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PART II

Series J Recommendations

SOUND-PROGRAMME AND TELEVISION TRANSMISSIONS

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SECTION 1

GENERAL RECOMMENDATIONS CONCERNING

SOUND-PROGRAMME TRANSMISSIONS

Recommendation J.11

HYPOTHETICAL REFERENCE CIRCUITS | fR FOR SOUND-PROGRAMME TRANSMISSIONS
’ | ’ |

(Geneva, 1972; amended at Geneva, 1976, and at Melbourne, 1988)

Terrestrial systems and systems in the fixed-satellite service

The CCITT,

considering

(a) that there is a need to define a hypothetical reference circuit to enable design performance standards to be set;

(b) that the hypothetical reference circuit should allow the different types of sound-programme circuits to be compared on a common basis,

unanimously recommends

(1) that the main features of the hypothetical reference circuit for sound-programme transmissions over a terrestrial system (shown in Figure 1/J.11), which may be provided by either radio or cable, should be:

— the overall length between audio points (B and C) is 2500 km,

— two intermediate audio points (M and M’) which divide the circuit into three sections of equal lengths,

— the three sections which are lined up individually and then inter-connected without any form of overall adjustment or correction;

(2) that the main features of the hypothetical reference circuit for sound-programme transmissions over a system in the fixed-satellite service (shown in Figure 2/J.11) should be:

This Recommendation corresponds to CCIR Recommendation 502.
The hypothetical reference circuits defined in this Recommendation should apply for both analogue and digital systems.
For maintenance purposes there may be a need to define other circuits of which an illustration is shown in Annex A of this Recommendation.

— one link: earth station — satellite — earth station,

— one pair of modulation and demodulation equipments for translation from baseband to radio frequency, and from radio frequency to baseband, respectively.

Figure 1/J.11, (M), p. 1

Figure 2/J.11, (M), p. 2

ANNEX A
(to Recommendation J.11)

Illustration of an international sound-programme connection

Figure A-1/J.11 illustrates a typical international sound-programme connection in which:

— point A, to be considered as the sending end of the international sound-programme connection, may be the point at which the programme originates (studio or outside location);

— point D, to be considered as the receiving end of the international sound-programme connection, may be a programme-mixing or recording centre or a broadcasting station;

— the local sound-programme circuit AB connects point A to the sending terminal station, point B, of the international sound-programme circuit BC;

— the local sound-programme circuit CD connects point C, the receiving terminal station of the international sound-programme circuit BC to the point D.

The hypothetical reference circuit must not be considered identical to any of the sound-programme circuits illustrated above or to those defined for maintenance purposes in [1]. However, some of these circuits may display the same structure as the hypothetical reference circuit. Such types of circuits are:

— an international sound-programme connection comprising three audio sections;

— a single sound-programme circuit made up of three audio sections.

In this case, the performance standards set for the hypothetical reference circuit may be applied to these circuits.

Figure A-1/J.11, (M), p. 3

Reference

[1] *Maintenance; international sound-programme and television transmission circuits* . Recommendations of the N Series. Fascicle IV.3.

Recommendation J.12

TYPES OF SOUND-PROGRAMME CIRCUITS ESTABLISHED

OVER THE INTERNATIONAL TELEPHONE NETWORK

(former Recommendation J.11; amended at Geneva, 1972 and 1980, and at Melbourne, 1988)

The CCITT recognizes the types of sound-programme circuits defined below.

Note — For the purposes of this Recommendation and other Recommendations in the Series J, sound-programme circuits have been classified in terms of the nominal effectively transmitted bandwidth. For convenience, the corresponding type of circuit from the administrative point of view (see Recommendation D.180 [1]) is given under each type of equipment in the following paragraphs.

1 15 kHz-type sound-programme circuit

This type of circuit is recommended for high-quality monophonic programme transmission and in certain arrangements is also recommended for stereophonic transmissions. This type of circuit corresponds to the ‘‘very wideband circuit’’ or ‘‘stereophonic pair’’, as appropriate, referred to in Recommendation D.180 [1].

The performance characteristics of 15 kHz-type sound-programme circuits suitable for both monophonic and stereophonic transmissions are defined in Recommendation J.21 and suitable equipment is specified in Recommendation J.31, for analogue transmission and in Recommendations J.41, G.735 and G.737 for digital transmission.

2 10 kHz-type sound-programme circuit

This type of circuit, previously known as the ‘‘normal programme circuit, type A’’, is recommended for monophonic transmission only. This type of circuit corresponds to the ‘‘wideband circuit’’ referred to in Recommendation D.180 [1]. The performance characteristics of 10 kHz-type sound-programme circuits are defined in Recommendation J.22 and suitable methods of provision are given in Recommendation J.32.

Note — Recommendations J.22 and J.32 are reproduced in Fascicle III.4 of the *Red Book* , ITU, Geneva, 1985.

3 Narrow bandwidth sound-programme circuit (7 and 5 kHz-type sound-programme circuit)

These types of circuits are recommended:

— for setting up a large number of temporary sound-programme circuits for the transmission of commentaries and reports on events of large interest (e.g. sporting events); and

— for permanent sound-programme circuits which are used primarily for speech transmission or as connection between studio outputs and long-, medium- or short-wave broadcast-transmitter inputs.

The performance characteristics of narrow bandwidth sound-programme circuits are defined in Recommendation J.23, and as suitable equipment for 7 kHz-type circuit is specified in Recommendation J.34, for analogue transmission.

Note — These types of circuits fall within the category of ‘‘medium-band circuits’’ referred to in Recommendation D.180 [1] for tariff purposes.

4 Use of ordinary telephone circuits

For this type of transmission of special programmes such as speech, some operational aspects are given in Recommendation N.15 [2].

References

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

[2] CCITT Recommendation *Maximum permissible power during an international sound-programme transmission* , Vol. IV, Rec. N.15.

Recommendation J.13

DEFINITIONS FOR INTERNATIONAL SOUND-PROGRAMME CIRCUITS

(former Recommendation J.12; amended at Geneva, 1972 and 1980)

Definition of the constituent parts of an international sound-programme connection

The following definitions apply to international sound-programme transmissions.

1 international sound-programme transmission

The transmission of sound over the international telecommunication network for the purpose of interchanging sound-programme material between broadcasting organizations in different countries. Such a transmission includes all types of programme material normally transmitted by a sound broadcasting service, for example, speech, music, sound accompanying a television programme, etc.

2 broadcasting organization (send)

The broadcasting organization at the sending end of the sound programme being transmitted over the international sound-programme connection.

3 broadcasting organization (receive)

The broadcasting organization at the receiving end of the sound programme being transmitted over the international sound-programme connection.

4 international sound-programme centre (ISPC)

A centre at which at least one international sound-programme circuit terminates and in which international sound-programme connections can be made by the interconnection of international and national sound-programme circuits.

The ISPC is responsible for setting up and maintaining international sound-programme links and for the supervision of the transmissions made on them.

5 international sound-programme connection

5.1 The unidirectional 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 organizations (see Figure 2/J.13).

5.2 The assembly of the ‘‘international sound-programme link’’ and the national circuits between the broadcasting organizations, constitutes the ‘‘international sound-programme connection’’. Figure 3/J.13 illustrates, by way of example, an international sound-programme connection as it might be encountered in practice.

6 international sound-programme link (Figure 2/J.13)

The unidirectional path for sound-programme transmissions 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 interconnected at intermediate ISPCs. It can also include national sound-programme circuits in transit countries.

7 international sound-programme circuit (Figure 1/J.13)

The unidirectional transmission path between two ISPCs and comprising one or more sound-programme circuit sections (national or international), together with any necessary audio equipment (amplifiers, compandors, etc.).

Figure 1/J.13, (M), p. 4

Figure 2/J.13, (M), p. 5

Figure 3/J.13, (M), p. 6

8 sound-programme circuit-section (Figure 1/J.13)

Part of an international sound-programme circuit between two stations at which the programme is transmitted at audio frequencies.

The normal method of providing a sound-programme circuit section in the international network will be by the use of carrier sound-programme equipment. Exceptionally sound-programme circuit sections will be provided by other means, for example, by using amplified unloaded or lightly loaded screened-pair cables or by using the phantoms of symmetric-pair carrier cables.

9 national circuit

The national circuit connects the ISPC to the broadcasting authority; this applies both at the sending and at the receiving end. A national circuit may also interconnect two ISPCs within the same country.

10 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 telephony circuits given 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.

Reference

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

Recommendation J.14

RELATIVE LEVELS AND IMPEDANCES ON AN INTERNATIONAL SOUND-PROGRAMME CONNECTION

(former Recommendation J.13; amended at Geneva, 1972, 1976 and 1980, and at Melbourne, 1988)

1 Level adjustment on an international sound-programme connection

The CCITT recommends the use of the *constant voltage* method international sound-programme connection , a zero absolute voltage level is applied (sine-wave signal of 0.775 volts r.m.s.) at the reference frequency 0.8 or 1 kHz, the absolute voltage level at the output of each sound-programme circuit (Points B, C, D . | | F of Figure 3/J.13) should be +6 dB (i.e. 1.55 volts r.m.s.). Therefore these points have to be regarded as relative level points of +6 dBrs according to Recommendations J.21, J.22 and J.23.

The zero relative level point is, in principle, the origin of the international sound-programme connection (Point A in Figure 3/J.13). Different conventions may be agreed between the telephone Administration and the broadcast organization within a country, provided that the levels on the international sound-programme link are unchanged.

A zero relative level point is, in principle, a point at which the sound-programme signals correspond exactly with those at the origin of the international sound-programme connection. At a point of zero relative levels, signals have been controlled in level by the broadcasting organization such that the peak levels very rarely exceed +9 dB relative to the peak values reached by a sine-wave signal of 0.775 volts r.m.s. (for a 600-ohm resistor load, when levels are expressed in terms of dBm).

In Recommendation 645, CCIR has defined test signals to be used on international sound-programme connections based on existing CCITT Recommendations.

2 Diagram of signal levels on an international sound-programme connection

All signal levels are expressed in terms of r.m.s. values of sine-wave signals with reference to 0.775 volts.

The voltage level diagram for an international sound-programme connection, however made up, should be such that the voltage levels shown will not exceed the maximum undistorted power which an amplifier can deliver to a sound-programme link when a peak voltage (i.e. +9 dB) is applied to a zero relative level point on the international sound-programme connection.

With these conditions, +6 dB is the nominal voltage level at the output of the terminal amplifiers of the sound-programme circuits making up the international sound-programme link (Points B, C, D . | | F of Figure 3/J.13).

Considering that rare excursions of the permitted maximum signal level may occur, and that adjustment errors and maintenance tolerance have to be taken into account, sound-programme circuits need a definite overload margin

If a sound-programme circuit which is part of the international sound-programme link is set up on a group in a carrier system, the objective for a new design of equipment is that the relative level of the sound-programme circuit, with respect to the relative level of the telephone channel, should be chosen such that the mean value and the peak value of the load presented by the sound-programme channel should be no higher than that of the telephone channels which are replaced by the sound-programme channel. The effects of pre-emphasis and compandors should, where present, be taken into consideration.

It is recognized that this condition may not be observed in all cases, particularly in certain existing types of equipments. It is recommended that in those cases the zero relative level points of the sound-programme circuit and of the telephone channels should coincide.

It might be as well, however, if the equipment could, where possible, tolerate a maximum difference of ± | dB between the relative levels of the sound-programme and telephone transmissions, so that the best adjustment can be obtained, depending on any noise or intermodulation present, but at the same time observing the constraints imposed by the considerations on loading.

Note — The relative level at which the modulated sound-programme signal is applied to the group link is given in Recommendations J.31 for 15 kHz-type circuits, J.34 for 7 kHz-type circuits and in the Annex to Recommendation J.22 for 10 kHz-type circuits.

3 Definitions and abbreviations for new sound-programme signals

Definitions and symbols are in current use to define relative levels for telephony. However, additional definitions and symbols are necessary for the absolute and relative levels in respect of sound-programme signals. The corresponding definitions and symbols for telephony and sound-programme signals are given below.

These symbols traditionally relate to telephony relative levels.

3.1 **dBm0**

The absolute signal power level, in decibels, referred to a point of zero relative level.

3.2 **dBr**

The relative power level, in decibels.

3.3 **dBm0s**

The absolute signal power level, in decibels, referred to a point of zero relative sound-programme level.

3.4 **dBrs**

The relative (power) level, in decibels, with respect to sound-programme signals. (This abbreviation is only applicable at points in a sound-programme circuit where the signals can nominally be related to the input by a simple scaling factor.)

Note — The use of level definitions is given in CCIR Recommendation 574.

Recommendation J.15

LINING-UP AND MONITORING AN INTERNATIONAL SOUND-PROGRAMME CONNECTION

(former Recommendation J.14; amended at Geneva, 1972 and 1980, and at Melbourne, 1988)

For the alignment of international sound-programme connections the CCIR, in Recommendation 661, recommends a *three-level test signal* .

This test signal is based on the test signal definitions given in CCIR Recommendation 645 and specifies a test signal which should be used on sound-programme circuits generally. A common alignment procedure for peak programme meters and VU-meters using the three-level test signal can be found in Annex I of CCIR Recommendation 645. From this information it can be seen what indicators will be produced by the three-level test signal on the different types of peak programme meters and volume meters.

To comply with the provisions of Recommendation J.14, the lining-up and monitoring of an international sound-programme connection should ensure that, during the programme transmission, the peak voltage at a zero relative level point will not exceed 3.1 volts, which is that of a sinusoidal signal having an r.m.s. value of 2.2 volts. The methods for achieving this condition as well as the relevant performance requirements are given in Recommendations N.10 to N.18 (see references [1] to [8]).

Some indication of the volume or of the peaks of the signals during programme transmission may be obtained by monitoring at the studio, in the repeater stations, or at the transmitter. One of the instruments, the characteristics of which are summarized in Table 1/J.15, may be used.

Since there is no simple relation between the readings given by two different instruments for all types of programme transmitted, it is desirable that the broadcast organization controlling the studio and the telephone Administration(s) controlling the sound-programme circuit should use the same type of instrument so that their observations are made on a similar basis.

In general the telephone Administration and the broadcast organization of a country agree to use the same type of instrument. It is desirable to reduce to a minimum the number of different types of instrument and to discourage the introduction of new types which only differ in detail from those already in service. The unified use of the peak indicator specified in reference [9] is under study.

During programme transmission, the signal level at the output of the last amplifier controlled by the sending broadcast organization (Point A of Figure 3/J.13) should be monitored to see that the meter deflection of the measuring instrument is always lower than the peak voltage for the overall line-up, allowance being made for the peak factor of the programme involved.

It should be remembered that the amplitude range from a symphony orchestra is of the order of 60 to 70 dB, while the specification for sound-programme circuits is based on a range of about 40 dB. Before being passed to the sound-programme circuit, therefore, the dynamic ratio of the studio output needs to be compressed.

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H.T. [T1.15]

TABLE 1/J.15

Principal characteristics of the various instruments used for monitoring the volume or peaks during telephone conversations or sound-programme transmissions

Type of instrument	{ Rectifier characteristic (Note 1) }	{ Time to reach 99% of final reading (milliseconds) }	{ Integration time (milliseconds) (Note 2) }	{ Time to return to zero (value and definition) }
{ (1) Vu meter (United States of America) }	1.0 to 1.4	300	165 (approx.)	Equal to the integration time
(2) Vu meter (France)	1.0 to 1.4	300 ± | 0%	207 ± | 0	{ 300 ms ± | 0% from the reference deviation }
{ (3) Peak programme meter, used by the Netherlands }	1	Not specified	{ 10 | s | or | (em1 | B 5 | s | or | (em2 | B 0-4 | s | or | (em15 | B }	{ 0 to —20 dB: 1-5 | 0 to —40 dB: 2-5 | }
{ (4) Programme level meter (Italy) }	1	Approx. 20 ms	Approx. 1.5 ms	{ Approx. 1.5 | from 100% to l0% of the reading in the steady state }
{ (5) Peak indicator for sound-programme transmissions used by the British Broadcasting Corporation (BBC peak programme meter) }	1		10 (Note 3)	{ 3 | for the pointer to fall 26 dB }
{ (6) Maximum amplitude indicator used by the Federal Republic of Germany (type U 21) }	1	Around 80	5 (approx.)	{ 1 or 2 | from 100% to 10% of the reading in the steady state }
{ (7) OIRT — Programme level meter: Type A sound meter				

Type B sound meter } For both types: less than 300 ms for meters with pointer indication, and less than 150 ms for meters with light indication } For both types: 1.5 to 2 | from the 0 dB point which is at 30% of the length of the operational section of the scale }	10 ± | 60 ± | 0	{ {		
{ (8) E.B.U. standard peak programme meter (Note 4) }	1	—	10	2.8 | for the pointer to fall 24 dB

Note 1 — The number given in the column is the index *n* | in the formula $V_{(output)} = [V_{(input)}]$ | *applicable for each half-cycle.*

Note 2 — The ‘‘integration time’’ was defined by the CCIF as the ‘‘minimum period during which a sinusoidal voltage should be applied to the instrument for the pointer to reach to within 0.2 neper or nearly 2 dB of the deflection which would be obtained if the voltage were applied indefinitely’’. A logarithmic ratio of 2 dB corresponds to 79.5% and a ratio of 0.2 neper to 82%.

Note 3 — The figure of 4 ms, that appeared in previous editions, was actually the time taken to reach 80% of the final reading with a d.c. step applied to the rectifying integrating circuit. In a new and somewhat different design of this programme meter using transistors, the performance on programme remains substantially the same as that of earlier versions and so does the response to an arbitray, quasi-d.c. test signal, but the integration time, as defined in Note 2, is about 20% greater at the higher meter readings.

Note 4 — This meter is intented specifically for use in monitoring sound signals transmitted internationally, and therefore incorporates a scale conforming to CCITT Recommendation N.15 [5], calibrated in dB from —12 to +12 relative to a level marked ‘‘TEST’’ corresponding to 0 dBm at a zero relative level point. In addition to the normal mode of opeation having the characteristics shown above, the meter may be operated temporarily in a ‘‘slow’’ mode faciliting the comparison of observations made at widely separate points. The peak values indicated in this mode have no absolute significance, and may only be used for such comparisons.

Tableau 1/J.15 [T1.15], p. 7

References

[1] CCITT Recommendation *Limits for the lining-up of international sound-programme links and connections* , Vol. IV, Rec. N.10.

[2] CCITT Recommendation *Essential transmission performance objectives for international sound-programme centres (ISPC)* , Vol. IV, Rec. N.11.

[3] CCITT Recommendation *Measurements to be made during the line-up period that precedes a sound-programme transmission* , Vol. IV, Rec. N.12.

[4] CCITT Recommendation *Measurements to be made by the broadcasting organizations during the preparatory period* , Vol. IV, Rec. N.13.

[5] CCITT Recommendation *Maximum permissible power during an international sound-programme transmission* , Vol. IV, Rec. N.15.

[6] CCITT Recommendation *Identification signal* , Vol. IV, Rec. N.16.

[7] CCITT Recommendation *Monitoring the transmission* , Vol. IV, Rec. N.17.

[8] CCITT Recommendation *Monitoring for charging purposes, releasing* , Vol. IV, Rec. N.18.

[9] IEC Publication 268-10A.

Recommendation J.16

MEASUREMENT OF WEIGHTED NOISE IN SOUND-PROGRAMME CIRCUITS

(Geneva, 1972; amended at Geneva, 1976 and 1980)

The noise objectives for sound-programme circuits are defined in terms of psophometrically weighted noise power levels at a zero relative level point. Psophometric weighting is used to ensure that the objectives and the results of measurements are directly related to the disturbing effect of the noise on the human ear. The psophometric weighting for sound-programme circuits consists of two operations:

— a frequency-dependent weighting of the noise signal, and

— a weighting of the time function of the noise signal to take account of the disturbing effect of noise peaks.

To achieve results which are comparable, it is recommended that for the measurement of noise in sound-programme circuits, a measuring set be used which conforms to the characteristics laid down in CCIR Recommendation 468 which is reproduced at the end of this Recommendation.

Annex A gives symbols and definitions used in noise measurements.

ANNEX A

(to Recommendation J.16)

Symbols and definitions used in noise measurements

A clear distinction should be made between measurements performed with equipment conforming to the Recommendation cited in [1] and those with equipment conforming to CCIR Recommendation 468.

It is recommended that the definitions and symbols in Table A-1/J.16 be used.

H.T. [T1.16]
TABLE A-1/J.16
Definitions and symbols for the specification of noise measured on sound-programme circuits

Definitions	Symbols
{ Unweighted noise level, measured with a quasi-peak measuring instrument complying with CCIR Recommendation 468 and referred to a point of zero relative sound-programme level }	dBq0s
{ Weighted noise level, measured with a quasi-peak measuring instrument complying with CCIR Recommendation 468 and referred to a point of zero relative sound-programme level }	dBq0ps

Tableau A-1/J.16 [T1.16], p.

Reference

[1] CCITT Recommendation *Psophometers (apparatus for the objective measurement of circuit noise)* , Green Book, Vol. V, Rec. P.53, Part B, ITU, Geneva, 1973.

CCIR RECOMMENDATION 468-4

MEASUREMENT OF AUDIO-FREQUENCY NOISE VOLTAGE

LEVEL IN SOUND BROADCASTING

(Question 50/10)

(1970 | | 974 | | 978 | | 982 | | 986)

The CCIR,

CONSIDERING

(a) that it is desirable to standardize the methods of measurement of audio-frequency noise in broadcasting, in sound-recording systems and on sound-programme circuits;

(b) that such measurements of noise should provide satisfactory agreement with subjective assessments,

UNANIMOUSLY RECOMMENDS

that the noise voltage level be measured in a quasi-peak and weighted manner, using the measurement system defined below:

This Recommendation should be brought to the attention of the CMTT.

1. Weighting network

The nominal response curve of the weighting network is given in Fig. 1 b which is the theoretical response of the passive network shown in Fig. 1 a. Table I gives the values of this response at various frequencies.

The permissible differences between this nominal curve and the response curve of the measuring equipment, comprising the amplifier and the network, are shown in the last column of Table I and in Fig. 2.

Note 1. — When a weighting filter conforming to § 1 is used to measure audio-frequency noise, the measuring device should be a quasi-peak meter conforming to § 2. Indeed, the use of any other meter (e.g. an r.m.s. meter) for such a measurement would lead to figures for the signal-to-noise ratio that are not directly comparable with those obtained by using the characteristics that are described in the present Recommendation.

Note 2. — The whole instrument is calibrated at 1 kHz (see § 2.6).

Figure 1a/J.16, (MC), p. 9

Figure 1b/J.16, (M), p. 10

H.T. [T2.16]
TABLE I

Frequency (Hz)	Response (dB)	Proposed tolerance (dB)
| 31.5 ± | .0 | **fR↑(↑1↑)** }	—29.9	{
| 63 |	—23.9	± | .4 | u(1)
| 00 | ± | .0 | **fR↑(↑1↑)** }	—19.8	{
| 00 |	—13.8	± | .85 | u(1)
| 00 |	— 7.8	± | .7 | u(1)
| 00 |	— 1.9	± | .55 | u(1)
1 | 00 | ± | .5 | **fR↑(↑1↑)** }	0 |	{
2 | 00 | ± | .5 | **fR↑(↑1↑)** }	+ 5.6	{
3 | 50 |	+ 9.0	± | .5 | u(1)
4 | 00 |	+10.5	± | .5 | u(1)
5 | 00 | ± | .5 | **fR↑(↑1↑)** }	+11.7	{
6 | 00 | | | | **fR↑(↑1↑)** }	+12.2	{
7 | 00 |	+12.0	± | .2 | u(1)
8 | 00 |	+11.4	± | .4 | u(1)
9 | 00 |	+10.1	± | .6 | u(1)
10 | 00 |	+ 8.1	± | .8 | u(1)
12 | 00 |	0 |	± | .2 | u(1)
14 | 00 |	— 5.3	± | .4 | u(1)
16 | 00 |	—11.7	± | .6 | u(1)
20 | 00 | ± | .0 | **fR↑(↑1↑)** }	—22.2	{
31 | 00 | + | .8 | u(1) —∞ | **fR↑(↑1↑)** 1) }	—42.7	{

This tolerance is obtained by a linear interpolation on a logarithmic graph on the basis of values specified for the frequencies used to define the mask, i.e. 31.5, 100, 1000, 5000, 6300 and 20 | 00 Hz.

Tableau I/J.16 [T2.16], p. 11

Figure 2/J.16, (M), p. 12

2. Characteristics of the measuring device

A quasi-peak value method of measurement shall be used. The required dynamic performance of the measuring set may be realized in a variety of ways (see Note). It is defined in the following sections. Tests of the measuring equipment, except those for § 2.4, should be made through the weighting network.

Note — After full wave rectification of the input signal, a possible arrangement would consist of two peak rectifier circuits of different time constants connected in tandem [CCIR, 1974-78].

2.1 *Dynamic characteristic in response to single tone-bursts*

Method of measurement

Single bursts of 5 kHz tone are applied to the input at an amplitude such that the steady signal would give a reading of 80% of full scale. The burst should start at the zero-crossing of the 5 kHz tone and should consist of an integral number of full periods. The limits of reading corresponding to each duration of tone burst are given in Table II.

The tests should be performed both without adjustment of the attenuators, the readings being observed directly from the instrument scale, and also with the attenuators adjusted for each burst duration to maintain the reading as nearly constant at 80% of full scale as the attenuator steps will permit.

H.T. [T3.16]
TABLE II

Burst duration (ms)	1 | u(1)	2	5	10	20	50	100	200
{ Amplitude reference steady signal reading (%) blanc (dB) }	blanc 17.0 —15.4	blanc 26.6 —11.5	blanc 40 | —8.0	blanc 48 | —6.4	blanc 52 | —5.7	blanc 59 | —4.6	blanc 68 | —3.3	blanc 80 | —1.9
Limiting values: { — lower limit blanc (%) blanc (dB) }	blanc 13.5 —17.4	blanc 22.4 —13.0	blanc 34 | —9.3	blanc 41 | —7.7	blanc 44 | —7.1	blanc 50 | —6.0	blanc 58 | —4.7	blanc 68 | —3.3
{ — upper limit blanc (%) blanc (dB) } }	blanc 21.4 —13.4	blanc 31.6 —10.0	blanc 46 | —6.6	blanc 55 | —5.2	blanc 60 | —4.4	blanc 68 | —3.3	blanc 78 | —2.2	blanc

92 | —0.7 (1) The Administration of the USSR intends to use burst durations ≥" | ms.

Tableau II/J.16 [T3.16], p. 13

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2.2 *Dynamic characteristic in response to repetitive tone-bursts*

Method of measurement

A series of 5 ms bursts of 5 kHz tone starting at zero-crossing is applied to the input at an amplitude such that the steady signal would give a reading of 80% of full scale. The limits of the reading corresponding to each repetition frequency are given in Table III.

The tests should be performed without adjustment of the attenuators but the characteristic should be within tolerance on all ranges.

H.T. [T4.16]
TABLE III

Number of bursts per second	2	10	100
{ Amplitude reference steady signal reading (%) blanc (dB) }	blanc 48 | —6.4	blanc 77 | —2.3	blanc 97 | —0.25
Limiting values: { — lower limit (%) blanc (dB) }	43 | —7.3	72 | —2.9	94 | —0.5
{ — upper limit (%) blanc (dB) }	53 | —5.5	82 | —1.7	100 | —0.0

Tableau III/J.16 [T4.16], p. 14

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2.3 *Overload characteristics*

The overload capacity of the measuring set should be more than 20 dB with respect to the maximum indication of the scale at all settings of the attenuators. The term ‘‘overload capacity’’ refers both to absence of clipping in linear stages and to retention of the law of any logarithmic or similar stage which may be incorporated.

Method of measurement

Isolated 5 kHz tone-bursts of 0.6 ms duration starting at zero-crossing are applied to the input at an amplitude giving full scale reading using the most sensitive range of the instrument. The amplitude of the tone-bursts is decreased in steps by a total of 20 dB while the readings are observed to check that they decrease by corresponding steps within an overall tolerance of ± | dB. The test is repeated for each range.

2.4 *Reversibility error*

The difference in reading when the polarity of an asymmetrical signal is reversed shall not be greater than 0.5 dB.

Method of measurement

1 ms rectangular d.c. pulses with a pulse repetition rate of 100 pulses per second or less are applied to the input in the unweighted mode, at an amplitude giving an indication of 80% of full scale. The polarity of the input signal is reversed and the difference in indication is noted.

2.5 *Overswing*

The reading device shall be free from excessive overswing.

Method of measurement

1 kHz tone is applied to the input at an amplitude giving a steady reading of 0.775 V or 0 dB (see § 2.6). When this signal is suddenly applied there shall be less than 0.3 dB momentary excess reading.

2.6 *Calibration*

The instrument shall be calibrated such that a steady input signal of 1 kHz sine-wave at 0.775 V r.m.s., having less than 1% total harmonic distortion, shall give a reading of 0.775 V, 0 dB. The scale should have a calibrated range of at least 20 dB with the indication corresponding to 0.775 V (or 0 dB) between 2 and 10 dB below full scale.

2.7 *Input impedance*

The instrument should have an input impedance ≥" | 0 k?73 and if an input termination is provided then this should be 600 ?73 ± 1%.

3. Presentation of results

Noise voltage levels measured according to this Recommendation are expressed in units of dBqps.

Note 1 — If, for technical reasons, it is desirable to measure unweighted noise, the method described in Annex II should be used.

Note 2 — The influence of the weighting network on readings obtained with different spectra of random noise is discussed in Report 496.

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[1974-78]: 10/28 (United Kingdom).

[1982-86]: **a** . 10/248 (Australia).

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STEFFEN, E. [1972] Untersu chungen zur Ger"auschspannungsmessung (Investigations into the measurement of noise voltage). *Techn. Mitt. RFZ* , Heft 3.

WILMS, H. | . | . [December, 1970] Subjective or pso phometric audio noise measurement: A review of standards. *J. Audio Eng. Soc.* , Vol. 18, **6** .

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[1978-82]: 10/9 (EBU); 10/31 (L | Ericsson); 10/38 (OIRT); 10/225 (German Democratic Republic).

ANNEX I

CONSTANT RESISTANCE REALIZATION OF WEIGHTING NETWORK

Figure 3/J.16, (M), p.

BIBLIOGRAPHY

AUSTRALIAN BROADCASTING COMMISSION Engineering Deve lopment Report No. 106 — Constant resistance realization of CCIR noise weighting network, Recommendation 468.

ANNEX II

UNWEIGHTED MEASUREMENT

It is recognized that unweighted measurements outside the scope of this Recommendation may be required for specific purposes. A standard response for unweighted measurements is included here for guidance.

Frequency response

The frequency response shall be within the limits given in Fig. 4.

This response serves to standardize the measurement and ensure consistent readings of noise distributed across the useful spectrum. When out-of-band signals, e.g. carrier leaks, are present at a sufficient amplitude, they may produce readings that are inconsistent between measuring equipments whose responses are different but still fall within the tolerance template of Fig. 4.

Figure 4/J.16, (MC), p.

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[1978-82]: 10/76 (CMTT/14) (Canada).

Recommendation J.17

PRE-EMPHASIS USED ON SOUND-PROGRAMME CIRCUITS

(Geneva, 1972)

The noise spectrum in group links is usually uniformly distributed, i.e. all parts of the frequency band are equally disturbed by the noise signal. Sound-programme signals, on the other hand, are not of uniform distribution. The mean power density of the signals tends to decrease towards higher frequencies. Furthermore, the sensitivity of the receiving part (consisting of the radio receiver, the loudspeaker and the human ear) in respect of noise is very dependent on the frequency. (This can be seen from the psophometric weighting curve which is a measure of the sensitivity of the complete receiving part.)

Taking these three facts together it appears to be advantageous to use pre-emphasis on sound-programme circuits set up on carrier systems.

The advantages which could be gained by using different pre-emphasis curves are rather small. It is recommended, therefore, that a single pre-emphasis curve should be used whenever pre-emphasis is applied to sound-programme circuits in group links.

It is further recommended that the pre-emphasis attenuation curve should be that given by the following formula:

Insertion loss between nominal impedances = 10 log$_{1\backslash d0}$$$3o75 +
$\frac{(*w}{000}$
$$2x2
$$3u1 +
$\frac{(*w}{000}$
$$2x2
$$3e (dB)

where ω is the angular frequency corresponding to frequency *f* are given in Table 1/J.17.

H.T. [T1.17]

TABLE 1/J.17

f (kHz)	Insertion loss (dB)
0	18.75
0.05	18.70
0.2	18.06
0.4	16.48
0.8	13.10
2	6.98
4	3.10
6.4	1.49
8	1.01
10	0.68
∞	0

Tableau 1/J.17 [T1.17], p.

The de-emphasis network should have a complementary curve.

The pre-emphasis curve calculated from this formula passes through the following points:

The measured pre-emphasis and de-emphasis curves should not depart by more than ± | .25 dB from the theoretical curves when the measured levels at 800 Hz are made to coincide with the theoretical levels.

Note — The formula given above defines only the ‘‘insertion-loss/frequency’’ characteristic. The level at which the modulated programme signal is different for the various types of sound-programme equipments and it depends on the modulation method and the type of compandors used. This information is given in the appropriate Recommendations (J.31, J.34, J.41).

Recommendation J.18

CROSSTALK IN SOUND-PROGRAMME CIRCUITS

SET UP ON CARRIER SYSTEMS

(Geneva, 1972; amended at Geneva, 1980)

This Recommendation outlines the principles followed by the CCITT in determining what limits are appropriately set for sources of crosstalk affecting sound-programme circuits and other principles which Administrations might apply to ensure that the objectives for intelligible crosstalk in sound-programme circuits are achieved in practice.

1 The causes of crosstalk arising in the transmission parts of telecommunications networks occur in:

a) frequency translating equipments at all levels, viz. audio, group, supergroup, and higher order translating equipments;

b) group, supergroup, etc., through-connection equipments (i.e. filter characteristics);

c) transmission systems, both the line (including repeater) and station equipments.

Different crosstalk mechanisms, e.g. inductive, capacitive and other couplings, intermodulation involving continuous fixed-frequency tones such as pilots, etc., operate in these equipments and systems. A particular channel may thus be disturbed by intelligible crosstalk from a number of potential disturbing sources.

However, because of the interconnections which occur at distribution points along the length of a sound-programme circuit, the same disturbing and disturbed signals are rarely involved in more than one exposure.

2 Only the more important crosstalk mechanisms are the subject of Recommendations (e.g. coaxial and balanced pair cable repeater section FEXT limits of the Series J Recommendations, Section 3); the limits are such that at least the objectives for intelligible crosstalk ratio between *telephone* circuits (generally 65 dB, Recommendation G.151 [1]) may be met. In some cases it is practicable to take into account the more stringent objectives for *sound-programme* circuits (Recommendations J.21, J.22 and J.23). Certain crosstalk mechanisms, because they are not significant for telephony (e.g. near-end crosstalk limits for cable repeater sections), are not the subject of Recommendations; nevertheless, they may be significant in relation to sound-programme circuit objectives.

In principle, a probability of exposure can be attributed to each source of crosstalk, not all potential sources exerting their influence in every case. Given the respective probabilities and distributions, the risk of encountering low values of crosstalk attenuation could be calculated.

Without carrying out this analysis it is estimated that the risk of encountering adverse systematic addition for some sources is small and the allocation of the complete overall objective to a single source of crosstalk as the minimum value of crosstalk attenuation appears justifiable. For other sources, particularly where the equipments involved are specifically intended for sound-programme transmission, it is appropriate to require some higher minimum attenuation values so as to allow for some adverse addition (Recommendation G.242 [2] specifying through-connection filter discrimination requirements against out-of-band components in the band occupied by sound-programme circuits is an example).

3 For these reasons meeting intelligible crosstalk objectives on sound-programme circuits in practice depends on:

a) reasonable care in the allocation of plant for sound-programme circuits, so that the principal crosstalk mechanisms, a single exposure to any of which may itself suffice to exceed the objective, are avoided.

Among these mechanisms are:

— far-end and near-end crosstalk at certain frequency bands in line-repeater sections (e.g. the lowest and highest frequency bands of coaxial systems);

— systematic addition of near-end crosstalk between go and return channels of a group link;

b) readiness to change allocated plant in the few cases where crosstalk is excessive because of systematic addition of two or more disturbing sources.

4 The CCITT limits agreed for crosstalk ratios between bands potentially occupied by sound-programme circuits are in terms of effects at single frequencies. The following factors need to be taken into account when assessing from such limits the probability of encountering intelligible crosstalk into real sound-programme circuits:

a) no methods of assessing the subjective effects of intelligible crosstalk in the bands occupied by sound-programme circuits have as yet been standardized;

b) the intelligibility of crosstalk can be affected by:

— the use of emphasis in the disturbed circuit;

— noise masking effects;

— modulation arrangements (e.g. double sideband) in the disturbed circuit;

— frequency offsets and inversions;

— the use of compandors;

c) the mechanisms most liable to cause excessive intelligible crosstalk are, in general, highly frequency-dependent. These cases are those readily prevented by selective plant allocation advocated in § 3 above;

d) crosstalk attenuation can, as a rule, be characterized by a mean value and a standard deviation; the mean value is usually several decibels higher than the worst value, which occurs with only a very small probability.

5 Go-return crosstalk

The assumptions made in the course of the CCITT study of go-return crosstalk in sound-programme circuits, and which served as the basis for the crosstalk limits prescribed in respect of group and higher-order translation equipments (Recommendation G.233 [3]), are given in the following:

a) the nominal maximum distance of the exposure to go-return crosstalk of two sound-programme circuits occupying opposite directions of the same group link is 560 km, i.e. 2/9 of the hypothetical reference circuit distance;

b) the equipments assumed to contribute to such go-return crosstalk are:

— 560 km of line;

— one pair of channel translations;

— one pair of group translations;

— three pairs of higher-order translations;

— two through connections.

The corresponding calculation is given in the Annex.

It was considered that the contribution of the line to go-return crosstalk can be limited to the range of values indicated in the Annex, given that precautions outlined in § 3 above are exercised.

It is possible that, in the study of new transmission systems, the CCITT will be able to take such account of sound-programme circuit crosstalk objectives so that these precautions may be relaxed somewhat. This study is in progress in the CCITT with respect to 60 MHz systems.

ANNEX A

(to Recommendation J.18)

Calculations of overall go-return crosstalk between

two sound-programme circuits occupying opposite directions of the same group link

H.T. [T1.18]

Equipment Crosstalk power per exposure in the disturbed circuit arising from a signal of 0 dBm0 on the disturbing circuit (pW) }	Crosstalk ratio limit (dB) Number of exposures	{ Total crosstalk power (pW)	Crosstalk ratio (dB)		
Line 80 to 85 (single homogeneous section) }	{ 10 to 3	2 (2/9 h.r.c.)	20 to 6	77 to 82	
Channel translation	85	3	2	6	82 |
Group translation	80	10	2	20	77 |
{ Supergroup and higher translations }	85	3	6	18	77.5
Through filters (cabling)	85	3	2	6	82 |

Tableau A/J.18 [T1.18] p.

References

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

[2] CCITT Recommendation *Through-connection of groups, supergroups, etc.* , Vol. III, Rec. G.242.

[3] CCITT Recommendation *Recommendations concerning translating equipments* , Vol. III, Rec. G.233.

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Recommendation J.19

A CONVENTIONAL TEST SIGNAL SIMULATING SOUND-PROGRAMME SIGNALS FOR MEASURING INTERFERENCE

IN OTHER CHANNELS

(Geneva, 1980)

The CCITT,

considering

(a) that on FDM systems non-linear crosstalk may cause mutual interference between the several types of transmission channels;

(b) that the interference depends on the total loading of the FDM system;

(c) that the interference in a channel can be measured as a noticeable deterioration of the signal-to-noise ratio;

(d) that for setting realistic performance limits of interference, a conventional test signal imitating the sound-programme channel loading is desirable,

unanimously recommends

that for simulating sound-programme signals a conventional test signal with the following parameters should be used:

(1) a uniform spectrum energizing signal covering the frequency band up to at least 15 kHz shall be shaped according to the nominal insertion loss/frequency shown in Table 1/J.19 and Figure 1/J.19;

This Recommendation corresponds to CCIR Recommendation 571.
For the definitions of absolute power, relative power and noise levels, see CCIR Recommendation 574.

Figure 1/J.19, (M), p.

(2) the conventional test signal can be produced from a Gaussian white noise generator associated with a shaping network conforming with Figure 2/J.19;

(3) the total test signal power applied to a sound-programme circuit under test shall be cyclically changed in level according to Table 2/J.19.

Note — This Recommendation is derived from studies given in Report 497.

Figure 2/J.19, (M) p.

H.T. [T1.19]
TABLE 1/J.19

<table>
<tr><th>Frequency (Hz)
Relative insertion-loss
(dB)
}</th><th>{

Tolerance (± | B)</th><th></th></tr>
<tr><td>| 31.5</td><td>10.9</td><td>0.5</td></tr>
<tr><td>| 63 |</td><td>3.4</td><td>0.3</td></tr>
<tr><td>| 00 |</td><td>0.4</td><td>0.2</td></tr>
<tr><td>| 122) |</td><td>(0.0)</td><td>(0) |</td></tr>
<tr><td>| 00 |</td><td>1.5</td><td>0.2</td></tr>
<tr><td>| 00 |</td><td>5.7</td><td>0.3</td></tr>
<tr><td>| 00 |</td><td>8.7</td><td>0.3</td></tr>
<tr><td>1 | 00 |</td><td>9.2</td><td>0.3</td></tr>
<tr><td>2 | 00 |</td><td>10.6</td><td>0.5</td></tr>
<tr><td>3 | 50 |</td><td>13.0</td><td>0.5</td></tr>
<tr><td>4 | 00 |</td><td>15.7</td><td>0.5</td></tr>
<tr><td>5 | 00 |</td><td>18.8</td><td>0.5</td></tr>
<tr><td>6 | 00 |</td><td>22.5</td><td>0.5</td></tr>
<tr><td>7 | 00 |</td><td>24.6</td><td>0.5</td></tr>
<tr><td>8 | 00 |</td><td>26.6</td><td>0.5</td></tr>
<tr><td>9 | 00 |</td><td>28.6</td><td>0.5</td></tr>
<tr><td>10 | 00 |</td><td>30.4</td><td>1.0</td></tr>
<tr><td>12 | 00 |</td><td>34.3</td><td>1.0</td></tr>
<tr><td>14 | 00 |</td><td>36.3</td><td>1.0</td></tr>
<tr><td>16 | 00 |</td><td>38.6</td><td>1.0</td></tr>
<tr><td>20 | 00 |</td><td>42.5</td><td>1.0</td></tr>
<tr><td>31 | 00 |</td><td>50.4</td><td>1.0</td></tr>
</table>

Tableau 1/J.19 [T1.19], p.

H.T. [T2.19]
TABLE 2/J.19

Step Time for which signal is applied }	Level	{
1	—4 dBm0s	4 s
2	+3 dBm0s	2 s
3	no signal	2 s

Tableau 2/J.19 [T2.19], p.

ANNEX A
(to Recommendation J.19)

Study Group XV of the CCITT had put some questions as regards CCIR Recommendation 571 and the CMTT has worked out their answers. As those questions and the answers may be helpful for anyone who applies the conventional test signal for carrying out measurements of any kind, they are given below:

Question

a) For the measurement of crosstalk from a sound-programme circuit to a telephone circuit, could the signal described in CCIR Recommendation 571 be used, considering the different bandwidth and possible frequency shift?

Reply:

— The intelligible crosstalk ratio is based on selective measurements in the telephone circuit when the sinusoidal signals are transmitted in the sound-programme circuit within the frequency range of 0.3 to 3.4 kHz. In Recommendation J.21 a minimum ratio of 65 dB is defined.

— The unintelligible crosstalk ratio should be ascertained by measuring the increase of noise in the telephone circuit by loading the disturbing sound-programme with the simulated test signal defined in CCIR Recommendation 571. As for this increase no tolerable values are recommended up to now, the CMTT proposes such values based on a maximum noise contribution produced by interference of —65 dBm0p. Depending on the basic noise level in the telephone circuit the following increased values can be tolerated:

H.T. [T3.19]
TABLE A-1/J.19

Basic noise level (dBm0p)	—75	—70	—65	—60	—55	—50
{ Tolerable increase of noise level (dB) }	10.4	6.2	3	1.2	0.4	0.1

Tableau A-1/J.19 [T3.19], p.

Question

b) What is the equivalent value for 65 dB ratio (given in Recommendations J.21, J.22 and J.23) using sinusoidal tones, when measuring with the recommended new test signal?

Reply:

The answer to this question is included in the proposal for the measurement of the ratio for the total crosstalk caused by intermodulation given in the answer to Question a).

Question

c) Can the signal defined in Table 2/J.19, from the point of view of the mean loading it would impose on transmission systems and in the light of Recommendations N.12 and N.13, be regarded as acceptable for unrestricted use over complete sound-programme circuits of any constitution?

Reply:

The conventional test signal simulating sound-programme signals defined in CCIR Recommendation 571/Recommendation J.19 in all aspects can be regarded as acceptable for unrestricted use over sound-programme circuits of any constitution.

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