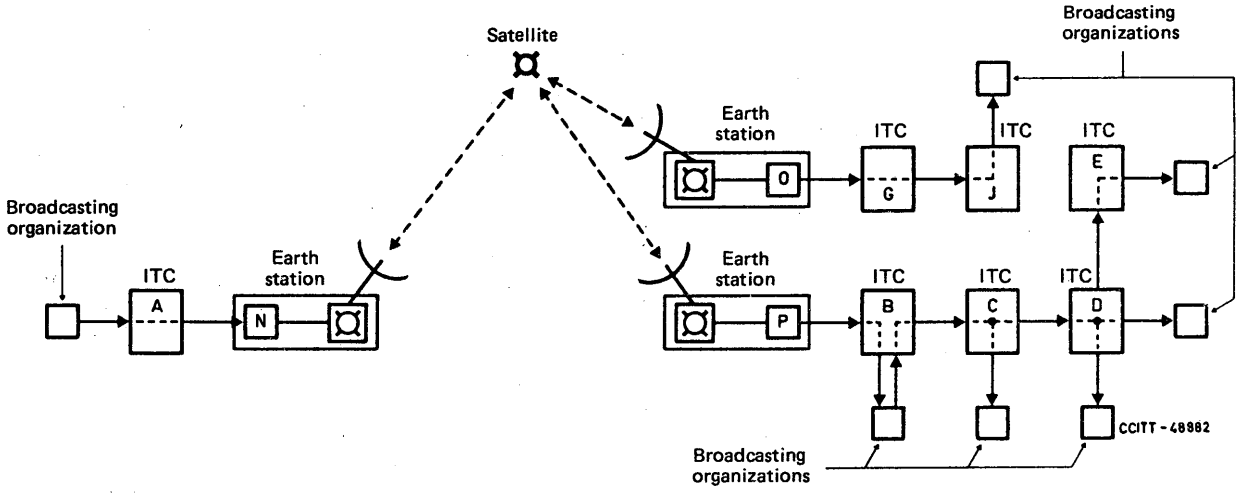
The use of insertion test signals (ITS) has been demonstrated to expedite the pre-transmission line-up testing of terrestrial and satellite circuit sections. Therefore, whenever possible, insertion test signals in accordance with CCIR Recommendations 567 [1] and 569 [2] should be used together with appropriate automatic measuring equipment during the line-up period. Insertion test signals from the sending broadcasting organization should also be used during the preparatory period and subsequent transmission for monitoring and fault location purposes.

An example of the circuits and circuit sections to be tested during the first half of the line-up period is shown in Figure 1/N.62.

Priority should be given to verifying the continuity and that the send and receive levels are correct.

Table 1/N.62 gives a suitable timetable of the sequence of measurements to be made during the line-up period.

At $H - 15$ min precisely, the circuit sections are interconnected to form international circuits and the international circuits interconnected to form international links which could be multiple destination. Tests are carried out from the sending ITC for each international link or international multiple destination circuit. (See the example given in Figure 1/N.62.) Again, priority is given to the continuity of each international circuit or link and the send and received levels.



Time	*H* – 30 min. to *H* – 15 min.	*H* – 15 min. to *H*	*H*
Test	A – N	A – B and G	IMDTC established from sending broadcasting organization to all receiving broadcasting organizations by action at A, B, C, D, E, J and by broadcasting organization fed from B
	N – O and P	B – E	
	P – B		
	B – C		
	C – D		
	D – E		
	O – G		
	G – J		

Note – *H* is the time from which the broadcasting organization has ordered the connection.

FIGURE 1/N.62

Example of an international multiple destination television connection (IMDTC)

At *H* precisely, or a few minutes beforehand if the pre-transmission tests have been completed, the ITCs extend the international circuits/links to the broadcasting organization so that the international television connection from the sending broadcasting organization to the receiving broadcasting organization(s) can be verified. Any interconnections required in the premises of the broadcasting organizations will also be made at this time. International television connections should be made available to the broadcasting organizations on time, even if all tests have not been completed, provided that the continuity and levels have been verified.

There is a need for broadcasting organizations to assess subjectively the quality of the television picture as per Table 1/N.64. If colour bar signals[1)] are used for this purpose, the composite signal (colour bars plus captions, etc.) must not exceed 1 volt (peak-to-peak) in order to preclude interference with adjacent video channels, particularly on half transponder satellite operation.

[1)] As defined in [3].

TABLE 1/N.62

Sequence of measurements

Items	Timing	Signal [a]	Measurement
1a 1b	$H-30$ to $H-25$ $H-15$ to $H-10$	B2 or B3 and B1 (pulse and bar) or insertion test signal [b]	Luminance bar amplitude error and short period variations (1 s) Bar tilt or base line distortion [c] 2T pulse-to-bar ratio
2a 2b	$H-25$ to $H-23$ $H-10$ to $H-8$	No input signal or "quiet line"	Signal-to-weighted-random-noise ratio [d]
3a 3b	$H-23$ to $H-21$ $H-8$ to $H-6$	A (field bar)	Field-time waveform distortion
4a 4b	$H-21$ to $H-19$ $H-6$ to $H-4$	Insertion test signals [b]	Chrominance-luminance gain inequality Peak differential gain Peak differential phase
5a 5b	$H-19$ to $H-15$ $H-4$ to H [e]	B2 or B3 and B1 or insertion test signals [b]	Verification of continuity and line-up

[a] Signals A, B1, B2 and B3 are defined in CCIR Recommendation 567 [1].

[b] To be inserted in appropriate lines of a video signal with a mean average picture level (APL).

[c] Bar tilt or base line distortion may be measured by mutual agreement of the Administrations concerned.

[d] Where an ITC has equipment for measuring the signal-to-weighted-noise ratio on the "quiet" line it should take that measurement during the first five minutes of the test sequence if insertion test signals are received.

[e] In accordance with Recommendation N.54 connection may be made to the broadcaster by an ITC during this period. Connection may also be made to the sending broadcaster provided the sending ITC is receiving a video signal from the broadcaster originating the transmission.

4 Tests to be made by the ITCs

Only 15 minutes is allowed for each of the series of tests referred to in § 2. This period is more than adequate if modern test equipment is used. The measurements to be carried out are defined in CCIR Recommendations 567 [1] or 569 [2].

Before the commencement of the line-up period the staff of the ITCs should ensure that the test generator(s) and measuring equipment are in good working order. It is particularly important that impeccable test signals should be sent so as to prevent receiving ITCs from concluding, on the basis of their measurements, that a circuit is faulty when that is not the case.

If difficulty is experienced in performing the required tests, as a minimum, the circuit continuity should be established and the send and received levels checked, with the assistance of the sending broadcasting organization. If colour bar signals are used for this continuity check, the amplitude should be checked and application must be in accordance with § 3.

Table 2/N.62 lists the parameters and test objectives for international television circuits/links.

TABLE 2/N.62

Test objectives [a]

Parameter	Circuit sections			International circuits			
	ITC/earth station	Earth station/ earth station [b]		Terrestrial only		Terrestrial plus satellite [b]	
		Half transponder	Full transponder	525-line	625-line	525-line	625-line
(1)	(2)	(3a)	(3b)	(4)		(5)	
Luminance bar amplitude error	± 0.5 dB or 5 % or 5 IRE units	± 0.25 dB or 2.5 % or 2.5 IRE units	± 0.25 dB or 2.5 % or 2.5 IRE units	± 1 dB or 11 % or 11 IRE units		± 1 dB or 11 % or 11 IRE units	
Short period variations of luminance bar error (1 s)	± 0.3 dB or 3 % or 3 IRE units	± 0.1 dB or 1 % or 1 IRE unit	± 0.1 dB or 1 % or 1 IRE unit	± 0.3 dB or 3 % or 3 IRE units		± 0.4 dB or 4 % or 4 IRE units	
Bar tilt	± 1 %	± 1.5 %	± 1 %	± 1 %	± 3 %	± 2 %	± 4 %
Base ligne distortion	± 1 %	Note	Note	± 1 %	± 3 %	Note	
2T pulse-to-bar ratio	± 6 %	± 6 %	± 6 %	± 6 %	± 8 %	± 12 %	± 10 %
Signal-to-weighted-random-noise ratio	56 dB	49 dB	54 dB	56 dB		48 dB	
Field time waveform distortion	± 2 %	± 2 %	± 1 %	± 2 %	± 6 %	± 4 %	± 6 %
Chrominance-luminance gain inequality	± 10 %	± 10 %	± 10 %	+ 8 % − 11 %	± 10 %	+ 12 % − 20 %	± 15 %
Peak differential gain	± 10 %	± 10 %	± 10 %	± 10 %	± 8 %	± 15 %	
Peak differential phase	± 3°	± 4°	± 3°	± 3°	± 5°	± 6°	± 8°

[a] In principle, the test objectives for terrestrial circuits/links apply to those having a length of about 1250 km.

[b] Test objectives given in columns 3a, 3b and 5 refer to temporary circuit sections and circuits provided by INTELSAT satellites and relate to expected performance in global beam utilizing earth stations having G/T of 40.7 dB/K and elevation angles of 10°. Different figures may be appropriate when other satellites, earth station sizes and elevation angles are employed.

Note – Under study.

References

[1] CCIR Recommendation *Television performance of television circuits designed for use in international connections*, Rec. 567, Vol. XII, ITU, Geneva, 1986.

[2] CCIR Recommendation *Definitions of parameters simplified for automatic measurement of television insertion test signals*, Rec. 569, Vol. XII, ITU, Geneva, 1986.

[3] EBU (European Broadcasting Union) *Video measurement and the correction of video circuits*, Technical Monograph 3116 (L.E. Weaver, 1978), Appendix 3, Sections 5, 6, 7 and 8.

Recommendation N.63

TEST SIGNALS TO BE USED BY THE BROADCASTING ORGANIZATIONS DURING THE PREPARATORY PERIOD

After the broadcasting organizations have taken over the international television connection, they may decide to make measurements on the complete connection from the point where the television programme is produced to the point or points where it is to be received.

The broadcasting organizations often use live pictures for testing during the preparatory period, especially when a standards convertor is involved. If for any reason they should need to send test signals then it is desirable that the telecommunication Administrations should recommend the broadcasting organizations in their countries to send signals that are in accordance with those recommended in Recommendation N.67 (at levels in accordance with Recommendation N.60), so that the staff at intermediate video interconnection points can, if necessary, compare the results of the measurements made by the broadcasting organizations with those obtained by the telecommunication Administrations during the line-up period. There is no occasion to readjust the output levels of the station equipment since these have already been set during the line-up period.

All test signals transmitted prior to the actual television transmission, being full field or otherwise, should be superimposed with the identification of the broadcaster and location from where the test signal is originating. This identification may be transmitted either in monochrome, or in colour, according to preference or to suit the technical requirements of the particular test signal being transmitted. If the local language of the originating source is not an internationally recognized language then the identification signal should be displayed not only in the local language of the country concerned but also in one of the internationally recognized languages.

When a full field signal is transmitted simply as a means to check link or tandem connection continuity, it may comprise any suitable composite video signal (such as test pattern, pulse/bar or other suitable picture or pattern) provided that it contains specific signal components that include Peak White, synchronizing pulses and the identification signal (as previously described) of the station or broadcaster transmitting the signal. The composite signal (colour bars plus captions, etc.) must not exceed 1 volt (peak-to-peak) in order to preclude interference with adjacent video channels, particularly on half transponder satellite operation.

When television pictures which contain electronically generated components, e.g. captions, are used, the out-of-band-spectral power in any 4 kHz band above 1.2 times the nominal video bandwidth shall not exceed −50 dB.

Recommendation N.64

QUALITY AND IMPAIRMENT ASSESSMENT

1 5-grade scale for quality and impairment assessment

The 5-grade scale, applicable to both quality and impairment assessments in Table 1/N.64 should be used.

TABLE 1/N.64

Grade	Quality	Impairment
5	Excellent	Imperceptible
4	Good	Perceptible but not annoying
3	Fair	Slightly annoying
2	Poor	Annoying
1	Bad	Very annoying

Although the scale is intended, in connection with television, to apply to *overall* picture assessment, it should be noted that the same scale could be used for a critical assessment of particular picture characteristics. Moreover, the number of the grade can be taken as either a quality assessment or an impairment assessment. Depending on the context, for example, a Grade 3 picture is of *fair* quality, having *slightly annoying* impairments. The same scale can be used in the case of types of transmission other than television.

Note 1 – It is implicit that before a circuit is handed over to a broadcasting organization all reasonable steps will have been taken to ensure that the circuit quality from the point of view of transmission is the best that can be achieved at the beginning of the preparatory period.

Note 2 – Grade 1 should be applied only to a transmission considered to be unusable by the broadcasting organization concerned. If, under exceptional circumstances, the broadcasting organization decides to use a transmission so graded, because of the interest in the information to be transmitted, this should not constitute a precedent for changing the grade or for changing the significance of Grade 1.

Note 3 – This Recommendation does not apply to the assessment of speech transmission quality in telephony.

Recommendation N.67

MONITORING TELEVISION TRANSMISSIONS. USE OF THE FIELD BLANKING INTERVAL

1 Monitoring points

Technical control by the telecommunication Administrations of a television transmission in progress should be possible at any time:

- at national and international television centres in the connection;
- at the last staffed-station immediately preceding the frontier of each country and at a point in the station which will include as much as possible of the station equipment in the direction of transmission concerned (by providing monitoring-demodulators if necessary).

These centres and stations should be equipped with an oscilloscope (the horizontal sweep frequency of which is synchronized to the line frequency) for monitoring the electrical signal and a picture-monitor for monitoring the complete picture.

2 Numbering of lines in a television field

For 625-line systems the numbering of the lines is as follows:

Line 1 starts at the instant indicated by 0_v in Figure 2-1 of CCIR Report 624 [1]; at this instant, the leading edge of the line synchronization pulse coincides with the beginning of the sequence of field synchronization pulses. The lines are numbered according to their sequence in time, so that the first field comprises lines 1 to 312 as well as the first half of line 313, whereas the second field comprises the second half of line 313 and lines 314 to 625.

For 525-line systems the numbering of the lines is as follows:

Line 1 of field 1 is the line starting with the first equalizing pulse at the instant indicated by 0_{E1} in Figure 2-3a of CCIR Report 624 [2], line 1 of field 2 is the line starting with the second equalizing pulse at one half-line period after the instant indicated by 0_{E2} in Figure 2-3b of this report [3].

3 625-line insertion test signals (ITS)

The advent of colour has caused the CCIR to recommend a comprehensive set of test signals which may be inserted on lines 17, 18, 330 and 331 for international monochrome or colour transmissions[1]. This signal is illustrated in Figure 1/N.67[2] and is made up as follows:

---

[1] As an interim measure some organizations may decide to omit some of the waveforms, but in this case care must be taken not to alter the mean values appreciably.

[2] A colour burst is present in the line blanking period during colour transmissions. In the case of PAL colour transmissions the chrominance subcarrier of the insertion signals is locked at 60° from the (B-Y) axis.

Line 17

A 10 µs white bar (B_2), a 2 T sine-squared pulse (B_1), a 20 T composite pulse (F) and a 5-riser staircase (D_1).

Line 18

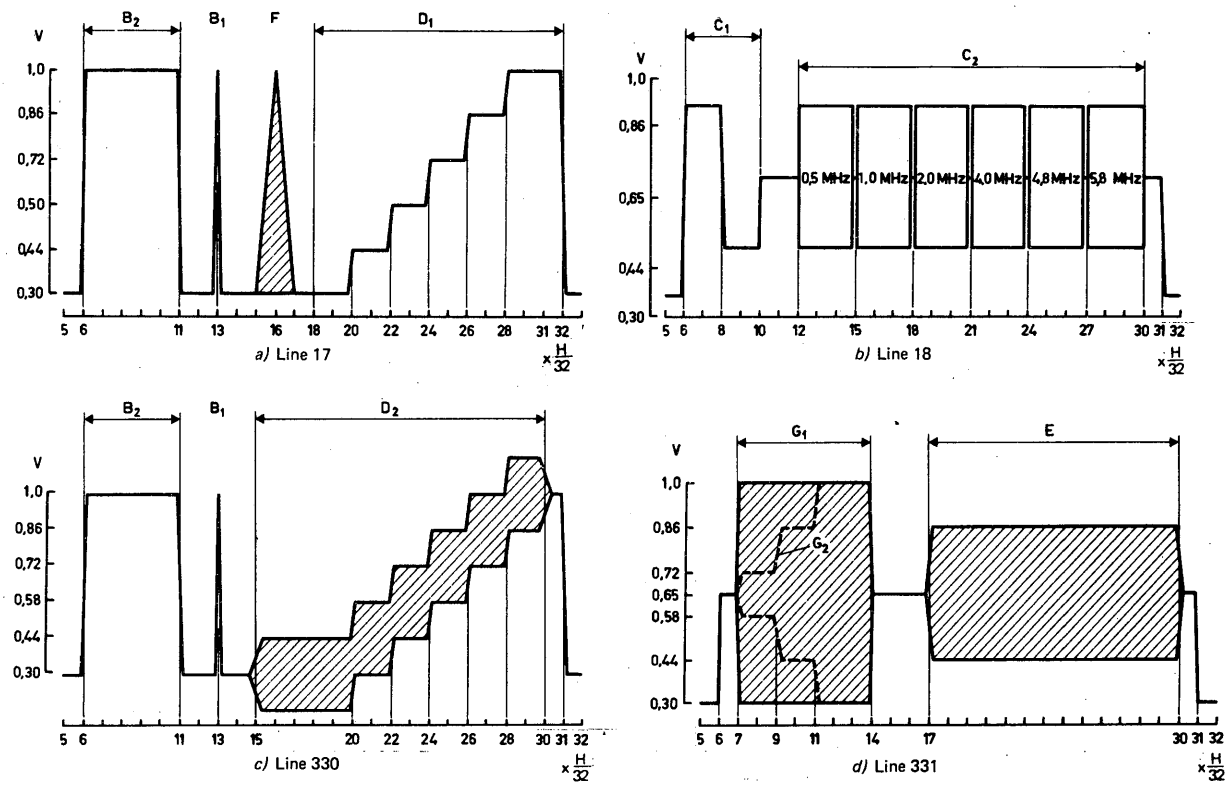
A multiburst (C_2) preceded by a reference bar signal (C_1)

Line 330

A 10 µs white bar (B_2), a 2 T sine-squared pulse (B_1) and a 5-riser staircase with superimposed colour subcarrier (D_2).

Line 331

A chrominance bar signal (G_1) or a three-level chrominance signal (G_2), followed by a sub-carrier reference bar (E).



Note – A detailed description of these signals is given in CCIR Recommendation 473 [4].

FIGURE 1/N.67

Test signal for insertion in field blanking intervals of a 625-line colour (or monochrome) television signal

4 525-line insertion test signal (ITS)

For colour the CCIR has recommended a comprehensive set of test signals which may be inserted on lines 17 of both fields (lines 17 and 280 if numbered consecutively) for international monochrome or colour transmissions. These signals are illustrated in Figure 2/N.67, *c*) and *d*) and are made up as follows:

Figure 2/N.67, c): a luminance bar (reference white level) (B_2), a 2 T sine-squared pulse (B_1), a modulated 12.5 T sine-squared pulse (F) and a superimposed 5-riser staircase (D_2);

Figure 2/N.67, d): a reference bar signal (C_1), a luminance pedestal, a multiburst signal superimposed on the pedestal (C_2) and a superimposed 3-level chrominance signal (G).

A detailed description of these signals is given in CCIR Recommendation 473 [4].

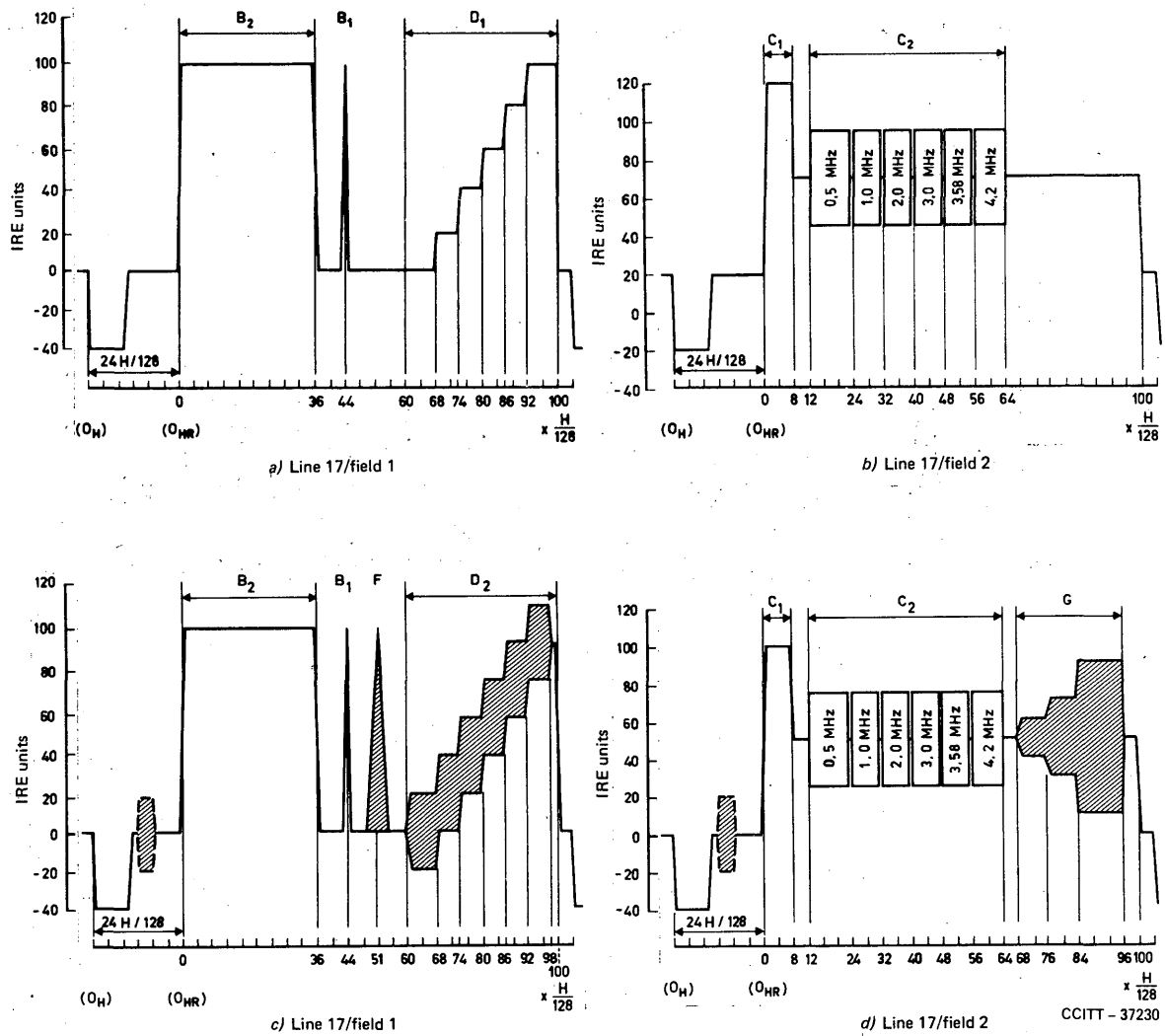


FIGURE 2/N.67

Test signal for insertion in field blanking intervals of a 525-line colour (or monochrome) television signal

5 Measurements on insertion test signals (ITS)

In order to carry out measurements on an insertion test signal, stations and centres should also be equipped with a line selector which enables only the test signal line (or lines) to be displayed on the oscilloscope.

Measurements which can be made with the above signals are given in Tables 1/N.67 and 2/N.67.

TABLE 1/N.67

625-line monochrome or colour signal (Figure 1/N.67)
(CCIR Recommendation 473 [4])

Characteristics measured	Waveform used	Line number
Linear distortions		
Insertion gain	B_2	17 and 330
Amplitude/frequency response	C_2 and C_1	18
Line-time waveform distortion	B_2	17 and 330
Short-time waveform distortion		
– step response	B_2	17 and 330
– pulse response	B_1	17 and 330
Chrominance-luminance gain inequality	B_2 and G_1 or G_2	17 and 330, 331
Chrominance luminance delay inequality	B_2 and F	17
	F	17
Nonlinear distortions		
Luminance line-time nonlinearity	D_1	17
Chrominance nonlinearity	G_2	331
Luminance chrominance intermodulation		
– differential gain	D_2	330
– differential phase	D_2 and E	330, 331
Chrominance luminance intermodulation	B_2 and G_1 or G_2	17, 331

TABLE 2/N.67

525-line monochrome or colour signal (Figure 2/N.67)

Characteristics measured	Waveform used	Line number
Linear distortions		
Insertion gain	B_2	17/field 1
Amplitude/frequency response	B_2 [a] and C_2	17 fields 1 and 2
Line-time waveform distortion	B_2	17/field 1
Short-time waveform distortion		
– step response	B_2	17/field 1
– pulse response	B_1	17/field 1
Chrominance/luminance gain inequality	B_2 and F	17/field 1
Chrominance/luminance delay inequality	F	17/field 1
Nonlinear distortions		
Line-time luminance nonlinearity	D_1 [b]	17/field 1
Chrominance nonlinearity	G	17/field 2
Luminance/chrominance intermodulation		
– differential gain	D_2	17/field 1
– differential phase	D_2	17/field 1
Chrominance/luminance intermodulation	G	17/field 2

[a] C_1 (line 17/field 2) may be used in place of B_2, when line-time distortion is suitably small.

[b] D_2 may be used when the chrominance/luminance intermodulation is suitably small.

6 Insertion and removal of test signals in the field blanking period

6.1 *International signals*

The appropriate international signals inserted by the originating broadcasting organization should be transmitted to the point of destination of the television connection. Exceptionally, if the connection includes a standards or colour systems convertor which does not pass signals occurring during the field blanking period, then the signals should be monitored at the upstream video point nearest to the convertor and new international signals, to the appropriate standard, should be inserted at the downstream point nearest to the convertor. The test signals should be available at any video connection point in order to facilitate assessment of performance. They may also be of use in carrying out any necessary readjustment of correctors at the final destination.

6.2 *National signals*

Any test signals inserted in lines 18 to 20 (525-line systems), or 19 to 21 (625-line systems) and the corresponding lines in the second field in either standard, should be regarded as national signals and should be removed at a suitable video point within the national frontier so that downstream countries on the circuit may use these lines for their own needs. Exceptionally, and subject to agreement between all the countries concerned, national signals may be transmitted across international frontiers.

7 General implementation

It is requested that Administrations of countries where national broadcasting organizations have the sole right of transmitting television signals should approach those organizations in order that the principles of this Recommendation may be applied as widely as possible.

Attention is drawn to the comments in Annex III to Part C of CCIR Recommendation 567 [5]. Particular attention is drawn to the unrepresentative result of measurements made on a single test line per field when half-field-rate dispersal waveforms are applied to the signal, e.g., on satellite circuits. Comment is also made in this reference to the difference between measurements made with full field test signals in accordance with CCIR Recommendation 567 [5] and measurements made automatically in accordance with CCIR Recommendation 569 [6].

References

[1] CCIR Report *Characteristics of television systems*, Vol. XI, Report 624, p. 5, Figure 2-1, ITU, Geneva, 1986.

[2] *Ibid.*, p. 7, Figure 2-3a.

[3] *Ibid.*, p. 7, Figure 2-3b.

[4] CCIR Recommendation *Insertion of test signals in the field-blanking interval of monochrome and colour television*, Vol. XII, Rec. 473, ITU, Geneva, 1986.

[5] CCIR Recommendation *Television performance of television circuits designed for use in international connections*, Vol. XII, Rec. 567, ITU, Geneva, 1986.

[6] CCIR Recommendation *Definitions of parameters simplified for automatic measurement of television insertion test signals*, Vol. XII, Rec. 569, ITU, Geneva, 1986.

2.3 Maintenance of leased circuits for television transmission

Recommendation N.73

MAINTENANCE OF PERMANENT INTERNATIONAL TELEVISION CIRCUITS, LINKS AND CONNECTIONS

1 Introduction

In most cases, circuits used for television transmissions are provided by the Administrations, although in some countries broadcasting organizations own all or part of the circuits within national boundaries.

The routine maintenance of circuits used for transmissions between two or more countries requires the closest cooperation between the Administrations/broadcasting organizations that provide the circuit sections.

It is recommended that routine maintenance measurements be carried out each month on permanently installed terrestrial circuits.

This Recommendation applies also for routine test transmission over leased satellite circuits for television transmissions directed to TVROs not related to an ITC.

2 Test signal elements

Diagrams of the different test-signal elements as defined in CCIR Recommendation 567 [1] are given in Annex A; the titles of those test-signal elements with the reference designations are given below:

Field bar	Signal A	Figures A-1/N.73 and A-2/N.73
Sine-squared pulse	Signal B1	Figures A-3/N.73 and A-4/N.73
Luminance bar	Signal B2 or, B3	Figures A-3/N.73 and A-4/N.73
Multiburst	Signal C	Figures A-5/N.73 and A-6/N.73
Staircase	Signal D1 and D2	Figures A-7/N.73 and A-8/N.73
Composite pulse	Signal F	Figures A-9/N.73 and A-10/N.73
Chrominance bar	Signal G1 (625-lines only)	Figure A-11/N.73
Three level chrominance bar	Signal G2 (625-lines only)	Figure A-11/N.73
Three level chrominance bar	Signal G (525-lines only)	Figure A-12/N.73

3 Test equipment

3.1 *Generators*

CCIR Recommendation 473 [2] defines the insertion test signals required for measurement purposes. The assembly of test signal elements in test lines is also referred to in Recommendation N.67 and most modern test signal generators can originate the test signals, either as insertion test signals or as full-field test signals. In the latter mode measurements can be carried out at standard values of average picture level (APL).

The assembly of test signal elements in the test lines is sufficient for the measurement of the large majority of television circuit parameters, that is, distortions occurring at line frequency and above. However, additional test signals are needed for low and very low-frequency measurements. A field bar is required for the measurement of field time distortions and, for the measurement of long-time waveform distortion, a signal is required which is switched at intervals of a few seconds between low and high APLs. (For further details see CCIR Report 636 [3].)

3.2 *Measurement equipment*

The measurement equipment may consist of:

– an oscilloscope or television waveform monitor with additional equipment for making nonlinearity measurements [1];

[1] A line selector for selecting insertion test lines for display with older type waveform monitors or oscilloscopes is commercially available.

– modern television waveform monitors equipped with line-selection and means for measuring nonlinearity distortion;
– automatic measurement equipment.

4 Measurement definitions

CCIR Recommendations 567 [1] and 569 [4] define the measurements that may be made on television circuits. There are slight differences in the way certain similar parameters are defined, for example, insertion gain and luminance bar amplitude, and differences in the way the results are expressed, for example, luminance bar amplitude and luminance bar amplitude error. To standardize routine maintenance measurements, it is recommended that the definitions given in Recommendation 569 [4] be used for maintenance purposes whenever possible. The results are then easier to analyze because the result of a measurement is zero for an undistorted parameter.

5 Access points

Measurements are taken at television signal access points which are well-defined points associated with the input and output of a television circuit. To suit the characteristics of the measurement equipment, the standard level/impedance at the access point should be 1 volt peak-to-peak into 75 ohms. The return loss at the access point shall be better than 30 dB.

The access point may be the point of interconnection or may be connected to it by a distortion-free circuit having zero loss or gain.

For flexibility, and to ensure that measured parameters are comparable to transmission parameters, it is necessary that the interconnection system in the ITC should handle programme and test signals in the same way. Figure 1/N.73 shows one method of realizing that objective.

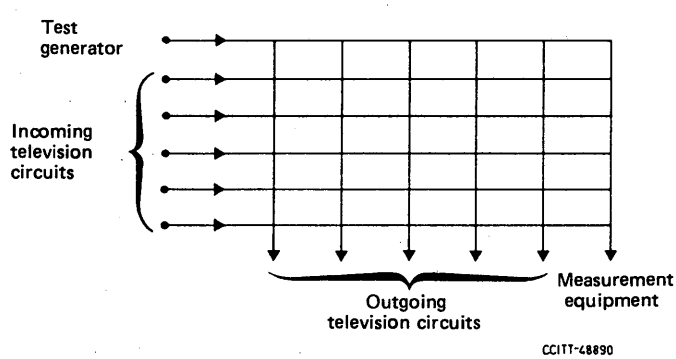


FIGURE 1/N.73

A typical television circuit/test signal switching matrix

6 Routine verification of test equipment

To ensure that test equipment errors will not lead to incorrect adjustment of a television circuit, the test equipment should be verified regularly.

The connection between the test signal generator and the measurement equipment, via the interconnection system, should be verified at intervals of, say, three months and the results should be within the limits given in Table 1/N.73.

TABLE 1/N.73

Limits for measurement chains

Parameter	Limits
Luminance bar amplitude error	± 1 %
Bar tilt/Base line distortion	± 1 %
2T pulse/bar ratio error	± 2 %
Peak differential gain	± 1 %
Peak differential phase	± 1°
Chrominance/luminance gain inequality	± 2 %
Chrominance/luminance delay inequality	± 5 ns
Signal-to-continuous-noise ratio (unified weighted)	⩾ 65 dB

7 Maintenance limits

The figures given in Table 2/N.73 showing the maintenance limits are based on the design objectives for hypothetical reference circuits given in CCIR Recommendation 567 [1] but refer to international television circuits, nominally one-third of the length of the hypothetical reference circuit, between terminal ITCs which are normally in adjacent countries. These limits are expected to apply for most of the time but may be exceeded for part of the time. Hence, maintenance staff must exercise judgement on the action to be taken when a circuit is outside the maintenance limits for any parameter. If the results are well outside the limits, for example, if the error is greater than twice the limit value or the signal-to-noise ratio is 3 dB worse than the limit value, the fault should be located and corrected. On the other hand, if the limits are only exceeded by a relatively small amount, corrective action should not be carried out unless a given parameter exceeds the maintenance limits in two successive months.

Maintenance limits for circuit sections which are different in length and construction from the circuit section equal to one third of the hypothetical reference circuit may be derived by the application of the Laws of Addition specified in CCIR Recommendation 567 [1] to the limits quoted in Table 2/N.73, but the precautions in § 10 should be noted.

TABLE 2/N.73

Maintenance limits for permanent international television circuits

Item (Note 12)	Parameter	Test waveform(s)	Maintenance limits	
			525	625
1	Luminance bar-error (Note 1)	B2 or B3	± 11 IRE units	± 11 % (± 1 dB)
2	Variation of luminance bar-error (e.g. 1 s)	B2 or B3	± 3 IRE units	± 2 % (± 0.2 dB)
3	Variation of luminance bar-error (e.g. 1 hour)	B2 ou B3	± 8 IRE units	± 11 % (± 1 dB)
4	Signal-to-continuous-weighted-noise ratio	No input signal (Notes 1, 3) or "quiet" line (Notes 2, 4)	⩾ 56 dB	⩾ 52 dB (Note 10)
5	Signal-to-periodic-noise ratio (power supply frequency − 0.1 kHz) (Note 2)	No input signal	⩾ 35 dB (Note 5)	
6	Signal-to-periodic-noise ratio (1 kHz − f_c) (Note 2)	No input signal	⩾ 55 dB	
7	Signal to impulsive noise ratio (Note 2)	No input signal	⩾ 25 dB	
8	Luminance non-linearity (Note 1)	D1	3 %	10 %
			(Note 6)	
9	Chrominance gain non-linearity (Note 2)	G ou G2	4 %	7 %
			(Note 6)	
10	Chrominance phase non-linearity (Note 2)	G ou G2	4°	5°
			(Note 6)	
11	Peak differential gain (Note 1)	D2	± 10 %	± 8 %
			(Note 6)	
12	Peak differential phase (Note 1)	D2	± 3°	± 5°
			(Note 6)	
13	Chrominance-luminance intermodulation (Notes 1, 2)	G or G2	± 3 % (Note 6)	
14	Sync. amplitude error (Note 1)	(Note 7)	± 10 % (Note 6)	
15	Long-time waveform distortion (Note 2)	"Bump" signal	40 % (Notes 13, 14)	

TABLE 2/N.73 *(cont.)*

Item (Note 12)	Parameter	Test waveform(s)	Maintenance limits	
16	Field-time waveform distortion (Note 2)	A (Note 11)	± 2 %	± 6 %
17	Line-time waveform distortion (Note 2) Bar tilt (Note 1)	B2 or B3	± 1 %	± 3 %
18	Base line distortion (Note 1)	B2 or B3	± 1%	± 3%
19	2T pulse/bar ratio error (Note 1)	B1 and B2 or B3	± 6 %	± 8 %
20	Short-time waveform distortion (Note 2)	B1	1st adjacent lobe 6 % 2nd adjacent lobe 3 %	
21	Gain/frequency characteristic (Note 2)	C (Note 8)	± 1 dB	+1.5 dB to −1 dB
22	Chrominance-luminance gain inequality (Note 1)	B2 or B3 and G, G_2 or F	± 10 %	± 10 %
23	Chrominance-luminance delay inequality (Note 1)	F	± 80 ns (Note 9)	

Note 1 – As defined in CCIR Recommendation 569 [4].

Note 2 – As defined in CCIR Recommendation 567 [1].

Note 3 – Noise measured via unified weighting filter and low and high pass filters specified in Annex II to Part C of CCIR Recommendation 567 [1].

Note 4 – Noise measured on line(s) allocated for noise measurement with weighting network and filters as given in Note 3 plus a chrominance frequency notch filter as specified in CCIR Recommendation 569 [4].

Note 5 – The maintenance limits refer to circuits without clamps. When clamps are used the maintenance limits are $\geqslant$ 50 dB.

Note 6 – Measured at APLs of 10% and 90%.

Note 7 – Video signal containing synchronizing signals with normal amplitude.

Note 8 – Measurements on C2 may be referred to C1 taking account of any difference in the amplitude of the two elements. The results of this test may conflict with those obtained with test waveforms. If this occurs the waveform results should be considered to be definitive.

Note 9 – The value is positive if the luminance component leads the chrominance component.

Note 10 – Further data is required to consider amendment to this figure.

Note 11 – A window signal is specified in CCIR Recommendation 567 [1] for use on 525-line systems. Test results are required before limits for this signal can be included. Use of this signal should be noted in the measurement results.

Note 12 – Routine measurements made at regular intervals may be limited to less than the complete list of items given in Table 2/N.73 by agreement between the Administrations concerned.

Note 13 – The value is provisional and for further study.

Note 14 – The maintenance limit applies to testing a circuit without clamping. This is the preferred method of measurement. When clamps are used, the maintenance limit is 6%.

8 Schedule for routine maintenance measurements

The performance of routine maintenance measurements between two ITCs requires adherence to routine procedures and a due regard to the allocated time. Tests (Table 3/N.73) should start at a scheduled time (Z) which has been agreed between the Administrations/broadcasting organizations concerned and should progress in accordance with the fixed timetable. This will give adequate time for measurements to be repeated if there is a possibility that one or more circuit parameters are outside tolerance limits.

It is necessary for the maintenance staff to book the routine maintenance period with the programme booking centre (PBC) on a regular basis so that the PBC can intervene when bookings are made for programme transmissions at the same time, and propose a different period for the routine maintenance measurements.

The test schedule shown in Table 3/N.73 should be used by the sub-control station at the sending end of the circuit unless there is a specific agreement between the Administrations/broadcasting organizations concerned to use a different test schedule.

TABLE 3/N.73

Schedule for routine maintenance measurements

Duration	Operation	Signal
Z to Z + 5 min	Check level	B2 or B3
Z + 5 to Z + 10 min	Measurement of linear distortions (APL low)	Test lines
Z + 10 to Z + 15 min	Measurement of nonlinear distortions (APL low)	Test lines
Z + 15 to Z + 20 min	Measurement of nonlinear distortions (APL high)	Test lines
Z + 20 to Z + 25 min	Measurement of noise	None
Z + 25 to Z + 30 min	Measurement of field-time waveform distortion	A
Z + 30 to Z + 35 min	Measurement of long-time waveform distortion	"Bump"
Z + 35 to Z + 95 min	Variation of luminance bar amplitude	B2 or B3

Note – Z is the agreed time to commence the tests.

9 Maintenance of international television circuits

In general the programme booking centre (PBC) will not know when permanent connections are in use for programme transmissions and the agreement of the customer must be obtained before such connections are interrupted in ITCs to carry out maintenance on a circuit.

10 Maintenance of international television circuits, links and connections

International television circuits, links and connections will comprise chains of circuit sections, both national and international, connected in tandem, which are maintained and may be leased as separate entities. Each of these circuit sections may have suitable maintenance limits derived as quoted in § 7.

The Laws of Addition may also be used to derive expected performance limits for such chains but precautions are necessary in the use of such limits for maintenance purposes. It is possible that the overall response of the circuit, link or connection may fail to meet the calculated performance expected, even though the response of each circuit section comprising the chain meets the individual maintenance limits used for the calculation of the overall response. In such cases the calculated response of the chain can only be used as a guide to the expected overall response on the initial lining up, unless additional overall equalizers are employed.

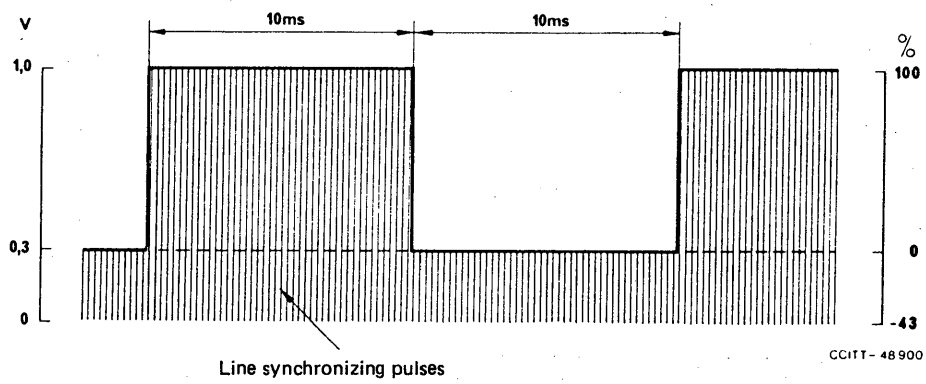
There is also the possibility that the difference between the actual and the calculated overall response of the chain can vary with time, even though the responses of the individual circuit sections remain within their respective maintenance limits.

ANNEX A

(to Recommendation N.73)

Test signal elements

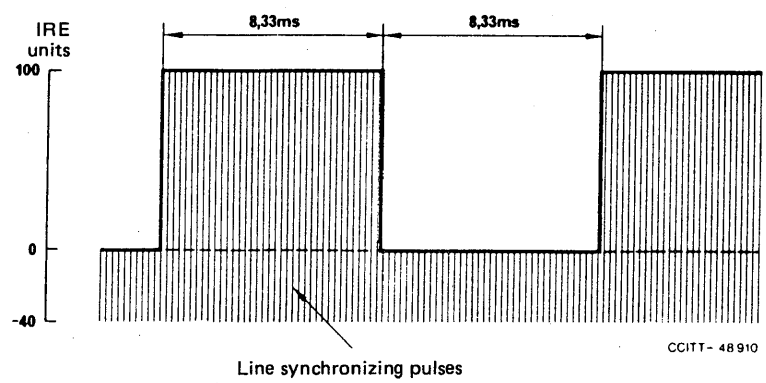
An indication of the signal elements required to carry out the tests mentioned in this Recommendation is given below in the form of figures. Preferred assemblies for insertion test signals are given in Recommendation N.67.



Note – This signal may contain field-synchronizing pulses.

FIGURE A-1/N.73

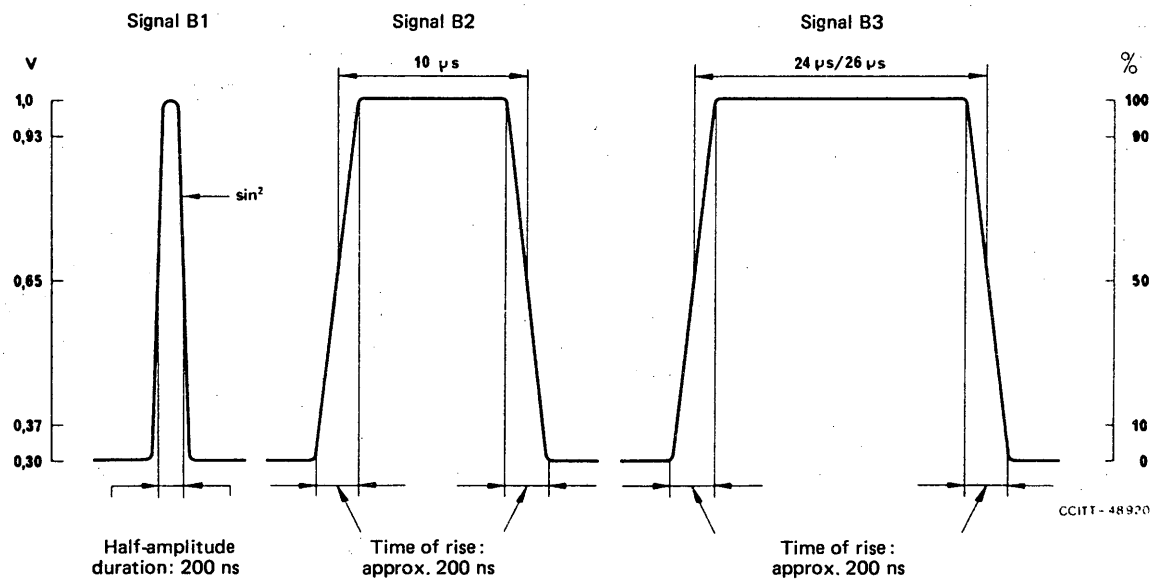
Signal A for 625-line circuits



Note – This signal may contain field-synchronizing pulses.

FIGURE A-2/N.73

Signal A for 525-line circuits



Note 1 – In some OIRT countries, a half-amplitude duration of 160 ns is used for B1 and a time of rise of 80 ns for B2.

Note 2 – In France, the normal time of rise of B2 and B3 is approximately 110 ns.

FIGURE A-3/N.73

Signal B for 625-line circuits

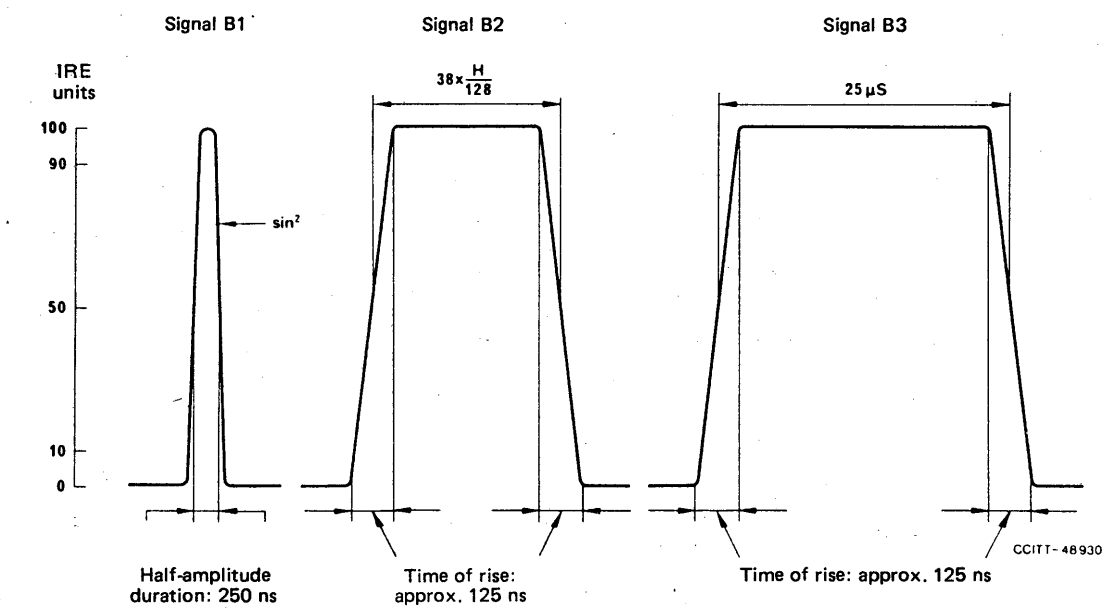
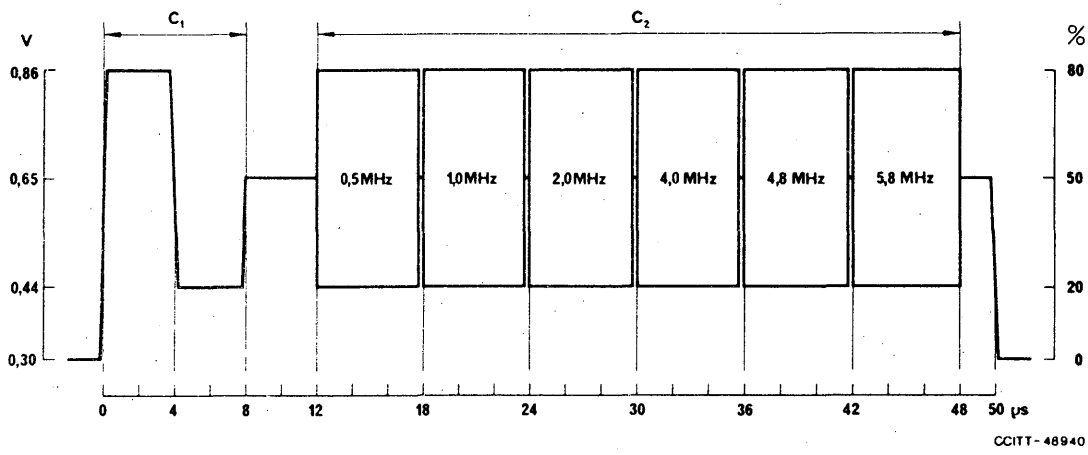


FIGURE A-4/N.73

Signal B for 525-line circuits



Note – Some OIRT countries use 1.5 MHz and 2.8 MHz for the 2nd and 3rd bursts.

FIGURE A-5/N.73

Signal C for 625-line circuits

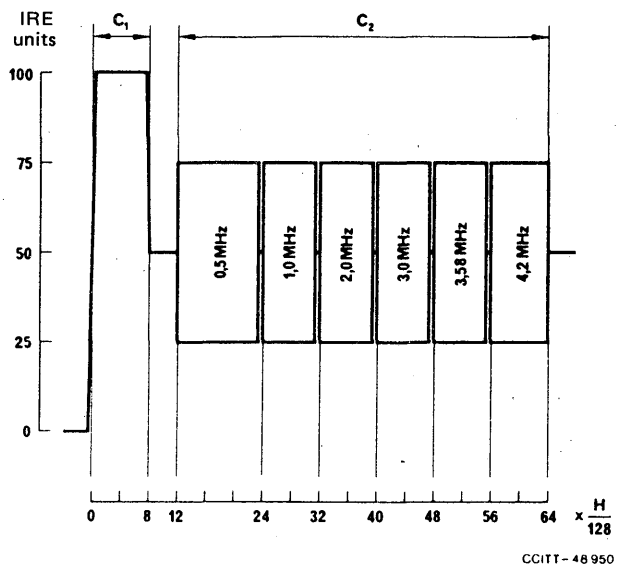
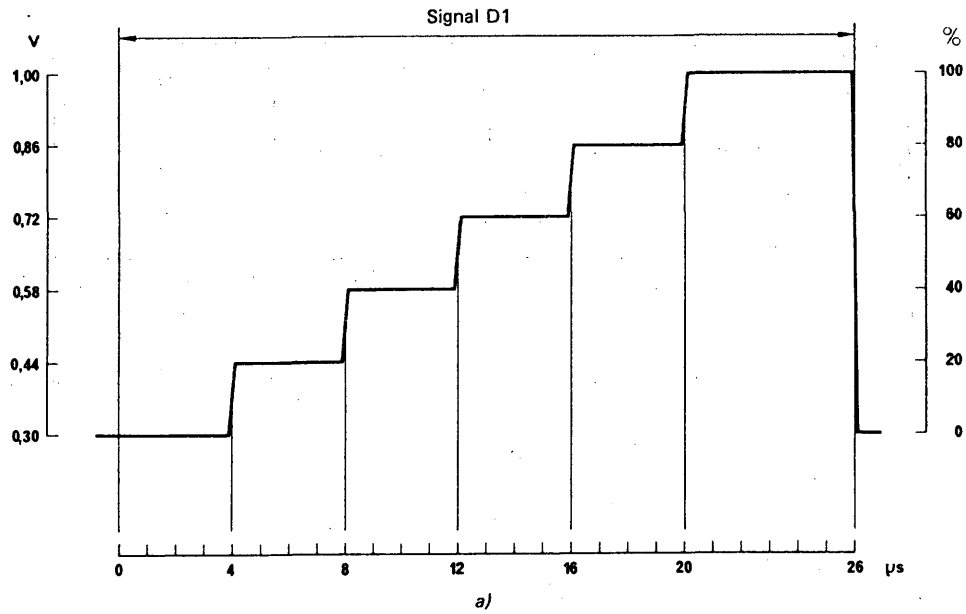
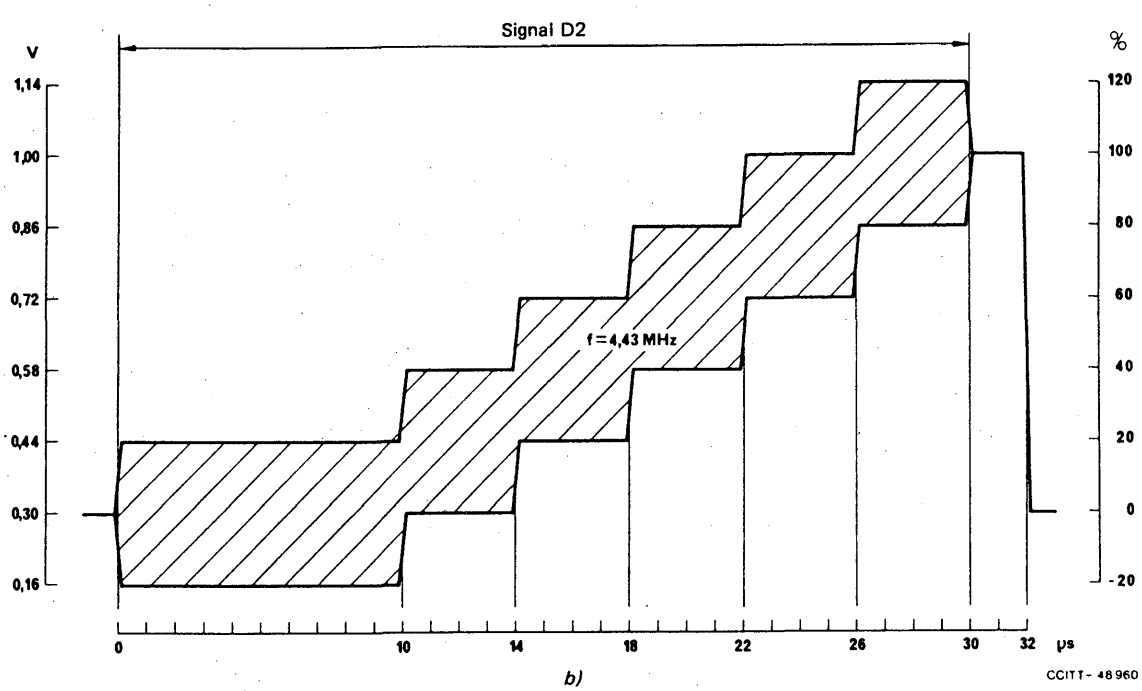


FIGURE A-6/N.73

Signal C for 525-line circuits

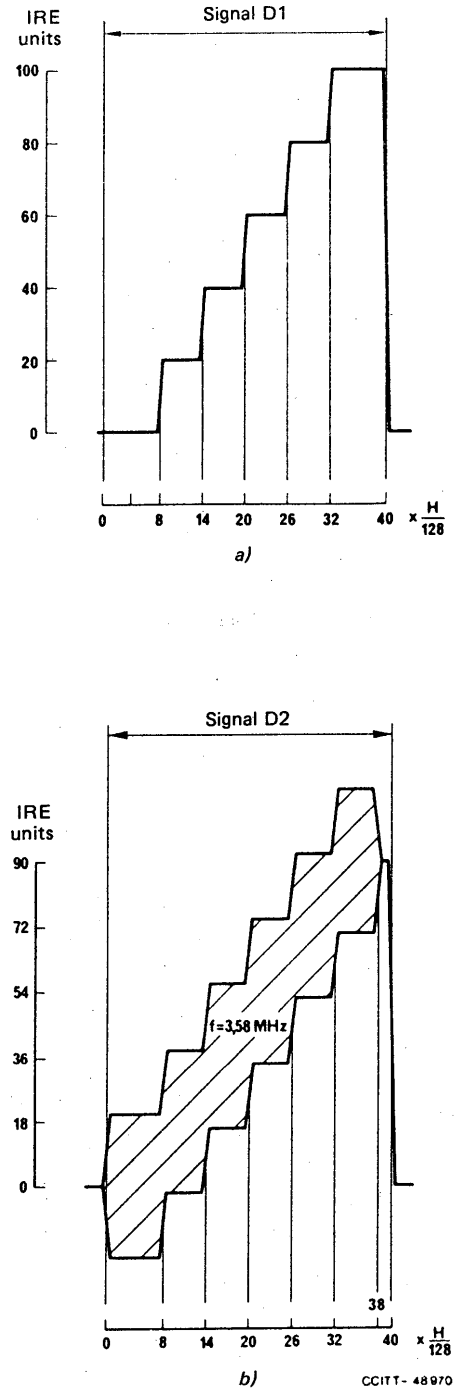




Note – In full-field test signals, each tread of the staircase may have a duration of 8.66 µs.

FIGURE A-7/N.73

Signal D for 625-line circuits



Note 1 – Scale refers to tread levels.

Note 2 – Sub-carrier amplitude is ± 20 IRE units.

FIGURE A-8/N.73

Signal D for 525-line circuits

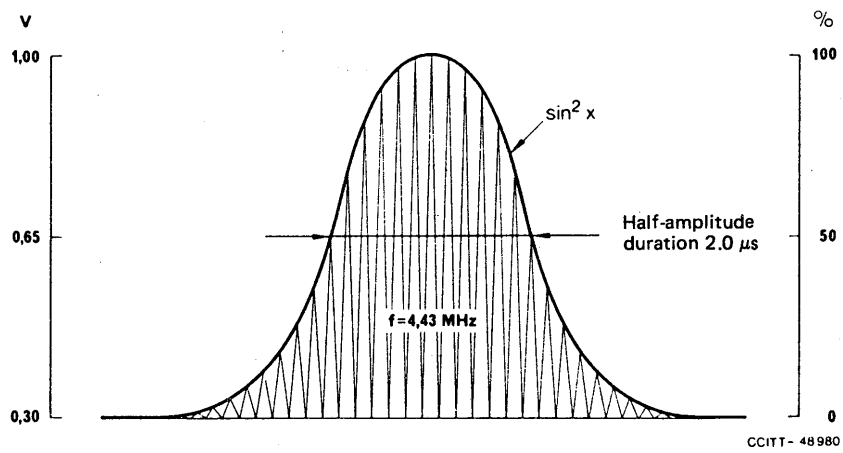


FIGURE A-9/N.73

Signal F for 625-line circuits

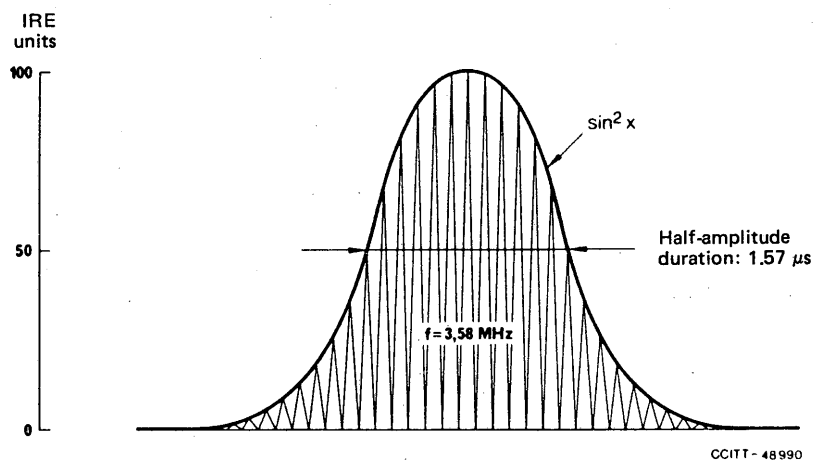


FIGURE A-10/N.73

Signal F for 525-line circuits

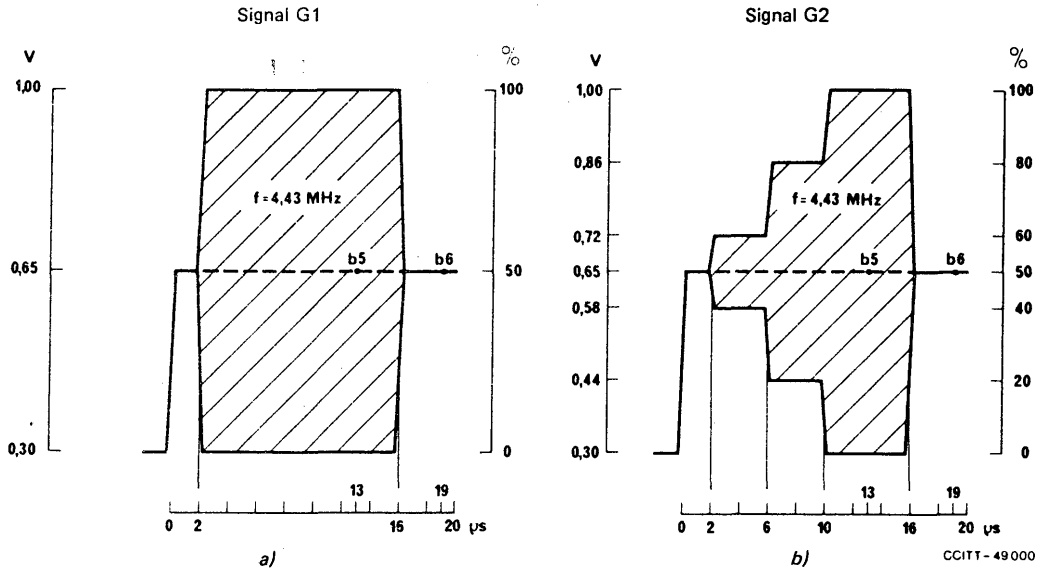


FIGURE A-11/N.73

Signal G for 625-line circuits

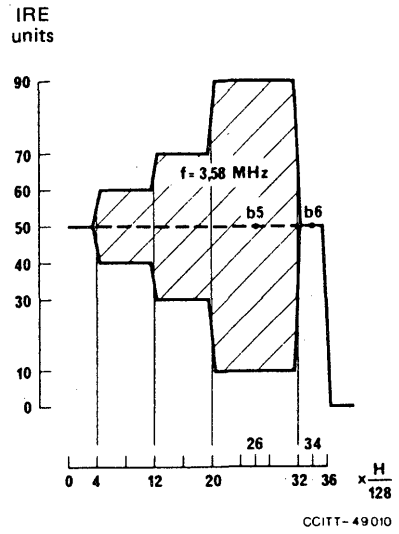


FIGURE A-12/N.73

Signal G for 525-line circuits

References

[1] CCIR Recommendation *Television performance of television circuits designed for use in international connections,* Vol. XII, Rec. 567, ITU, Geneva, 1986.

[2] CCIR Recommendation *Insertion of test signals in the field blanking interval of monochrome and colour television signals,* Vol. XII, Rec. 473, ITU, Geneva, 1986.

[3] CCIR Report *Long-time waveform distortion in long distance television circuits,* Vol. XII, Rec. 636, ITU, Geneva, 1986.

[4] CCIR Recommendation *Definitions of parameters simplified for automatic measurement of televison insertion test signals,* Vol. XII, Rec. 569, ITU, Geneva, 1986.

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SECTION 3

INTERNATIONAL VIDEOCONFERENCE TRANSMISSIONS

3.1 International videoconference transmissions – Definitions

Recommendation N.81

DEFINITION FOR APPLICATION TO INTERNATIONAL VIDEOCONFERENCE TRANSMISSIONS

(under study)

3.2 Line-up, service commissioning and maintenance of videoconference systems

Recommendation N.86

LINE-UP AND SERVICE COMMISSIONING OF INTERNATIONAL VIDEOCONFERENCE SYSTEMS OPERATING AT TRANSMISSION BIT RATES OF 1544 AND 2048 kbit/s

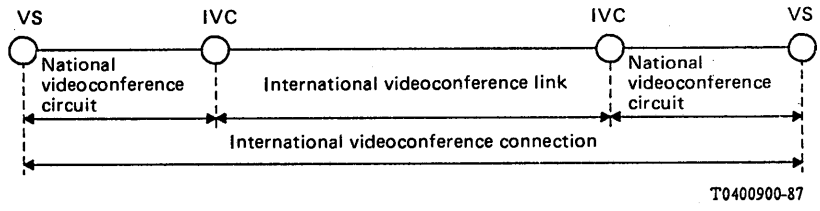
1 General

This Recommendation deals with the line-up and service commissioning of international videoconference systems routed over transmission paths operating at transmission bit rates of 2048 and 1544 kbit/s. In this context an international videoconference system comprises the international videoconference connection and the videoconference rooms which are interconnected.

Figure 1/N.86 shows the constituent parts of an international videoconference connection. Recommendation H.110 [1] describes hypothetical reference connections for videoconferencing.

The video codecs are normally located within the videoconference studios but in some circumstances are located elsewhere so that the local tail serving the videoconference studio may be provided on wideband analogue (e.g. 5.5 MHz) or higher order digital transmission systems (e.g. 140 Mbit/s). Codecs are described in Recommendation H.120 [2].

The location of any 2048/1544 kbit/s remultiplexers which may be involved will be as agreed between the Administrations.



VS Videoconference studio
IVC International videoconference centre

FIGURE 1/N.86

The constituent parts of an international videoconference connection

Supplement No. 5.2 gives guidance on the setting up and testing arrangements for videoconference studios.

The international videoconference centre provides the interconnection point of the national videoconference circuit and the international link. This interconnection may be made manually or by automatic means.

Normally the international videoconference link will be common for all videoconference calls between the two Administrations concerned, whereas the national videoconference circuits will vary from call to call. Thus, in addition to the setting up and lining up of the constituent parts of the international videoconference connection, service commissioning tests are made between videoconference studios prior to the opening of an international videoconference service to ensure that a service can be satisfactorily sustained.

2 Setting up and lining up the constituent parts of the connection

2.1 *National videoconference circuits*

The national videoconference circuits should be set up and tested in accordance with the national procedures of the Administrations concerned. This will include the line up of any sections which may not be provided as 2048 or 1544 kbit/s digital paths. The 2048 and 1544 kbit/s data performance limits to be met are given in Table 1/N.86 and it is recommended that two data tests should be made, each of one hour's duration, on different days and at times that cover the peak traffic periods on the route concerned.

2.2 *International link*

The international videoconference link will only need to be set up and tested when establishing the first service between two Administrations. The procedures of Recommendation 555 [3] should apply.

A data test should be made of five hours duration and should be scheduled so as to include the peak traffic period on the route concerned. The test results should meet the data performance limits given in Table 1/N.86.

3 Performance check codec-to-codec

The constituent parts of the connection having been satisfactorily lined up and connected together at the international videoconference centres, three data tests (each of one hour's duration) should be made between the codecs. The tests should be made on different days and at times to cover the peak traffic periods for the route. The testers should be connected at the digital line side of the codecs, as close to the codecs as possible. Each test should meet the data performance limits given in Table 1/N.86.

Where loop facilities exist, loop measurements may be made in order to obtain reference measurements for subsequent maintenance. Care must be taken to avoid simultaneous operation of loop facilities.

TABLE 1/N.86

Path performance test limits [a]

	Nominal data rate [b] (kbit/s)	Bit error ratio (BER)	Max. errors in 1 hour	Severely errored events [c] in 1 hour	Error-free seconds (EFS) (%)
National videoconference circuit	2048	1×10^{-6}	7 142	0	92
	1544	1×10^{-6}	5 530	0	92
International videoconference link	2048	1×10^{-6}	7 142	2	92
	1544	1×10^{-6}	5 530	2	92
International videoconference connection	2048	3×10^{-6}	21 427	2	92
	1544	3×10^{-6}	16 589	2	92

[a] The limits are provisional and subject to further study.

[b] Structured formatting required with a consequent reduction in actual test data rate as follows:
At 2048 kbit/s, test data rate = 1984 kbit/s (time slots 1 to 31 only);
At 1544 kbit/s, test data rate = 1536 kbit/s (8 bits used for frame alignment).

[c] Severely errored events are defined by the particular data tester used, e.g. 20 000 errors in 100 000 bits. A continuous period of up to 10 seconds, during which severely errored transmission persists, will be considered as a single severely errored event.

Note 1 – In addition to the above limits the BER shall be no worse than 1×10^{-5} over any 5-minute period during the tests (5952 errors at 2048 kbit/s and 4608 errors at 1544 kbit/s). If this test fails, then corrective action shall be taken on the offending section.

Note 2 – For loop-tests, the above limits should be doubled (92% EFS becoming 84% EFS).

4 Digital test equipment

The data tester required for the above tests shall be capable of transmitting and receiving a test pattern within a signal structured in accordance with Recommendation G.732 [4] for 2048 kbit/s interfaces or Recommendation G.733 [5] for 1544 kbit/s interfaces. The nature of the test pattern is undefined but should be the subject of further study.

When working through a 2048/1544 kbit/s remultiplexer, the test signal should be restricted to time slots 1-24 with time slots 25-31 being vacant.

If compatible testers are not available at both ends of the link or connection under test, then one tester should be used to transmit and receive with a loop being provided at the other end.

5 Videoconference studios

All videoconference studios that will be used for international videoconference calls should comply with agreed design standards. Providers and operators of such studios are encouraged to adopt the provisions of Supplement No. 5.2 until CCITT Recommendations are specified. The adoption of common standards facilitates the interworking between any pair of studios in different countries with pre-call adjustments reduced to a minimum.

6 Service commissioning tests

6.1 *General*

The international videoconference connection having been satisfactorily tested, functional video and audio service commissioning tests should be undertaken between the videoconference studios.

6.2 *Test videoconference studios*

The videoconference studio chosen by an Administration for commissioning tests should be typical (with regard to the parameters of Supplement 5.2) of all the other studios to be used fo the service. This studio should then serve as a reference studio for any future tests between videoconference studios with other Administrations.

The reference studio for each Administration should be identified to all other Administrations. The parameters of this studio should also be shared with all other Administrations.

6.3 *Commissioning test*

The end-to-end commissioning tests between videoconference studios are described in Supplement 5.2. The purpose of the tests is to demonstrate that the international videoconference system performs adequately when the constituent parts are connected together. The tests include a subjective assessment of the main functions of each videoconference studio and selected objective tests. The tests are not intended to be exhaustive, but should serve as sample checks in compliance with the standards and as a confident indicator to both Administrations before the opening of an internatinal videoconference service.

References

[1] CCITT Recommendation *Hypothetical Reference Connections for Videoconferencing using primary digital group transmission*, Vol. III, Rec. H.110.

[2] CCITT Recommendation *Codecs for videoconferencing using primary digital group transmission*, Vol. III, Rec. H.120.

[3] CCITT Recommendation *Bringing international digital blocks, paths and sections into service*, Vol. IV, Rec. M555.

[4] CCITT Recommendation *Characteristics of primary PCM multiplex equipment operating at 2048 kbit/s*, Vol. III, Rec. G.732.

[5] CCITT Recommendation *Characteristics of primary PCM multiplex equipment operating at 1544 kbit/s*, Vol. III, Rec. G.733.

Recommendation N.90

MAINTENANCE OF INTERNATIONAL VIDEOCONFERENCE SYSTEMS OPERATING AT TRANSMISSION BIT RATES OF 1544 AND 2048 kbit/s

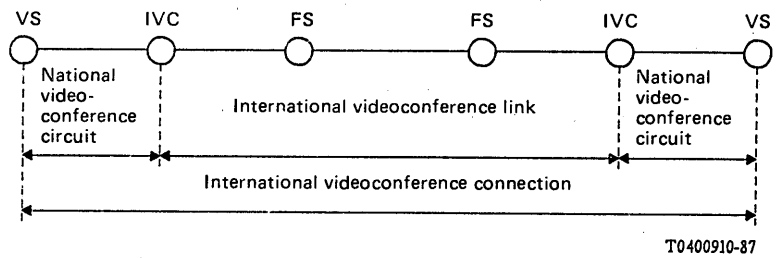
1 Scope

This Recommendation deals with the maintenance procedures to be applied to international videoconferencing systems operating at transmission bit rates of 1544 and 2048 kbit/s.

2 General

2.1 The configuration shown in Figure 1/N.90 is a simplified description of a typical connection.

2.2 Each participating Administration shall establish an international videoconference centre (IVC) with the same general responsibilities and functions as those set out in Recommendation N.55 for an international television centre (ITC) in respect of international television connections. However, as a videoconference connection is a bidirectional transmission path, the choice of control and sub-control IVCs shall always be established by mutual agreement. This choice should hold for all the international videoconference connections serving two Administrations.



VS Videoconference studio
IVC International videoconference centre
FS Frontier station, e.g. earth station

FIGURE 1/N.90

The constituent parts of an international videoconference connection

2.3 The maintenance procedures are designed to facilitate restoration of service when a videoconference connection is broken, or unacceptably degraded, during a videoconference call. At this time it is essential that close cooperation is maintained between control and sub-control IVCs in order to minimize disruption to the call.

2.4 The IVCs will require to be provided with equipment such as codecs, monitors and cameras so as to be able to make limited functional checks (visual and audio) for confirmation of call establishment and rapid fault sectionization.

Additionally, testers should be available for 1544 and 2048 kbit/s data performance tests. The testers should be able to send a structured test signal in accordance with either the Recommendation G.732 [1] or H.733 [2] structures. The test pattern should be a pseudo random test signal of sequence length 2^{15-1} as described in Recommendation O.151 [3].

The tester conforming to Recommendation G.733 [2] should be able to work at 1536 kbit/s information rate, sending the test signal in time slots 1 to 24.

The tester conforming to Recommendation G.732 [1] should be able to work at 1536 or 1984 kbit/s information rates. When switched to 1536 kbit/s it should send the test signal in time slots 1 to 15 and 17 to 25. When switched to 1984 kbit/s it should use time slots 1 to 31.

3 Pre-call tests

It is essential that pre-call tests are made to confirm that a scheduled call will be satisfactory. All equipments and all parts of the international videoconference connection to be used in a call should be checked beforehand on the day of the call. For this purpose tests should be made of the complete transmission path between the appropriate videoconference studio(s) and frontier station(s) by each Administration and between the frontier stations (EF's).

These pre-call tests are intended to be simple checks to establish that the transmission paths are acceptable, for example, that the transmitted and received radio frequency carrier levels at each earth station are within their prescribed limits.

Additionally, where the international videoconference connection is new or where previous, similar calls have suffered problems a complete studio-to-studio functional test should be made. This should take the form of a visual and, if appropriate, audio subjective assessment of the end-to-end performance. Such tests should be sufficiently in advance of the start of the call (15 to 30 minutes) to give some opportunity for clearing any problem which may be found. As experienced and confidence is gained, the time required for pre-call testing should reduce.

4 Fault localization

4.1 A general outline of the fault localization procedure for international videoconference connections is given below. This approach aims to rapidly localize a fault to a circuit section.

4.2 Fault reports may be received by either IVC on a connection but shall only be accepted from points within their own country.

4.3 On receipt of a fault report the IVC shall monitor the connection where possible to broadly localize the fault unless this is obvious from the fault report or from other information, e.g. system alarms. The IVC should then immediately advise the distant IVC of the reported fault and any information which may assist to determine the course of action to be taken.

4.4 If the source of the problem is not known then both IVCs shall work together to determine in which circuit section the fault lies, e.g. by means of loopback. Preferably this should be in accordance with an agreed planned procedure. If these procedures do not localize the fault then the IVCs shall agree the further action to be taken.

4.5 If at any stage the fault is localized then the appropriate clearance procedures should be put in hand.

4.6 Both IVCs should be in constant telephone contact during these procedures. The IVCs should report to their respective videoconference studios (VSs) no longer than 10 minutes after receipt of the fault report advising on localization progress and estimated time to restore service. A second status report should be given after a further maximum period of 10 minutes. If, at 20 minutes following the fault report, the time to restore service has not been determined then the customers should be so advised and a decision made as to whether or not to abort the call.

4.7 If, during localization, the overall connection is found to be satisfactory, the problem may be caused by the interworking of the studio equipment (e.g. codecs). In this case it may prove necessary to monitor and test the connection VS to VS.

4.8 Minor problems that are reported for correction but which do not make a call unusable, shall be accepted for clearance and entered in the fault record but shall not count against the service availability of the connection. Action to deal with such problems should not interrupt an ongoing call, except at the direction of the control IVC.

4.9 Where a videoconference call transmission is encrypted, the VSs shall be required to remove the encryption for fault localization and clearance purposes when requested by the IVCs.

5 Maintenance parameters

5.1 The maintenance limits for 1544 and 2048 kbit/s transmission paths are given in Table 1/N.90. Where the national videoconference circuit includes wideband analogue or higher order digital system sections then the national maintenance standards should apply to these sections.

5.2 Because of the need to restrict the time taken for dealing with faults during scheduled videoconference calls, any assessment of the 1544 and 2048 Kbit/s performance that may be required should be based on bit error ratio (BER) measurements only. The measuring time should be kept to the minimum necessary for the investigation in hand.

5.3 Where maintenance activities do not risk the establishment or completion of a scheduled videoconference call then any assessment of the 1544 and 2048 kbit/s performance should be against all the parameters shown in Table 1/N.90. Such measurements should be made over a minimum period of 15 minutes.

TABLE 1/N.90

Maintenance limits [a]

	Nominal data rate [b] (kbit/s)	Bit error ratio (BER)	Max. errors in 15 minutes	Severely errored events [c] in 15 minutes	Error-free seconds (EFS) (%)
National videoconference circuit	1544	1×10^{-6}	1382	0	92
	2048	1×10^{-6}	1785	0	92
International videoconference link	1544	1×10^{-6}	1382	0	92
	2048	1×10^{-6}	1785	0	92
International videoconference connection	1544	3×10^{-6}	4147	0	92
	2048	3×10^{-6}	5357	0	92

[a] The limits are provisional and subject to further study.

[b] Structured formatting required with a consequent reduction in actual test data rate as follows:
At 2048 kbit/s, test data rate = 1984 kbit/s (time slots 1 to 31 only);
At 1544 kbit/s, test data rate = 1536 kbit/s (8 bits used for frame alignments).

[c] Severely errored events are defined by the particular data tester used, e.g. 20 000 errors in 100 000 bits. A continuous period of up to 10 seconds, during which severely errored transmission persists, will be considered as a single severely errored event.

References

[1] CCITT Recommendation *Characteristics of primary PCM multiplex equipment operating at 2048 kbit/s*, Vol. III, Rec. G.732.

[2] CCITT Recommendation *Characteristics of primary PCM multiplex equipment operating at 1544 kbit/s*, Vol. III, Rec. G.733.

[3] CCITT Recommendation *Error performance measuring equipment for digital systems at the primary bit rate and above*, Vol. IV, Rec. O.151.

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PART II

SUPPLEMENTS TO SERIES M AND N RECOMMENDATIONS

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1 Technical information

Supplement No. 1.1

PREFIXES USED IN THE DECIMAL SYSTEM

(For this Supplement, see page 409, Volume IV.2 of the *Green Book*)

Supplement No. 1.2

TRANSMISSION MEASUREMENT CONVERSION TABLES

(For this Supplement, see page 409, Volume IV.2 of the *Green Book)*

Supplement No. 1.3

THE NORMAL (OR LAPLACE-GAUSS) DISTRIBUTION

(For this Supplement, see page 416, Volume IV.2 of the *Green Book*)

Supplement No. 1.4

METHODS OF QUALITY CONTROL

(For this Supplement, see page 422, Volume IV.2 of the *Green Book*)

Supplement No. 1.5

MATHEMATICAL PROCESSING OF THE MEASUREMENT RESULTS OF THE VARIATIONS OF THE OVERALL LOSS OF TELEPHONE CIRCUITS

(For this Supplement, see page 451, Volume IV.2 of the *Green Book*)

Supplement No. 1.6

STATISTICAL THEORY REQUIREMENTS

(For this Supplement, see page 459, Volume IV.2 of the *Green Book*)

2 Measuring techniques

Supplement No. 2.1

SOME GENERAL OBSERVATIONS CONCERNING MEASURING INSTRUMENTS AND MEASURING TECHNIQUES

(For this Supplement, see page 463, Volume IV.2 of the *Green Book*)

Supplement No. 2.2

MEASUREMENTS OF LOSS

(For this Supplement, see page 471, Volume IV.2 of the *Green Book*)

Supplement No. 2.3

LEVEL MEASUREMENTS

(For this Supplement, see page 475, Volume IV.2 of the *Green Book*)

Supplement No. 2.4

MEASUREMENT OF CROSSTALK

(For this Supplement, see page 480, Volume IV.2 of the *Green Book*)

Supplement No. 2.5

MEASURING ERRORS AND DIFFERENCES DUE TO IMPEDANCE INACCURACIES OF INSTRUMENTS AND APPARATUS. USE OF DECOUPLED MEASURING POINTS

(For this Supplement, see page 482, Volume IV.2 of the *Green Book*)

Supplement No. 2.6

ERRORS IN THE INDICATIONS GIVEN BY LEVEL-MEASURING INSTRUMENTS DUE TO INTERFERING SIGNALS

(For this Supplement, see page 489, Volume IV.2 of the *Green Book*)

Supplement No. 2.7

MEASUREMENT OF GROUP DELAY AND GROUP-DELAY DISTORTION

(For this Supplement, see page 492, Volume IV.2 of the *Green Book*)

Supplement No. 2.8

MEASUREMENTS OF SUDDEN PHASE CHANGES ON CIRCUITS

(For this Supplement, see page 508, Volume IV.2 of the *Green Book*)

Supplement No. 2.9

VIBRATION TESTING

(For this Supplement, see page 511, Volume IV.2 of the *Green Book*)

Supplement No. 2.10

METHOD FOR MEASURING THE FREQUENCY SHIFT INTRODUCED BY A CARRIER CHANNEL

(For this Supplement, see page 522, Volume IV.2 of the *Green Book*)

Supplement No. 2.11

RAPID VERIFICATION TEST FOR ECHO CONTROL DEVICES

Recommendation M.580 discusses the setting-up and lining-up of international circuits for public telephony. This Supplement describes a method for the rapid verification of adequate echo control on those circuits fitted with echo control devices when they are initially established.

1 This test should be performed after all loss and noise testing of a newly established circuit is completed. It consists of an exchange of tones to verify that the echo control device at each terminal is functional as wired in the circuit.

2 The circuit control should initiate the test with the distant international maintenance centre. It is intended to be applied during initial line-up to every circuit (manual and automatic) with a control device at each terminal should there be any doubt that echo control is not effective for either end.

3 If we label the calling maintenance centre the A Terminal, and the called maintenance centre the B Terminal, the following sequential procedure should be applied as indicated, and then also with A and B interchanged.

3.1 Terminal A sends a 1020 Hz[1)] tone at -15 dBm0 to Terminal B.

3.2 Terminal B sends a 1020 Hz tone at -21 dBm0 to Terminal A after the 1020 Hz tone is heard at B.

3.3 No 1020 Hz tone should be heard at Terminal A. *On the contrary,* if a tone is heard, echo control at Terminal B is not taking place. The echo control device at B should be checked as appropriate to the type of device in the circuit.

[1)] For additional information concerning the choice of a test frequency, see Recommendation O.6 [1]

3.4 Remove the 1020 Hz tone at Terminal A to cause the release of the echo control device at Terminal B.

3.5 The 1020 Hz tone from Terminal B should be heard at Terminal A to verify that the B control device has released. *On the contrary*, if tone is not heard, check the echo control device B.

3.6 Remove all 1020 Hz test tones from Terminal A and Terminal B. The above test is simply a check to determine that the echo control device is effectively in the circuit at each terminal. *It is not a substitute for detailed echo control device testing.*

Reference

[1] CCITT Recommendation *1020 Hz reference test frequency*, Vol. IV, Rec. O.6.

Supplement No. 2.12

AN AUTOMATIC DATA ACQUISITION AND EFFECTIVE PROCESSING PROCEDURE FOR GROUP AND SUPERGROUP PILOT LEVELS

(For this Supplement, see page 524, Volume IV.2 of the *Green Book*)

Supplement No. 2.13

LOOP METHOD FOR THE MAINTENANCE OF 4-WIRE TELEPHONE-TYPE LEASED CIRCUITS

(For this Supplement, see page 267, Volume IV.1 of the *Orange Book*)

Supplement No. 2.14

AUTOMATIC MEASURING DEVICE FOR CARRIER SYSTEMS WITH A LARGE NUMBER OF CHANNELS

(For this Supplement, see page 268, Volume IV.1 of the *Orange Book*)

Supplement No. 2.15

DETECTION OF CIRCUIT FAULTS

(For this Supplement, see page 275, Volume IV.1 of the *Orange Book*)

Supplement No. 2.16

RECEIVING RELATIVE LEVELS AT RENTERS' PREMISES FOR INTERNATIONAL LEASED CIRCUITS USED FOR DATA TRANSMISSION[1)]

1 General

In the Series M Recommendations dealing with special quality international leased circuits (Recommendations M.1020 [1] and M.1025 [2]), it is advised that the receiving relative level at the renters' premises should not be lower than −13 dBr. This is a minimum value, and assumes that the power of the transmitted data signal is the maximum allowed by Recommendation V.2 [3], namely −13 dBm0.

[1)] This Supplement is based upon the replies received to the questionnaire appearing in CCITT Collectiveletter No. 17 (11 June 1981). A detailed analysis of the replies appears in Contribution COM IV-No. 46 of the 1981-1984 Study Period.

Under the above conditions, the absolute power available to the line signal detector of the receiving data modem is -26 dBm – the minimum value required by some modems specified in Series V Recommendations.

The value of -13 dBr makes no allowance for present and foreseen influences on the received absolute power at data modems, as discussed below.

2 Influences on the absolute power received at renters' premises

2.1 *General*

The value of absolute power received at a renter's premises (and therefore available to a modem) is influenced by a number of factors, as follows:

- power of the data signal transmitted by the sending modem;
- variations of overall loss with time on the international leased circuit;
- effect of loss/frequency distortion on the international leased circuit;
- errors in circuit engineering and line-up.

Each of these influences is discussed below.

2.2 *Transmitted power*

The majority of Administrations have adopted the maximum data signal power level permitted by Recommendation V.2 [3], namely, -13 dBm0. However, a significant number of Administrations already use a level of -15 dBm0, while others intend to use this level in the future.

2.3 *Variations of overall loss with time*

The overall loss of an international leased circuit is permitted to vary between $\pm$ 4 dB of the nominal value; see, for example, Recommendation M.1020 [1], § 2.4.

In the international network and many national networks, extensive use is made of automatic gain control equipment on FDM groups, supergroups, etc. and on transmission systems. Also, improved circuit engineering and an expanding international network have led to circuits having relatively simple constitutions. Finally, international leased circuits benefit from the inherent gain stability of digital transmission media, which are increasingly being used in their provision.

The net effect of the above factors is that the expected variation in overall loss of an international leased circuit is much lower than $\pm$ 4 dB, and may be negligible in most cases.

2.4 *Loss/frequency distortion*

The loss/frequency distortion of an international leased circuit is determined with respect to the loss at 1020 Hz. However, the centre of the frequency band produced by Series V data modems is in the range 1700 Hz to 1800 Hz.

Where a circuit has required equalization for loss/frequency distortion, the difference between the loss at 1020 Hz and that at 1700/1800 Hz is negligibly small. But, where a circuit does not have required equalization, this difference can be significant. Typical values are 1 dB for circuits to Recommendation M.1020 [1], and 5 dB for circuits to Recommendation M.1025 [2].

2.5 *Errors in circuit engineering or line-up*

Any error in the engineering or line-up of an international leased circuit which increases/decreases its nominal overall loss will obviously have a direct and proportional impact on the absolute power received at the renter's premises.

3 Impact on the receiving relative level at renters' premises

Each of the factors discussed in § 2 will have a calculable impact upon the absolute power received at a renter's premises. This impact is likely to differ for different Administrations and will depend upon such influences as the size of the national network, the extent to which automatic gain control is used and the relations with which the Administration operates circuits.

Thus, individual Administrations must determine what impact, if any, the factors in § 2 have upon the receiving relative level they must adopt (have adopted) to ensure proper modem operation.

References

[1] CCITT Recommendation *Characteristics of special quality international leased circuits with special bandwidth conditioning*, Vol. IV, Rec. M.1020.

[2] CCITT Recommendation *Characteristics of special quality international leased circuits with basic bandwidth conditioning*, Vol. IV, Rec. M.1025.

[3] CCITT Recommendation *Power levels for data transmission over telephone lines*, Vol. VIII, Rec. V.2.

Supplement No. 2.17

RESULTS OF AN INVESTIGATION OF THE SERVICE AVAILABILITY PERFORMANCE OF INTERNATIONAL LEASED CIRCUITS MADE IN 1982

1 Introduction

Using the assessment procedure specified in Recommendation M.1016 [1], 13 Administrations participated in an investigation of the service availability performance of their mutual international leased circuits. This investigation was undertaken from 1 January 1982 (0000 UTC[1]) to 31 March 1982 (2400 UTC), and involved 910 full-time, point-to-point international leased circuits.

This supplement contains the results of this investigation, as evaluated by the Federal Republic of Germany.

2 Results

2.1 Table 1 gives the general performance results for all (910) international leased circuits involved. The results under column B are based on faults and down-times known to the control stations (Recommendation M.1012 [2]) of the circuits. The results under column C are based on information from the sub-control stations (Recommendation M.1013 [3]) *and* the control stations.

2.2 Table 2 gives the service availability performance results for each Administration involved in the investigation. For each case, only those international leased circuits to the remaining 12 Administrations participating in the investigation are included.

2.3 The cumulative frequency distribution graph in Figure 1 shows the percentage of circuits (y-axis) and the corresponding downtime (x-axis) recorded during the observation period. The key results (from Table 1, column B) have been shown on the graph.

2.4 In accordance with the procedures specified in Recommendation M.1016 [1] (§ 5.2 and Annex C), the Administrations participating in the performance assessment also exchanged additional information for consideration when results from different sources are compared.

The results of the analysis of this information appear in Table 3. Again, column B relates to information from the control stations while column C is based on information from both control and sub-control stations.

2.5 It must be emphasized that all the results in Tables 1 and 2 and Figure 1 relate to a three-month observation period, as mentioned in § 1 above.

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[1] UTC = Coordinated universal time (UTC equals GMT, but replaces it).

TABLE 1

Data and service availability performance results for all circuits involved in the assessment
(Observation period = 3 months)

Data and results (A)		Information from: Control station (B)	Control and sub-control stations (C)
a) Number of circuits involved		910	910
b) Number of faults on all circuits		1357	2 049
c) Downtime of all circuits	(h)	8819	11 650
d) Mean downtime per circuit	(h)	9.7	12.8
e) Mean time to restore service (MTRS)	(h)	6.5	5.7
f) Mean number of faults per circuit		1.49	2.25
g) Mean availability per circuit	(%)	99.55	99.40
h) Mean time to failure (MTTF)	(h)	1443	954
i) Circuits with downtime better than mean value	(%)	80.0	
j) Circuits for which no downtime was recorded	(%)	47.7	
k) Downtime not exceeded by 95% of the circuits	(h)	54.0	

Note – A later investigation held in 1983 on 22 circuits showed results which are in line with the above results.

TABLE 2

Results from each country to all other countries

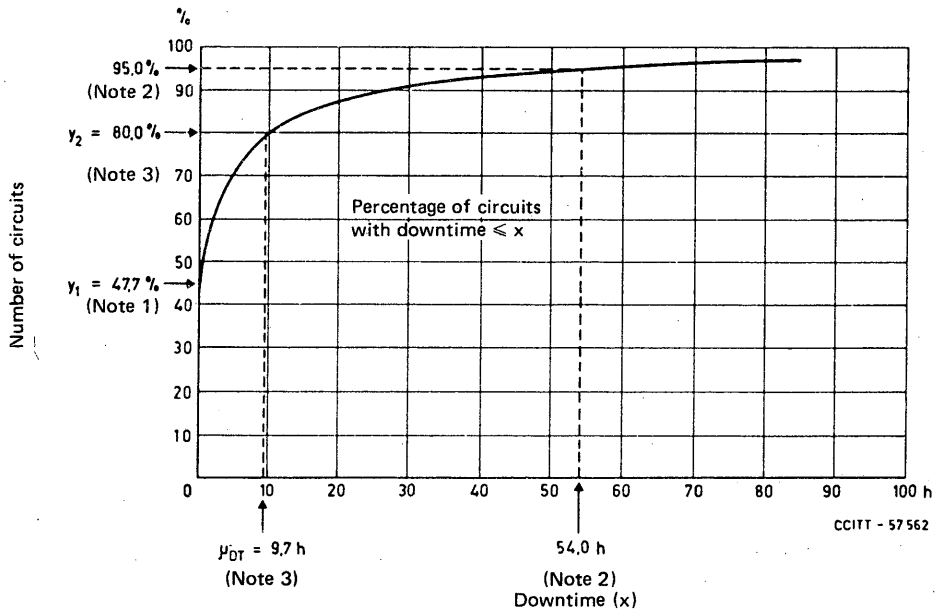
Investigation of international leased circuits

(Observation period = 3 months)

Administration	No. de circuits involved	Number of faults on all circuits	Downtime of all circuits	Mean downtime per circuit	MTRS	Mean no. faults per circuit	Mean availability per circuit	MTTF	Circuits with downtime better than mean value	Circuits with no recorded downtime	Downtime not exceeded by 95 % of the circuits
			(hours)	(hours)	(hours)		(%)	(hours)	(%)	(%)	(hours)
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)
1	9	6	12.7	1.4	2.1	0.67	99.93	3238	68.9	77.8	12
2	100	76 120	399 529	4.0 5.3	5.3 4.4	0.76 1.20	99.82 99.75	2837 1796	79.0	64.0	18
3	10	74 114	183 334	18.3 33.4	2.5 2.9	7.40 11.40	99.15 98.45	289 187	70.0	10.0	52
4	25	49 76	274 342	11.0 13.7	5.6 4.5	1.96 3.04	99.49 99.37	1096 706	80.0	24.0	23
5	3	13 16	96 196	32.0 65.7	7.4 12.3	4.33 5.33	98.52 96.96	491 393	66.7	0.0	92
6	315	471 678	3507 4511	11.1 14.3	7.5 6.7	1.50 2.15	99.48 99.34	1437 997	79.1	42.5	65
7	91	108 187	1177 1382	12.9 15.2	10.9 7.4	1.19 2.05	99.40 99.30	1809 1044	81.3	51.7	62
8	30	126 190	180.2 305.5	6.0 10.2	1.4 1.6	4.20 6.33	99.72 99.53	513 339	73.3	23.3	28
9	100	185 228	869 988	8.7 9.9	4.7 4.3	1.85 2.28	99.60 99.54	1163 943	77.0	44.0	45
10	68	61 130	188 462	2.8 6.8	3.1 3.6	0.90 1.91	99.87 99.69	2405 1126	80.9	64.7	21
11	1	0 1	0 0.2	0.0 0.0	0.0 0.0	0.0 1.0	100 99.99	2160 2160	0.0	100	0
12	150	163 230	1902 2192	12.7 14.6	11.7 9.5	1.09 1.53	99.41 99.32	1976 1399	77.3	52.0	73
13	8	16 23	19.7 25.6	2.5 3.2	1.2 1.1	2.00 2.88	99.89 99.85	1079 750	62.5	50.0	7
Mean	910	1357 2049	8819 11650	9.7 12.8	6.5 5.7	1.49 2.25	99.55 99.40	1443 954	80.0	47.7	54.0

Note 1 – First row is control station data; second row is control + sub-control data.

Note 2 – Results have been rounded off in some cases.



Note 1 – Point y_1 is the intercept on the y-axis, and corresponds to zero downtime. In this case, 47.7 % of circuits (= 434 circuits) were not the subject of a fault report to the Administrations within the 3 month observation period.

Note 2 – 95 % of circuits had a downtime of less than 54.0 hours.

Note 3 – Point y_2 is the intercept on the y-axis which corresponds to the mean downtime per circuit (μ_{DT}). In this case, 80.0 % of circuits (728 circuits) had less than 9.7 hours of downtime.

Note 4 – The results reflected in this graph are taken from Table 1, column B.

FIGURE 1

Cumulative frequency distribution graph showing percentage of circuits with downtime better than x hours (910 circuits, from all countries to all countries; observation period = 3 months)

TABLE 3

Results of analysis of additional information exchanged between the participating Administrations

Types of information exchanged and possible replies (A)	Replies (% of circuits)	
	Control station only (B)	Control and sub-control stations (C)
International leased circuits are given priority maintenance attention over public circuits		
Yes	47.0	29.0
No	53.0	71.0
Duplicated circuit sections (circuit level only)		
Subscriber line (terminal national section) and/or national line (wholly or partly) and/or international line	9.8	7.1
No duplication	90.2	92.9
Fault clearance service		
Office hours only	31.0	33.9
24 hours/7 days per week	69.0	66.1
Limits applied to determine if a fault exists		
M.1040 [4]	45.7	43.8
M.1040 type, but with more stringent limits or additional parameters	0.0	0.2
M.1040 type, but with less stringent limits or fewer parameters	0.0	0.0
M.1020 [5]	52.6	53.6
M.1020 type, but with more stringent limits or additional parameters	1.6	0.9
M.1020 type, but with less stringent limits or fewer parameters	0.1	1.5
M.1025 [6]	0.0	0.0
M.1025 type, but with more stringent limits or additional parameters	0.0	0.0
M.1025 type, but with less stringent limits or fewer parameters	0.0	0.0
Customer informed about planned outages		
In principle always	71.4	66.5
In principle never	0.0	0.0
Sometimes	28.6	33.5

References

[1] CCITT Recommendation *Assessment of the service availability performance of international leased circuits*, Vol. IV. Rec. 1016.

[2] CCITT Recommendation *Circuit control station for leased and special circuits*, Vol. IV, Rec. M.1012.

[3] CCITT Recommendation *Sub-control station for leased and special circuits*, Vol. IV, Rec. M.1013.

[4] CCITT Recommendation *Characteristics of ordinary quality international leased circuits*, Vol. IV, Rec. M.1040.

[5] CCITT Recommendation *Characteristics of special quality international leased circuits with special bandwidth conditioning*, Vol. IV, Rec. M.1020.

[6] CCITT Recommendation *Characteristics of special quality international leased circuits with basic bandwidth conditioning*, Vol. IV, Rec. M.1025.

3 Supplements to the Series O Recommendations

(see Fascicle IV.4)

4 Transmission performance of the international network

Supplement No. 4.1

STABILITY OF OVERALL LOSS AND PSOPHOMETRIC NOISE: RESULTS OF ROUTINE MAINTENANCE MEASUREMENTS MADE ON THE INTERNATIONAL NETWORK DURING THE FIRST HALF OF 1978

(For this Supplement, see page 68 of Fascicle IV.3 of the *Yellow Book*)

Supplement No. 4.2

RESULTS AND ANALYSIS OF THE 10th SERIES OF TESTS OF SHORT BREAKS IN TRANSMISSION

(For this Supplement, see page 80 of Fascicle IV.3 of the *Yellow Book*)

Supplement No. 4.3

CHARACTERISTICS OF LEASED INTERNATIONAL TELEPHONE-TYPE CIRCUITS

(For this Supplement, see page 564, Volume IV.2 of the *Green Book*)

Supplement No. 4.5

INSTRUCTIONS FOR MAKING FUTURE MEASUREMENTS OF THE TRANSMISSION QUALITY OF COMPLETE CONNECTIONS FOR RECORDING THE RESULTS OF THE MEASUREMENTS

(For this Supplement, see page 569, Volume IV.2 of the *Green Book*)

Supplement No. 4.6

INSTRUCTIONS FOR MAKING FUTURE MEASUREMENTS OF THE TRANSMISSION QUALITY OF NATIONAL EXTENSIONS (EXCLUDING SUBSCRIBER'S LOCAL LINES) AND FOR RECORDING THE RESULTS OF THE MEASUREMENTS

(For this Supplement, see page 580, Volume IV.2 of the *Green Book*)

Supplement No. 4.7

INSTRUCTIONS FOR MAKING FUTURE MEASUREMENTS OF THE TRANSMISSION QUALITY OF INTERNATIONAL CIRCUITS AND INTERNATIONAL CENTRES AND FOR RECORDING THE RESULTS OF THE MEASUREMENTS

(For this Supplement, see page 587, Volume IV.2 of the *Green Book*)

Supplement No. 4.8

RESULTS AND ANALYSIS OF TESTS OF IMPULSIVE NOISE

(For this Supplement, see page 593, Volume IV.2 of the *Green Book*)

Supplement No. 4.9

WEIGHTING OF MEASUREMENTS RELATING TO THE STABILITY OF CIRCUITS IN THE INTERNATIONAL NETWORK ACCORDING TO THE SIZE OF CIRCUIT GROUPS

(For this Supplement, see page 283, Volume IV.1 of the *Orange Book*)

Supplement No. 4.10

TRANSIENT ANALOGUE CIRCUIT IMPAIRMENTS AND THEIR EFFECT ON DATA TRANSMISSION

(For this Supplement, see page 86 of Fascicle IV.3 of the *Yellow Book*)

5 Maintenance of television circuits

Supplement No. 5.1

REQUIREMENTS FOR THE TRANSMISSION OF TELEVISION SIGNALS OVER LONG DISTANCES

(For this Supplement, see page 598 of Fascicle IV.2 of the *Green Book*)

Supplement No. 5.2

SETTING-UP AND TESTING OF INTERNATIONAL VIDEOCONFERENCE STUDIOS

(Information submitted by the United Kingdom)

1 To ensure the adequate performance of international digital videoconference calls it is necessary to check, before any videoconference studio is put into international service, compatibility with existing studios and that minimum technical standards are achieved.

The standards for establishing a videoconference studio are given in [1].

Having established a new videoconference studio to these standards it is then necessary to make checks of the satisfactory performance between the new studio and an established (reference) studio. These checks are described in the following sections.

2 Test equipment

To conduct the tests it will be necessary to have the following test equipment:

a) a white noise generator set to a bandwidth of 50 Hz-10 kHz;

b) a filter which produces a flat (within 3 dB) white or pink noise response within the band 250-3000 Hz rolling off at 48 dB/octave outside these limits;

c) an audio amplifier and associated loudspeaker with the following properties:

   i) the loudspeaker must be able to deliver a sound pressure level of at least 100 dB SPL[1)] at 150 mm from the loudspeaker in the axis of the loudspeaker;

   ii) the acoustic properties must be similar to the average human mouth (as regards the law of decreasing acoustic pressure in the axis of emission and the law of directivity);

   iii) the loudspeaker must be single and small (diameter less than 15 cm) conforming to DIN 45 500;

d) a sound pressure level meter (with A-weighting and linear scale);

e) a level measuring set.

3 Video tests

3.1 Electronically generated colour bars should be viewed on video monitors both locally, and at the distant end, from each camera in turn and any noticeable degradation should be corrected.

3.2 Each camera should be checked in turn for correct colour balance and saturation. Cameras with remote pan, zoom or focus options should also have those tested.

3.3 Satisfactory pictures of the distant studio should be subjectively judged on the local studio monitor.

3.4 Camera switching should also be tested. Switching should not cause excessive break-up of picture. Composite syncs should be in synchronisation and colour subcarriers should be in phase for all video sources.

3.5 Facilities such as graphics, split screen, slides, facsimile, etc, should be tested to ensure correct operation. (When testing the graphics option, it is important to ensure that the codec has been switched to its high resolution mode.)

4 Audio tests

The audio tests described in § 4.2 shall be performed after the studio has been set up in accordance with § 4.1.

The audio levels should be set up using a white noise source. The position of microphones should not be changed throughout the tests and should represent their location during actual calls.

It should be noted that the levels specified for the following tests are based on those given in [1] but modified by experience.

4.1 *Local audio test*

i) Connect the white noise generator, filter, amplifier and loudspeaker in series. With the Sound Pressure Level Meter (SPLM) placed as in Figure 1, a), adjust the white noise level to measure 90 dBSPL on the SPLM.

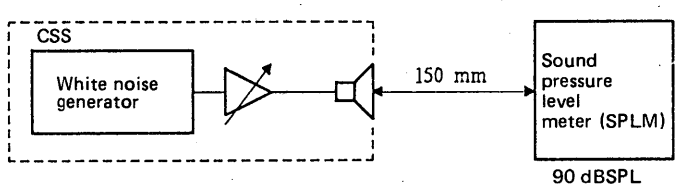
[1)] SPL = sound pressure level

ii) The loudspeaker should now be positioned relative to the optical reference point (ORP – see Note) as in Figure 1b) and the audio levels at the input to the codec should have an average value of −9 dBm with respect to all seating positions. Any adjustment to achieve this should be made immediately prior to the codec (Figure 1, b)).

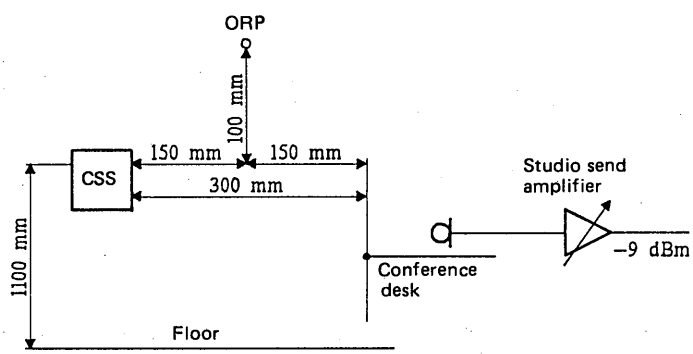
Note – The optical reference point is the point located 1200 mm from the floor level and 150 mm to the rear of the working edge of the conference desk and on the centre line of each seating position.

iii) The white noise generator, filter and amplifier should be used to simulate the nominal received level (−9 dBm) from a codec into the studio loudspeaker. Measure the sound pressure level at the ORP which should be in the range of 67 to 75 dBA, depending on the acoustic conditions (Figure 1, c)).

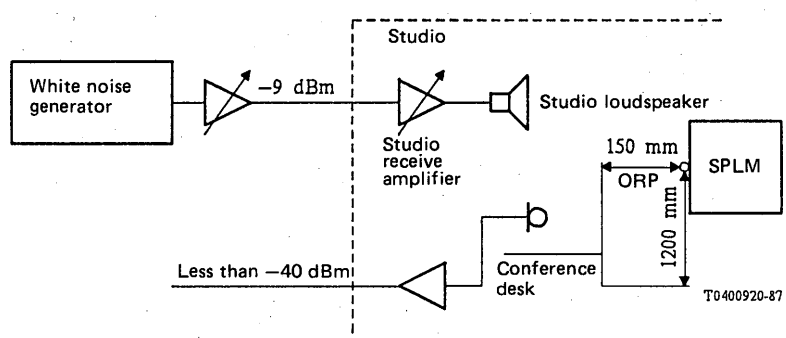
The audio level at the input to the codec due to loudspeaker/microphone acoustic coupling should be measured at less than −40 dBm.



a) Calibrated sound source (CSS)



b) Send side alignment



c) Receive side alignment and acoustic coupling

FIGURE 1

Audio alignment

4.2 *Audio tests (studio-to-studio)* (Figure 2)

In the following tests, each end will be required to send and measure audio levels at the codec interface. For ease of testing each end has been designated either A or B and this should be decided prior to any testing.

The received level at "A" will be referred to as studio Level 1 and the received level at "B" will be referred to as studio Level 2.

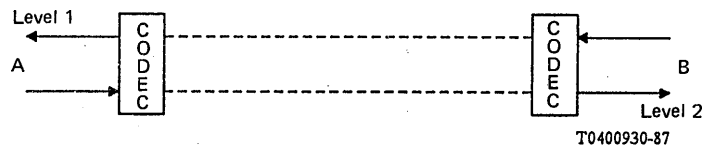


FIGURE 2

Designations for levels and ends for audio tests

The white noise source referred to below is positioned as in Figure 1, b) and adjusted as described in § 4.1 ii).

– *Electrical noise*

Conditions: A and B mute room microphones.
A and B enable echo canceller.

Measurements: Level 1 = electrical noise from Studio B.
Level 2 = electrical noise from Studio A.

Specification: Level 2 < −53 dBm (flat) at audio output of codec.
Level 1 < −53 dBm (flat) at audio output of codec.

4.2.1 *"A" end audio tests*

a) *Level check*

Conditions: B sends white noise source at −9 dBm level.
B enables studio microphone.
A mutes studio microphone.
A and B enable echo cancellers.

Measurements: i) A measures Level 1 at audio output of codec.
ii) A measures sound pressure level at ORP.

Specification: i) Level 1 at audio output of codec = −9 dBm.
ii) Level at ORP = 67 to 75 dBA.

b) *Echo check*

Conditions: A sends white noise at −9 dBm level.
B enables studio microphones.
A and B enable echo cancellers.

Measurements: A measures Level 1 (echo).

Specification: Level 1 < −40 dBm at audio output of codec.

c) *Echo return loss measurement*

Conditions: A sends white noise at −9 dBm level.
B enables studio microphones.
A enables echo canceller.
B disables echo canceller.

Measurements: A measures Level 1.

Specification: Level 1 < −15 dBm at audio output of codec.

d) *Crosstalk check*

Conditions: A sends white noise at −9 dBm level.
B mutes studio microphones.
A and B enable echo canceller.

Measurements: A measures level 1 (crosstalk).

Specification: Level 1 < −50 dBm.

4.2.2 *"B" end audio tests*

a) *Level check*

Conditions: A sends white noise source at −9 dBm level.
A enables source microphone.
B mutes studio microphone.
B and A enable echo cancellers.

Measurements: i) B measures Level 1 at audio output of codec.
ii) B measures sound pressure level at ORP.

Specification: i) Level 2 at audio output of codec = −9 dBm.
ii) Level at ORP = 67 to 75 dBA.

b) *Echo check*

Conditions: B sends white noise a −9 dBm level.
A enables studio microphones.
B and A enable echo cancellers.

Measurements: B measures Level 1 (echo).

Specification: Level 2 < −40 dBm at audio output of codec.

c) *Echo return loss measurement*

Conditions: B sends white noise at −9 dBm level.
A enables studio microphones.
B enables echo canceller.
A disables echo canceller.

Measurements: B measures Level 2.

Specification: Level 2 < −15 dBm at audio output of codec.

d) Crosstalk check

Conditions: B sends white noise at −9 dBm level.
A mutes studio microphones.
B and A enable echo canceller.

Measurements: B measures Level 2 (crosstalk).

Specification: Level 2 < −50 dBm.

5 Overall subjective checks

As a final confidence check, the general quality of the sound and vision received from the distant studio should be subjectively checked at the "A" and "B" ends for all seating positions.

Reference

[1] CEPT T/TR 01-02E (Nice, 1985)

6 Miscellaneous

Supplement No. 6.1

EFFECT ON MAINTENANCE OF THE INTRODUCTION OF NEW COMPONENTS AND OF MODERN EQUIPMENT DESIGN

(For this Supplement, see page 620, Volume IV.2 of the *Green Book*)

Supplement No. 6.2

NEW OPERATION AND MAINTENANCE ORGANIZATION IN THE MILAN ITALCABLE INTERCONTINENTAL TELECOMMUNICATIONS CENTRE

(Information submitted by Italcable)

1 Introduction

The purpose of this Supplement is to inform the readers of Volume IV about the new operation and maintenance organization which began service in 1986 in the Milan Italcable Intercontinental Telecommunications Centre.

The organization which has been implemented consists essentially in the integration of the transmission, line signalling and switching technical staff into one single group.

The motivation behind these changes is that at the Italcable Centre the type of switching equipment is completely electronic, equipment rooms of the Centre are grouped in a logistical arrangement and the digitalization process within the Centre is at an advanced stage.

This situation has given Italcable the opportunity to change its organization to exploit the advantages offered by a purely digital network.

2 Logistical arrangement of equipment rooms

- The transmission and switching systems are on the same floor.
- The supervision room is the same for the transmission and switching equipment and is placed in an intermediate position between the rooms where the transmission and switching systems are located.
- The supervision of both transmission and switching systems from the same technical staff allows integrated control of the the telephone system and faster elimination of failures.

3 Digitalization process

In Italy, as in other countries, the process of digitalization of the transmission and switching equipment is in the phase of gradual implementation.

Particularly in the Milan Italcable Intercontinental Centre a digital switching system is in the phase of testing (at present 2 SPC wholly electronic exchanges of the type TDM/PAM are active).

The switching exchanges in Italy with which the Milan Italcable Centre is connected are also replacing their electromechanical switches with digital ones.

4 Technicians training

The most onerous problem that Italcable had to overcome was re-training the technical staff by means of courses and the organization of periods of cooperative work in order to obtain a homogeneous and thorough preparation of technicians with different knowledge and background experience.

To guarantee the operation and the maintenance of the transmission and switching equipment, Italcable had to provide the same course twice for two separate groups, in order that a group of qualified technicians was always available for service.

This principle was attained both for the switching technicians who attended a transmission course and for the transmission technicians who attended a switching course.

A period of side-by-side collaboration followed the theoretical training in order to obtain the experience required.

The whole training phase lasted about 10 months for a total of 35 man-months.

5 Organization

Italcable has now an organization for the transmission and the switching equipment which is subdivided into 4 sections, namely:

1) planning,
2) operation,
3) hardware maintenance,
4) software maintenance.

Only the staff of the Operation Section, which is employed for maintaining the continuity of service, is present 24 hours a day, seven days a week.

The other technicians work normal office hours five days a week. This has allowed in the Milan Centre an easy transition towards an organization, which has now been carried out, based on a division according to functions.

6 Conclusions

After about a year of experience with the new organization, it is possible to estimate with some certainty the advantages reached in the Milan Intercontinental Centre to which about 3000 circuits are connected (about 1200 are international):

1) The centralized supervision of the transmission and switching equipment has eliminated the wasted periods of time which were needed for the transmission of failure information between transmission and switching staff. It has also allowed a global view of the telephone communication process and, consequently, it has reduced the duration of "out-of-service periods".
2) The integration of the switching and transmission functions has improved the efficiency of the staff and it has increased the operational efficiency (+16% improvement in number of operated circuits/man-hours worked monthly).
3) As a whole there has been an improvement, both in quality of service and availability of the transmission and switching systems.
4) Concerning the changes involved for the operation staff, it is evident that this has become less problematic and overall more efficient.

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