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PART I

Series N Recommendations

MAINTENANCE OF INTERNATIONAL SOUND-PROGRAMME

AND TELEVISION TRANSMISSION CIRCUITS

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MONTAGE: PAGE 2 = PAGE BLANCHE

SECTION 1

INTERNATIONAL SOUND-PROGRAMME TRANSMISSION

1.1 International sound-programme transmissions — Definitions

Recommendation N.1

DEFINITIONS FOR APPLICATION TO INTERNATIONAL SOUND-PROGRAMME TRANSMISSIONS

,

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

Definitions in this Recommendation apply both to analogue and digital systems.
Annex A to this Recommendation gives definitions for units of measurements for sound-programme transmissions.

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

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.

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]).

Figure 1/N.1 p.

Figure 2/N.1 p.

Figure 3/N.1 p.

Figure 4/N.1 p.3

Figure 5/N.1 p.

ANNEX A

(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 Impedance

voltage correction

level

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)**

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

The term ‘‘load level’’ is used provisionally and is subject to further consideration.

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.

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

In a transmission system based on power levels the absolute power level or load level ($L_{m\d0}$) 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

$$L_{m\d0} = L_m — L_r$$

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.

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

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

This Recommendation applies also to 7 kHz and 15 kHz digital sound-programme 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* | onnection ;

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

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

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

2 Provision of control circuits for sound-programme and television transmission

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.

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.

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.

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]

Wider tolerance limits are recommended for 15-kHz type sound-programme circuits because of performance limitation of

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.

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 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

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.

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.)

H.T. [1T1.10]

TABLE 1/N.10

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

Item	Parameter	Unit	Limits

{

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

}

Item	Parameter	Unit	Limits

{

{

{

14	Intelligible crosstalk ratio A/B	dB	48
15	Crosstalk ratio (intermodulation) A/B	dB	58

}

{

MONTAGE:

Additional parameters for stereo transmission

}

Table 1/N.10 [1T1.10], p.

H.T. [2T1.10]

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

Item	Parameter	Unit	Limits		
{					
{					
{ 14 Intelligible crosstalk ratio A/B dB 48 }					
{ 15 Crosstalk ratio (intermodulation) A/B dB 58 **MONTAGE:** Additional parameters for stereo transmission }					

Table 1/N.10 (cont.) [2T1.10], p.

H.T. [T2.10]

TABLE 2/N.10

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

Item	Parameter	Unit	Limits

Table 2/N.10 [T2.10], p.

H.T. [T3.10]

TABLE 3/N.10

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

Item	Parameter	Unit	Limits

Table 3/N.10 [T3.10], p.

H.T. [T4.10]

TABLE 4/N.10

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

Item	Parameter	Unit	Limits

Table 4/N.10 [T4.10], p.

H.T. [T5.10]

TABLE 5/N.10

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

Item	Parameter	Unit	Limits

Table 5/N.10 [T5.10], p.

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 | 00 Hz | 1)

for an international sound-programme link composed entirely of 10-kHz sound-programme circuits 50, 800 and 10 | 00 Hz | 1)

for an international sound-programme link comprising at least one 7 kHz sound-programme circuit 50, 800 and 7 | 00 Hz | 1)

for an international sound-programme link comprising at least one 6.4-kHz sound-programme circuit 50, 800 and 6 | 00 Hz | 1)

for an international sound-programme link comprising at least one 5 kHz sound-programme circuit 100, 800 and 5 | 00 Hz | 1)

for an international sound-programme link comprising at least one ordinary telephone circuit 300, 800 and 3 | 00 Hz

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

Or the frequency appropriate to the telephone-type circuit used.

[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.