INTERNATIONAL RADIO CONSULTATIVE COMMITTEE

C.C.I.R.

DOCUMENTS OF THE

Xth PLENARY ASSEMBLY

GENEVA, 1963

VOLUME V

SOUND BROADCASTING
TELEVISION

INTERNATIONAL RADIO CONSULTATIVE COMMITTEE

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Recommendations of Sub-section E.1 : Audio-frequency and recording

Recommendations of Sub-section E.2 : Radio-frequency

Recommendations of Sub-section E.3 : Tropical broadcasting

Recommendations of Sub-section E.4 : Television

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Questions and Study Programmes allocated to the C.M.T.T. (C.C.I.R./C.C.I.T.T. Joint Commission for television transmissions); Opinions and Resolutions of interest to this Commission; List of documents of the Xth Plenary Assembly concerning the C.M.T.T.

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* This list includes only those Study Programmes which do not derive from Questions. A Study Programme derived from a Question carries the same serial number as this Question, followed by a letter (e.g. S.P. 102 A (XII)). It is inserted in the book immediately after the text of the Question from which it is derived.

ARRANGEMENT OF VOLUMES I TO VII OF THE DOCUMENTS OF THE Xth PLENARY ASSEMBLY OF THE C.C.I.R.

(Geneva, 1963)

VOLUME I	Emission. Reception. Vocabulary (Sections A, B and K and Study Groups I, II and XIV).
VOLUME II	Propagation (Section G and Study Groups V and VI).
VOLUME III	Fixed and mobile services. Standard frequencies and time signals. International monitoring (Sections C, D, H and J and Study Groups III, XIII, VII and VIII).
VOLUME IV	Radio-relay systems. Space systems. Radioastronomy (Sections F and L and Study Groups IX and IV).
VOLUME V	Sound broadcasting and television (Section E and Study Groups X, XI, XII and the C.M.T.T.).
VOLUME VI	Resolutions of a general nature. Reports to the Plenary Assembly. List of participants. List of documents in numerical order.
VOLUME VII	Minutes of the Plenary Meetings.

Note 1. — To facilitate references, the pagination in the English and French texts is the same.

Note 2. — At the beginning of Volume VI will be found information concerning the Xth Plenary Assembly of the C.C.I.R. and the participation at this meeting, the presentation of texts (Definitions, origins, numbering, complete lists, etc.) together with general information on the organization of the C.C.I.R.

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QUESTIONS AND STUDY PROGRAMMES ASSIGNED TO STUDY GROUP X (BROADCASTING); OPINIONS AND RESOLUTIONS OF INTEREST TO THIS STUDY GROUP

QUESTIONS AND STUDY PROGRAMMES ASSIGNED TO STUDY GROUP XI (TELEVISION); OPINIONS AND RESOLUTIONS OF INTEREST TO THIS STUDY GROUP

The following texts, which are not contained in this Volume, also concern sound broadcasting and television.

Text	Subject	Volume
The majority of the Recommendations and Reports of Section B	Reception	I
Rec. 368	Propagation below 10 Mc/s	II
Rec. 370	Propagation between 40 and 1000 Mc/s	II
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Rec. 354	Communications by satellites	IV
Rep. 212	Communications by satellites	IV
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RECOMMENDATIONS OF SECTION E: (SOUND BROADCASTING AND TELEVISION)

E. 1 - Audio-frequency and recording

RECOMMENDATION 261 *

STANDARDS OF SOUND RECORDING FOR THE INTERNATIONAL EXCHANGE OF PROGRAMMES

Single track recording on magnetic tape

The C.C.I.R., (Geneva, 1951 — London, 1953 — Warsaw, 1956 — Los Angeles, 1959)

UNANIMOUSLY RECOMMENDS

that single-track recording on magnetic tape should be in accordance with the following technical standards:

1. Speed of tape

Primary speeds: { 15 in./s (38·1 cm/s) nominal value
7½ in./s (19·05 cm/s) „ „

Secondary speed **: 30 in./s (76·2 cm/s) „ „

The actual value of tape speed should be as close as possible to the nominal value. A tolerance of not more than $\pm$ 0·5% is considered desirable.

2. Width of tape

0·246 $\pm$ 0·002 in. (6.25 $\pm$ 0·05 mm)

3. Strength of tape

The tape should be suitable for use on a machine exerting a maximum (transient) stress of 2·2 pounds (1 kg).

4. Direction of winding

If the top surface of a spool is distinguished by markings, by a label or by other means (especially if the hub is asymmetrical), then the tape should be wound in such a way that during reproduction it may be unwound in a counterclockwise direction.

5. Tape spools

Two types of hub are accepted for international programme exchange:

Fig. 1 gives the principal dimensions of the type more generally used in Europe;

Fig. 2 gives the dimensions of the hub more generally used in the United States and of the accompanying flange;

Fig. 3 gives the main dimensions of a typical machine fitting to receive the hub of Fig. 1.

Fig. 4 gives the main dimensions of an adapter to enable the machine fitting of Fig. 3 to receive the hub of Fig. 2.

Whenever the exchange of recorded programmes has to be effected by cine-type flanged spools, the spools must conform to the standards established in Publication 94 of the International Electrotechnical Commission.

As far as possible, for the exchange of recorded programmes, only flanged spools or spool hubs with flanges should be used.

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* This Recommendation replaces Recommendation 209.

** The secondary speed should only be used by prior agreement.

6. Maximum diameter of a full spool

for the hub shown in Fig. 1: 290 mm *
for the hub shown in Fig. 2: 267·5 mm

7. Tape leader

A non-magnetic identification strip at least one metre long should be placed at the beginning of the tape giving at least the number of the spool and the reference number (see § 8 below). This information should be given on the side of the leader continuous with the unrecorded side of the tape.

Note. — It is recommended that, whenever possible, the unrecorded side of the tape should be identified by some form of marking continuous throughout the length of the tape.

8. Programme identification

A label giving the following information should accompany each reel:

— broadcasting organization,
— programme title,
— reel number,
— total number of reels,
— reference number,
— total playing time of programme,
— speed of tape (marked as prominently as possible).

9. Reproducing characteristics

A *standard replay chain* is specified and recordings for programme interchange should give a response within the tolerances stated below when reproduced on this standard replay chain:

9.1 *Nominal characteristic*

The *standard replay chain* is defined as one having the same response as that of an "ideal" reproducing head, the open-circuit voltage of which is amplified in an amplifier with a response curve as specified below:

For tape speeds of 15 in./s (38·1 cm/s) and 30 in./s (76·2 cm/s), the specified frequency response curve falls with increasing frequency in conformity with the impedance of a series combination of a capacitance and a resistance having a time constant of 35 μs. This curve is shown in Fig. 6.

For a tape speed of 7½ in./s (19·05 cm/s), the specified frequency response curve falls with increasing frequency in conformity with the impedance of a series combination of a capacitance and a resistance having a time constant of 100 μs. This curve is shown in Fig. 7.

9.2 *Tolerances*

Tapes for international programme interchange should be recorded so that, when reproduced on a standard replay chain the response falls between upper and lower limits defined as follows for tape speeds of 15 in./s (38·1 cm/s) and 30 in./s (76·2 cm/s):

upper limit

— from 50 c/s to 100 c/s falling regularly by 1 db,
— from 100 c/s to 5000 c/s flat,
— from 5000 c/s to 10 000 c/s rising regularly by 1 db,
— from 10 000 c/s to 15 000 c/s flat;

lower limit

— from 50 c/s to 100 c/s rising regularly by 3 db,
— from 100 c/s to 7500 c/s flat,
— from 7500 c/s to 15 000 c/s falling regularly by 3 db.

From 100 to 5000 c/s the flat portions of the upper and lower limits are 2 db apart. These limits are shown in Fig. 8.

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* In France, the maximum diameter is 270 mm.

For a tape speed of 7½ in./s (19·05 cm/s), the response should fall within limits defined as follows:

upper limit

— from 50 c/s to 10 000 c/s flat;

lower limit

— from 50 c/s to 100 c/s rising regularly by 3 db,
— from 100 c/s to 5000 c/s flat,
— from 5000 c/s to 10 000 c/s falling regularly by 3 db.

From 100 to 5000 c/s the flat portions of the upper and lower limits are 2 db apart. These limits are shown in Fig. 9.

Note 1. — An "ideal" reproducing head is defined as a ferromagnetic reproducing head, the losses of which are negligible. Normally this means that the gap is short, that the arc of contact with the tape is long compared with the relevant wavelengths on the tape and that the losses in the material of the head are small.

With the reproducing heads used in practice, compensation for the head losses must be added to the replay amplifier.

With good replay heads, a mean value of this equalization may be used for the two higher speeds and even for the three speeds.

Note 2. — The open circuit voltage developed in a ferromagnetic reproducing head depends on the surface induction * on the tape while it is in contact with the head. It has been found that, provided a coated high-coercivity tape is used, the surface induction in free space will be altered, when the tape is placed in contact with the head, by an approximately constant factor over the whole range of wavelengths. Under these circumstances, the relative surface inductions at different frequencies can be measured by at least three methods that are described in the Annex. From such measurements, the departure of the response of a reproducing head from the " ideal " can be defined, and consequently a standard replay chain can be established as a primary standard. Test tapes can then be made which can serve as secondary standards for use in normal operations.

Note on use of reproducing characteristics. — A different standard replay chain has been adopted in the U.S.A. for 15 in/s (38·1 cm/s). The difference between the nominal characteristics of the standard replay chain of the U.S.A. and that of the C.C.I.R., is less than the tolerance in § 9. Furthermore a different characteristic is used in France for 30 in./s (76·2 cm/s).

ANNEX

1. Methods of measuring the magnetization of a tape

There are two general ways in which the surface induction/frequency characteristics of a tape may be determined:

1.1 by means which do not affect the surface induction. This implies the use of a non-magnetic reproducing device. For example, reproduction by means of a simple non-magnetic conductor placed in the field at the surface of the moving tape is practicable as a laboratory method and may therefore be used to establish a primary standard. This can be used to determine the relative change of surface induction with wavelength created by the presence of a magnetic head;

1.2 by means of a magnetic reproducing device, which necessarily affects the surface induction of the tape in a manner dependent on recorded wavelength. In this category, there are two ways in which conventional magnetic heads have been used, one method involving heads with a short gap, the other involving heads with a long gap. In both cases, the gap in the

* In this Recommendation and in the Annex the term " surface induction " means the normal surface induction, that is to say the flux density at right-angles to the surface of the tape.

reproducing head must be sufficiently accurate, magnetically, to give well-defined minima of reproduced level, one in the short gap method or several in the long gap method. To ensure that the same results will be obtained with both magnetic and non-magnetic reproducing devices, a coated high-coercivity tape must be used.

Steps must be taken to ensure that the arc of the tape in contact with the head is long enough in relation to the longest wavelengths recorded. If this is not so, it may be found that output level at the lower frequencies is slightly higher than that given by an ideal head and that the deviation increases as the frequency decreases while remaining as a general rule within the tolerances defined above. The error may be reduced by using bigger reproducing heads for the very low frequencies.*

1.2.1 *The " short-gap " method*

The longest wavelength at which a minimum of reproduced level occurs is called the effective gap length d. The necessary correction for the gap length is calculated on the assumption that the output is proportional to

$$[\sin (\pi d/\lambda)] \,/\, (\pi d/\lambda)$$

This correction must not exceed 5 db at the shortest wavelength considered. Any necessary correction for eddy current losses must also be determined, for example, by comparing outputs at various tape speeds or by the use of an inducing loop. Once these corrections are known and applied, the head may be used as an " ideal " head to measure relative surface inductions on the tape over the wavelength range considered.

1.2.2 *The " long-gap " method*

In this method, a head is used with a gap some 50 times longer than that of the normal reproducing head. In practice, an erase head can usually be adapted for the purpose. The response of such a head should show a series of well-defined maxima and minima as shown in Fig. 10.

A curve through the successive maxima is a measure of the relative surface induction on the tape, when the necessary correction for the eddy current losses of the head has been made. This curve falls approximately 4 db/octave compared with the curve of surface induction/frequency in air, as determined by a non-magnetic reproducing device, or by a " short-gap " head. This correction must therefore be applied.

The precise steps by which the procedures of §§ 1.2.1 and 1.2.2 may be applied in practice are outlined in the following.

2. Standardization by the short-gap magnetic head

Using the short-gap method, a recording equipment is set to the standard condition in the following way:

2.1 A *gliding tone* is recorded on a tape and reproduced by means of the head to be used for the measurements. The longest wavelength at which the output disappears is noted. This wavelength will be equal to the effective gap length, from which the gap correction may be deduced. If this correction exceeds 5 db the head is unsuitable for this measurement.

Since the measurement must take place at a very short recorded wavelength, a high-coercivity tape should be used, and a certain amount of pre-emphasis will be found useful. To avoid making the measurements at an unnecessarily high frequency, the lowest tape speed available should be used.

2.2 The tape with the gliding tone is reproduced at two different speeds and the output curves are compared. If the curves can be brought to coincidence by displacing one frequency scale so that equal wavelengths coincide, it may be assumed that frequency-dependent losses are negligible. If not, these losses may be deduced from the two curves mentioned or, alternatively, from a measurement with an inducing loop.

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* See Report 79.