IMPORTANT CCIR-STANDARDS FOR THE AUDIO-WORLD PREPRINT NO 1984 (G9)

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Presented at
the 73rd Convention
1983 March 15-18
Eindhoven, The Netherlands

AES

AN AUDIO ENGINEERING SOCIETY PREPRINT

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ABSTRACT: Different opinions exist on principal quality aims in audio studio technology. Therefore different interpretation of standards to the same problem was the result. Herein technical and commercial interests are often opposing.
Broadcasting and television organizations should respect the point of view of the listener and conditions of the international programme exchange.
At the example of "Audio Frequency Noise Measurement" and the status now reached with CCIR recommendation 468-3, it will be informed on results of the special working group 10-C "AF Characteristics of Sound Broadcasting Systems" of Study Group 10 of the CCIR.
Furthermore several other important CCIR documents are explained which are not known in general in the AES, but which should be taken into consideration at work on the development of quality in AF.

1. INTRODUCTION

The work of the C.C.I.R. (International Consultative Committee of the International Telecommunication Union, Geneva) has been unknown to many audio engineers.

In publications, i. a. in the J.A.E.S., the results of the CCIR, in the field of audio techniques as well as in subjective quality assessment, are seldom mentioned. In the field of entertainment (home) electronics and high fidelity techniques the work of the IEC (International Electrotechnical Comission) is better known.

But the results of the CCIR are relevant to the field of studio techniques in general, the parameters of which formerly were higher by some orders than those applied for entertaiment electronics. The rapid evolution of electrotechnics, especially the coming of digital technique, makes this difference more and more diminish.

Therefore, it is necessary to consider more the high requirements of studio technique in general, because it is only on these conditions that quality limits and quality aims may better be defined.

With the following synopsis, an attempt is made to establish a relation to the activities of the AES. Therewith it should be noted, that the CCIR is not preparing "standards", but "recommendations", "reports" and "opinions". The status of these documents which are elaborated by a great number of member organizations is so highly esteemed that national standards or recommendations are derived therefrom.

2. THE WORK OF STUDY GROUP 10 FOR AUDIO TECHNOLOGY

2.1. ORGANIZATION OF WORK /1/

Under the direction of its chairman, Carlo Terzani (Italy), the study group 10 - broadcasting service (sound) is concerned with:

- the technical aspects of the broadcasting service and the broadcasting-satellite service,
- the special problems of broadcasting in the Tropical Zone,
- standards for audio-frequency equipment, including recording, to facilitate the international exchange of programmes.

The tasks of audio technology are treated by two of the five working groups:

- working group 10-C (Chairman: G. Steinke, German Democratic Republic):
  "Audio-frequency characteristics of sound broadcasting signals"
- working group 10-D (Chairman: P. Zaccarian, EBU/CBU):
  "Recording of sound programmes"

In 1981 within the working group 10-C an interim working party IWP 10/6), under the chairmanship of N.H.C. Gilchrist (UK) was established to intensively work on problem of programme level control and quality parameters.

2.2. SURVEY OF IMPORTANT RESULTS ACHIEVED IN AUDIO TECHNOLOGY /1/

The working group 10-C "AF Characteristics" strives to establish quality parameters to be observed and attained for sound signals and equipments within the transmission chain between studio and listener.
In this connection, the standards to be defined by the CCIR are limited to the transmission chain and the relevant transmission sections which are of importance for the international exchange of programmes. Further values of interest are given as an additional information, which permit conclusions to be drawn for the standardization of partial sections which lie in the competence of other organizations.

Considering that the determination of objective parameter values departs from those values which are obtained by subjective-statistical tests of listening groups, it is possible to recognize their limits set by the relevant technico-economical conditions. On the other hand, it is very difficult to determine those thresholds for which a further technical improvement, in general, is neither useful nor necessary, because in the studio - as is well known - extremely high output values for the equipment and devices should be required because of the great number of processing and rerecording processes used.

The conditions for the objective parameters of the individual transmission sections are determined with the help of the addition laws, taking as a basis the safe subjective limits for the reproduction with the listener.

Indication of "dream values" or "nice figures", as are loved to be cited by the entertainment electronics, is not relevant to the CCIR.

For a long time, working group 10-C has considered the determination of the measurement of noise voltage as the "lower" point in the level profile as its most essential point for its work. (Rec. 468-3), (see para 3.1.).

Further studies some of which are not yet solved in a satisfactory way refer to programme level measurement problems and the various level values for the transmission (IWP 10/6, and Rep. 293-5; 292-5), (see para 3.2.).

With regard to the unified measurement of the loudness of the programmes and the measures to be derived for programme handling it was not possible to achieve a practicable result while with the analysator by ZWICKER and other more recent methods, better suited means have meanwhile been developped (Rep. 465-3), (see para 3.3.).

A principal recommendation and a report were prepared (Rec. 562-3; Rep. 799-1), (see para 3.4.) with regard to the carrying out of subjective studies required for all parameters.

For such studies as well as for the control and assessment of the programmes themselves, so-called (unified) reference listening rooms are of importance. Inspite of comprehensive knowledge it was not yet possible to establish a definite recommendation (Report 797-1), (see para 3.5.). On the other hand, the OIRT (ORGANISATION INTERNATIONAL DE RADIODIFFUSION ET TÉLEVISION) was able to prepare recommendations for OIRT reference listening rooms (E 86/1) and to conduct subjective tests therein, which permitted to effectively improve the international programme exchange.

For several years, the working group 10-C is concerned with fundamental determinations for digital techniques in studios, but hitherto was not in a position to elaborate a draft recommendation because the coordination with other international organizations proved to be time-consuming. (Report 948, 949, 797-1, 953) (see para 3.6.).

The problems associated with analogue recording technique are dealt with by working group 10-D; applicable IEC Publications are completed by recommendations and reports for the special concerns of broadcasting and television (Rec. 408-4; Rep. 800, Rep. 622-3, Rep. 950, Rec. 564, Rec. 563), (see para 3.7.).

A first Report is available relating to digital recording (Rep. 950).

3. RELEVANT RECOMMENDATIONS AND REPORTS OF THE CCIR

3.1. MEASUREMENT OF NOISE VOLTAGE

Recommendation 468-3 (1982): Measurement of audio-frequency noise voltage level in sound broadcasting

Extract of essential data:

The CCIR recommends that the noise voltage level should be measured and weighted as quasi-peak value, in whichcase the measurement system used is defined as follows:

1. Weighting network

Nominal frequency response according to fig. 1b and fig. 2 for a passive network according to fig. 1a.
Table I +) shows the values and tolerances at various frequencies. The whole measuring device is calibrated at 1 kHz.

2. Characteristics of the measuring equipment

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.
In the corresponding tables, the dynamic performance

- at single tone bursts (Table II)
- at repetitive tone bursts (Table III)

is indicated (5-ms-bursts of 5-kHz-tone).

In the measurements the amplitude is set such that the steady signal would give a reading of 80 % of full scale. The burst should start at zero-crossing. The tables give the limits of reading corresponding to each duration of tone burst (Table II) or corresponding to each repetition frequency (Table III).
The recommendation contains furthermore information on

- overload characteristics
- reversibility error
- overswing
- calibration
- input impedance

The noise voltage level should be represented in transmission units (according to CCITT J. 14 and J. 16) "dB qp".

(q = quasi-peak level

p = for psophometer or of pondere = weighted)

The additional index "s" is used with values for sound programme lines.

+) Table I contained in the official volume /1/ shows some printer's errors at the frequencies 200 - 1000 Hz, which are corrected in the present contribution.

Comments by the author:

The argumentation for the fundamental characteristics laid down in recommendation 468-3 is contained i. a. in report 398-2 (1974) Geneva /2/. According to this, the best agreement between measurements of the audio-frequency noise and the subjective assessment is obtained with the help of a modified version of the sound level meter by Niese /3/ and a weighting curve according to fig. 1 (1b) in Rec. 468-3. This is confirmed by studies conducted in Great Britain and the Federal Republic of Germany, the German Democratic Republic and some other OIRT member countries. Concerning the weighting curve an immediate agreement was possible among the organization participating in the CCIR. The noise should be weighted with high quality sound reproduction in conformity with ear response characteristic and noise impression; therefore, the curve according to fig. 1 (1b) is incontestable. The curve which the IEC prepared for purely acoustical purposes, namely for the loudness of noise (background noise, interfering noise), (the so-called curve A) proved to be unsuitable because when weighting electroacoustical transmissions or recordings, annoyance as well as masking effects are far more predominant. Comprehensive tests have shown - as is pointed out in CCIR Report 398-2 - that curveAproduces large errors, in case that certain types of noise prevail particularly with wide bandwidth circuits having frequency responses up to 15 kHz and with impulsive type noise. Furthermore the weighting of the noise voltage level is based on special listening conditions (high quality broadcasting listening room, see CCIR report 797-1 or OIRT Recommendation 86/1, together with studio listening equipment), where the noise level is lower than that used in curve A of the IEC (30 dBA).

Considering that presently no international unified reference listening equipment exists and hence the frequency response of the sound pressure is not defined at the listener's place, the frequency weighting curve for noise voltage measurements should suitably be related to a frequency-independant sound pressure.

As compared with the former weighting curve P 53 of the CCITT, there are differences in the measurement results because of the fact that the higher frequencies are now more emphasized. With quasi-stationary or stationary signals, the difference between the "former" (P 53) and the "recent" noise voltage values (Rec. 468-3) is about 5 zo 6 dB, i. e., the signal-to-noise values are lower by this value than they were formerly. This seemingly "deterioration" of equipment has aroused a certain concern among the manufacturers of broadcasting receivers, but with pertinent explanation and correct complete indication of the values no problems should be left.

The experienced engineer is not interested in "nice figures". The proposal by R. DOLBY, to maintain the numerical values hitherto used in approximation in that the reference frequency of the filter is increased from 1 kHz to 2 kHz /4/, was not accepted by the CCIR.

Within the high-quality studio suite, complications and errors would result therefrom, e. g. on account of the different preemphasis and deemphasis characteristics of the networks in the transmission path, of the different conditions of measurement etc.

But the weighting curve is only one factor to be considered. The temporal weighting is also a decisive magnitude. As said above, the CCIR was of the unanimous opinion (1974) that the temporal weighting according to NIESE ($\tau_{t=23ms}$) gives the best agreement with subjective values with the largely differing interference noise (see figure 3 from /5/. Nevertheless, the CCIR decided already in 1974 unanimously in favour of quasi-peak value measurements for the following reasons (see Report 398-2 /2/):

- the instrument would not be expensive;
- its use would be less fatiguing than most of the others;
- measuring devices of this kind have successfully been used in many countries for several years.

Therefore, it was unanimously felt that the recommendation of a different type would have been advisable only if it had properties which could compensate for the economical advantages of the recommended quasi-peak instrument. From this it can be concluded, however, that the NIESE weighting may get some importance again, when the electronic circuitry is further developped, economic solutions and general experience in the use of Rec. 468-3 for digital technique will be gained. Rec. 468-3 excludes the use of rms value measurement as it is not intended for the measurement of quality parameters. Quality assessments may correctly relate only to the subjective noise impression. Insofar it is not always reasonable to differentiate between studio quality and Hi-Fi-quality (entertainment electronics); on the contrary, the buyer is mislead by the seemingly "favorable" figures of an rms value measurement.

The situation is another one, when due to unsufficient quality of transmission paths (e. g. in telephone lines), the measurement of quasi-peak values leads to non-constant and reproducible measured values on account of stochastic-type interference. In the case of series production and checking of apparatus with short checking times by automatic measuring appliances it may be advantageous too to use, for type acceptance tests, also rms value measurement (weighted and unweighted) in addition to noise measurements. For this purpose, however, separate standards should be laid down, which have no reference to Recommendation 468-3.

If, for certain reasons, measurement of unweighted quasi-peak value measurements should be required, it would be suitable to apply the curve (see fig. 4) given in Rec. 468-3, annex II for a "standard frequency response". (But annex II is no more part of the competence of Rec. 468-3!).

In practice, if white[*] is used with a bandwidth of 15 kHz, the following differences in the measured results /6/ are obtained:

- between rms value measurements and quasi-peak value measurements: approx. 4 dB
- between the measurements weighted according to Rec. 468-3 and unweighted measurements: approx. 8,5 dB
- from this it follows that we obtain between unweighted rms value measurements and weighted quasi-peak value measurements: approx. 12,5 dB

Likewise, in case of rms value measurement according to the IEC-curve A as compared with the quasi-peak value measurement according to CCIR-468-3, a difference of 10 to 14 dB exists depending on the signal spectrum.

H.A.O. WILMS (see /7/) meanwhile suggested to complete these indications for further discussions by measurements with red, pink and "green" (IEC loudspeaker test signal) noise and different time constants. On this subject, we can report only at a later date.
In addition, H.A.O. Wilms pointed out to remember that the measurement technologies of sound level meters, peak programme level meters (see para 3.2.) and noise voltage meters exhibit certain relationships which would question the solutions hitherto achieved (e. g. with regard to time constants) and require a reconsideration. It should be the concern of the various international bodies (CCIR, IEC, OIRT, EBU, AES) to deal with these suggestions in a coordinated effort. This would also be advantageous for the world-wide use of the CCIR Recommendation 468-3, and not only in broadcasting and television studio technique.

[*] noise

3.2. STANDARDISATION OF LEVELS AND QUALITY PARAMETERS

Results to these questions are contained in the following two Reports:

Report 292-5: Measurement of programme level in sound broadcasting

Considering that hitherto it has not been possible to specify conditions for a unified measurement method, the Report contains information for 7 programme level meters in use (including the so-called VU meter).
The annex to the report describes the terminology as is used in the CMTT for level indications, for better understanding by the representatives of broadcasting and television organizations. Unfortunately, even here mistake and new confusion did arise.

Report 293-5: Audio-frequency parameters for the stereophonic transmission and reproduction of sound

In this report, attempts are made since 1963 to specifiy fundamental "overall values" for the essential quality parameters of the entire transmission chain in order to derive a recommendation therefrom. Up to now, this was not possible. Therefore, an interim working party IWP 10/6 of the CCIR was established, in order to reach the desired and neccesary result in short time by a higher concentration of work.

Comments by the author:

The IWP 10/6 is charged to prepare quality parameters and suitable methods of measurement for them for the international programme exchange in broadcasting and television sound channels. This incorporates i. a. the determination of attainable values or values to be achieved in future for the parameters and the relevant operating and testing levels. The establishment of this special Interim Working Party appeared to be necessary as inspite of the multitude of existing recommendations in the CCIR, CCITT, CMTT, OIRT, EBU and others as the essential bodies of broadcasting and television organizations, more and more problems in the international programme exchange arose on account of omissions, misinterpretation and even errors in the relevant documents. In addition, the transmissions showed increasingly frequently impairements with the listeners the causes of which were assumed to be before the points of exchange to international transmission chains and which hitherto were not sufficiently recognized or have been underestimated.

Especially because of the transition from analogue to digital technique which may be expected in the near future, some fundamental questions of broadcasting transmission need urgently to be clarified. In the digital technique, the question of "overloading" is i. a. much more critical than in the analogue technique.

The 2nd meeting of the IWP 10/6 was held in September 1982 in UK and discussed the replies submitted in response to a special questionnaire, when it became evident that the data in Report 293-5, which contains above all the results of common agreements between the EBU and the OIRT, are no more sufficient to prepare a recommendation.

Some years ago, the OIRT member organisations prepared already, through the Technical Commission, Study Groups I and II, with the specific Recommendation 62/2 /8/, fundamental agreements on the essential quality parameters of the sound channel which in addition to the subjectively perceivable impairments determined by listening groups, contain also the parameter conditions required for technical reasons at reasonable cost (for channels used for programme exchange, as well as for information for the entire channel up to the listener's receiving set). But the questions of correct programme level regulation and level relationships cannot be considered further by the OIRT alone as this should be done in consultation with other international organisations (see /9/).

Special problems arise by the fact that France, Australia and the USA are still using mainly the so-called VU meter ("volume meter") instead of a quasi-peak meter as control instrument for programme level regulation to avoid overloading. The IWP 10/6 considers it essential, as a premise for better quality in programme exchange, to determine in the CCIR uniform measurements and conditions for a programme level meter and to use these likewise at all control points of the sound channel from the origine (studio) and within the PTT.
If desired, a compromise should be attempted regarding the peak programme level meters hitherto used, possibly with shorter integration time than that which was used in the OIRT and the EBU up to now. The VU meter is rejected by the majority as being unadequate.

In order to bring to an and the confusion concerning the differing level indications in the various bodies, IWP 10/6 has prepared new definitions for a "programme level profile" (see figure 5).
This profile may be used to derive and specify all realistic values for the "point of relative level 0" (i. e. the point of exchange between the radio house and the international programme connections), but also all values used for the special transmission equipments.

Alignment Level, AL

The level of a sine wave signal, at a frequency of 1 kHz, which is used to align the international sound-programme connection (the alignment period should be preferably to less than 30 seconds). The "alignment level" is further used as reference for all other levels.

Permitted Maximum Level, PML

A sine wave signal at this level would be 9 dB above the alignment level. Its peak level should not be exceeded by the peaks of sound-programme signals (i. e. if the alignment is 0 dBu (0,775 V), then the instantaneous peak amplitude of the sound-programme signal should not exceed 3,1 V).

Measurement Level, ML

The level 12 dB below the alignment level, at which long-term measurement are made at all frequencies (see CCITT Rec. N. 12 and N. 21).

Overload Margin

Although the peaks of the sound-programme signal should not exceed the "permitted maximum level", an overload margin must be provided so that rare excursions of the sound-programme signal above the permitted maximum level may be tolerated. (Reasons for this may be equipment and line tolerances and the presently used programme level regulating methods).

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The 2nd meeting of the IWP 10/6 was of the unanimous opinion that the "permitted maximum level" cannot correctly be held at the time being. (Measurements made in various countries showed frequent excursions by instantaneous pulses of very brief duration in the sound-programme signal in the order of 5 to 10 dB!). With the elaboration of uniform programme level regulating and measurement methods and limiters (control amplifiers) it is planned that the necessary overload margin should be defined more precisely (about 6 dB of range).
While the definition for the minimum level could not yet be given, this parameter may well be derived from figure 5 as lower limit for the "dynamic of programme signal" (such as the 40 dB which are in general use).
It can be stated that the establishment of the IWP 10/6 and its work was a decisive step towards the solution of some important complex problems arising in the broadcasting transmission.

The 3rd meeting is planned for september 1983 in connection with the next interim meeting of the CCIR Study Group 10. (The tasks and objectives of the IWP 10/6 are specified in the CCIR Resolution 40/1).

3.3. DETERMINATION OF THE SUBJECTIVE LOUDNESS OF A BROADCASTING PROGRAMME (Report 465-3)

This Report informs about the work hitherto carried out by the CCIR, especially on the results achieved by the special working party IWP 10/1, which was active from 1970 to 1978, but was not able to achieve feasible practicable results. It is stated that the determination of subjective loudness of Programmes depends on too many imponderables to derive a unified control and measurement procedure for programme level regulation from the knowledge hitherto achieved.
It was considered more reasonable to recommend first a compression of speech for improving the balance between music and speech sequences and empirical values for the modulation of speech in relation to different musical genres.

Comments by the author:

Just as in several countries, comprehensive studies were also conducted in the GDR relating to this aspect /10/ which lead to similar conclusions as those contained in CCIR Report 465-3. It is of special importance that the complex listening conditions, including the setting (regulation) of the listener's receiving apparatus and of the psychical-physical situation of the listener are taken into account. Automatic programme emissions, the transmission of programme identification signals and corresponding regulation means at the listener's receiving set will probably be necessary, if a fundamental solution of the problem will be achieved.

Thereby an essential partial problem appears to be the loudness control of the programme signals themselves in order to find a basis for level regulation. The most practicable approach hitherto presented was the "loudness indicator" by JONES and TØRICK /10/ 1982.

For many other criteria for programme loudness, weighting measures are missing to obtain the measured loudness value in correct relation to the complete programme level regulation. It will be interesting to see the approach, E. ZWICKER announced in this contribution to be presented at the 73rd AES Convention.

3.4. SUBJECTIVE ASSESSMENT OF SOUND QUALITY

Recommendation 562-1 (and Report 799-1)

To provide a basis to be unified, the Recommendation contains definitions for:

- a five-grade quality scale
  (the formula for a possible conversion to a six-grade scale is given)
- a seven-grade comparison scale.

Annex I gives some further indications for

- the selection of the listening group (expert listeners)
- test procedure and duration
- choice of programme sequences
- listening conditions.

The Report 711-1 give first experience with subjective studies in the field of digital techniques. The results of test to determine the upper cut-off frequency are of special importance, 15 kHz being considered to be sufficient.

Comments by the author:

Subjective studies are of growing importance as may be seen from the survey on the state of art for the AES given by TOOLE /11/. Apart from the CCIR documents cited above, a number of recommendations of the OIRT are used in studio technique which shall be dealt with at this place for information and which give data for the assessment of broadcasting programmes and for the work of international comparisons of listening groups (OIRT-E 63/1; E 91) /12/. For the assessment of studios and concert halls a special OIRT Recommendation (E 68) was prepared for the first time, which also proved valuable for acoustical studies on the determination of the relations between objective and subjective (room) parameters.
Due to the lack of an international unified terminology, the work of subjective-statistical nature is hampered. A monography published by the OIRT is a useful contribution to this subject /13/ which would also be of interest for the work in the CCIR and the AES (see also /14/).

3.5. DETERMINATION OF THE ACOUSTICAL PROPERTIES OF CONTROL ROOMS AND HIGH-QUALITY LISTENING ROOMS IN ROADCASTING (Report 797-1)

Considering in the report that the conflicts between the acoustic and operational requirements have not been optimally resolved, it is therefore not appropriate to specify a "standard control room". On the other hand, it seems to be necessary to come to an agreement for uniform "reference listening rooms", to conduct therein subjective tests as well as assessments of music and speech programmes on the basis of defined conditions. Such standard listening rooms should be a prerequisite to reach uniform opinions on programmes intended for international exchanges.
Therefore, part I of the Report contains data of "control rooms" for information. Unanimsmous opinion exists on the reverberation time to be obtained (0,2 to 0,4 s). The opinions on volume differ from ≥ 30 m^3 (Canada, EBU), ≥ 40 m^3 (UK) up to 120 - 150 m^3 (OIRT for stereophony; for monophony about 90 m^3 seems to be sufficient). Further comments are concerning the shape, diffusion, symmetry of the room.
A recommendation cannot be derived and expected from that data.

Part II of the report-"Listening rooms"-shows the endeavours for standardization. But an important aspect also needs to be taken into account: given two acoustically identical rooms, significant differences in reproduced sound quality will occur if different types of studio louspeaker equipment is used in each room, which have not yet been quantified.
The OIRT member countries have submitted proposals for a necessary CCIR Recommendation on the basis of OIRT Rec. 86/1 (see Table I).
In that standard also the distances of the loudspeakers from the side and backwalls are prescribed (≥ 1 m from the side walls; 0,7 m from the backwall).
Annex I contains valuable advices (mostly contributed by the UK, BBC) to the parameters

- Reverberation time (it should not differ by more than ± 10 % from the design values over the range 160 Hz to 6,3 kHz);
- room proportions (also for small listening groups the volume should not be too small because then the dependence on the number of occupants and the equipment is greater);
- Shape of the room (isolated eigentones which can cause colorations should be avoided; there is no evidence that making the walls of the room non-parallel is more beneficial than other methods);
- Diffusion (arranging the different types of acoustic treatment in relatively small patches, equally intermixed on the wall and ceiling surfaces;
- Early reflections (these can be reduced by spacing the loudspeakers away from the walls and covering the surfaces with acoustic absorbers which are effective at low and middle frequencies; significant reflections at higher frequencies occurring from quite small protruding wall and ceiling parts, desks etc., should be avoided, especially at the height of the head of the listeners).

Furthermore, the report contains information on background noise level, room symmetry, position of the loudspeakers etc.

Comments by the author:

The growing number of publications on subjective testing in the field of AES, but also of other organizations, requires the support of the work in the CCIR, to standardize a "Standard listening room". The IEC is also working on this subject. Because of the conditions of HiFi-equipment it is felt that a volume of 80 m^3 and a reverberation range of 0,3 to 0,6 s is sufficient. But it is well-known that in the field of studio technique this is unfavourable, especially if larger test groups are used.
In many countries it is well-known too that early reflections must be suppressed in the listening zones by sufficiently absorbing surfaces. On the other hand, use of a reflecting backwall, as recommended in the LEDE concept has not yet found enough resonance. Probably it is less suited for universal use of a reference listening room and the listening with several distributed loudspeakers (as for quadrophony).

A reference to a so-called "médium living room" (i. e. with higher reverberation time etc.) has not proved useful. Loudspeaker tests (OIRT, GDR) have shown that the (not yet sufficient) relations between subjective and objective parameters may vary strongly as a function of reverberation time. This might explain the erroneous assessments which appear therewith. HIRATA /16/ et al, consider a time of o,3 ± 0,1 s more useful (like other organizations too).

The requirement of standardization was taken into account in the meantime by the Scandinavian countries. BORENIUS /15/ reported some time ago on proposals. The OIRT members have made good experience with their Rec. 86/1 and look now for improvements.

It can be expected that in the period 1983/84 the CCIR will present definite proposals for a recommendation; a special Study Programme 50D/10 contains the relevant questions.

3.6. DIGITAL TECHNIQUES

In this field, only few documents exist in Study Group 10 up to now, although it has become a priority task. Inspite of the rapid evolution of digital techniques, only few common premisses could be agreed upon in the studio field. It is true that here a good agreement between the members of the OIRT, EBU, IEC, AES and CCIR can be stated so that principal difficulties could be avoided. Considering that the Journal AES is preferably dealing with digital techniques and is also promoting standardization work, bibliographic information shall be omitted here. Only some comments to CCIR documents shall be given.

Report 948: "Digital audio techniques for studios and quality measurements"

A common data-frame used inside studios and the methods of measuring the distortion caused by bit errors are given, together with the results of studies carried out by the EBU.

Report 949: "Sampling frequency for digital sound signals in broadcasting studios"

The Report contains in the annex a proposal for a recommendation which envisages a 48 kHz sampling frequency for use in broadcasting studios, including recording as well as for sound signals in television applications. The aim of this publication is to bring about a coordination within the CCIR as well as with other organizations until the date of the next interim meeting (1983/84).

Report 799/1: "Subjective assessment of quality of sound in broadcasting using digital techniques"

The report was already mentioned in para 3.3. Besides studies on the upper cut-off frequency (15 kHz), results relating to other parameters of the EBU, France and Italy as well as the relations with the studies carried out by the CMTT are pointed out.

Report 953: "Digital coding for the emission of high-quality sound signals in satellite broadcasting"

It is referred to texts of other working groups of the Study Groups 10 and 11. They contain the proposal to use a 32 kHz sampling frequency for satellite broadcasting (analogous to the transmission circuits). This proposal was not accepted by the majority as a basis for a recommendation at the last CCIR meeting.

yet

3.7. SOUND SIGNAL RECORDING (Working group 10-D)

In the following, the most essential results are given in a short synopsis only because practically, IEC Publications have been adopted for most of the problems.

Recommendation 408-4 (on Study question 52/10 and study programme 52 A/10): "Standards of sound recording on magnetic tape for the international exchange of programmes"

Monophonic and stereophonic recordings should be based on the IEC-Publication 94, with some additional requirements for stereophonic recordings, the most important of which follow:

- reference signal (control section) before a programme begins (1000 Hz with -9 dB; on stereophonic tapes at first 5 s in the A-(left) channel, then a pause of about 10 s, then about 5 s in the right channel (see also Report 622-2));
- width of the track $\geq$ 2 mm
- distance between tracks $\geq$ 0,75 mm (for the introduction of the time code on 6,3 mm tape, more precise definitions are possibly to be expected).
- amplitude/frequency response
- level difference
- phase difference
- crosstalk
- weighted signal-to-noise ratio

It is not considered useful to give an extract of the values concerned; at a given time, a complete reproduction in the J.A.E.S. should be considered.

Report 622-2 (on Study question 52/10; Study Programme 52 A/10) "Sound recording on magnetic tape for the international exchange of programmes"
- "Use of special section for checking the technical parameters of stereophonic tapes"

The OIRT proposes in the Report that the control section contained in Rec. 408-4, for the beginning of the programme should be completed by a section relating to frequency response (40 Hz, 10.000 Hz, each 10 s at -10 dB below maximum level) in order to get a rapid control on the quality of the recording to be reproduced.

(The proposal relates to quality differences which persistently appear on tapes intended for programme exchange).

Report 950 (on Study question 52/10 and Study programme 52 B/10)
"Digital recording of audio signals"

The Report contains at present only a contribution by Japan (NHK) relating to an experimental stationary-head magnetic tape recorder. The quality parameters achieved are indicated.

Recommendation 564
"Use of magnetic tape cartridges and cassettes for sound broadcasting"

The cassettes used at present should comply with the IEC definitions.
A future professional cassette for a tape width of 6,3 mm should use a tape speed of 9,5 cm/s and should have a playing time capability of up to 30 minutes.

References

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TABLE I

Frequency (Hz)	Response (dB)	Proposed tolerance (dB)
31·5	− 29·9	±2·0
63	−23·9	±1·4 (1)
100	−19·8	±1·0
200	−13·8	±0·85 (1)
400	− 7·8	±0·7 (1)
800	− 1·9	±0·55 (1)
1 000	0	±0·5
2 000	+ 5·6	±0·5 (1)
3 150	+ 9·0	±0·5 (1)
4 000	+10·5	±0·5 (1)
5 000	+11·7	+0·5
6 300	+ 12·2	0
7 100	+12·0	+0·2 (1)
8 000	+11·4	+0·4 (1)
9 000	+10·1	±0·6 (1)
10 000	+ 8·1	+0·8 (1)
12 500	0	±1·2 (1)
14 000	− 5·3	±1·4 (1)
16 000	−11·7	±1·65 (1)
20 000	−22·2	±2·0
31 500	−42·7	+2·8 (1) / −∞

(1) 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 20 000 Hz.

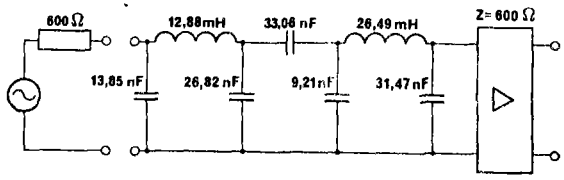


FIGURE 1a - Weighting network, simple form

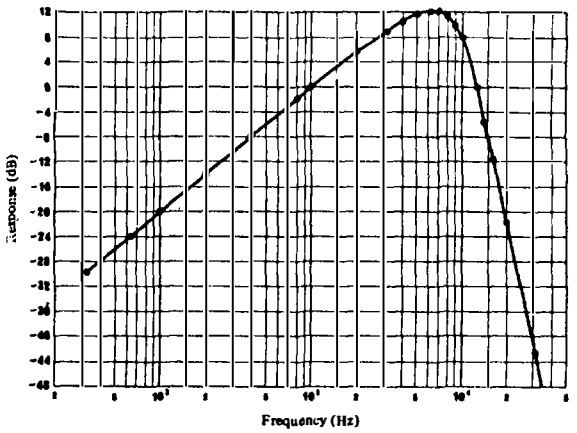


FIGURE 1b – *Frequency response of the weighting network shown in Fig. 1a*

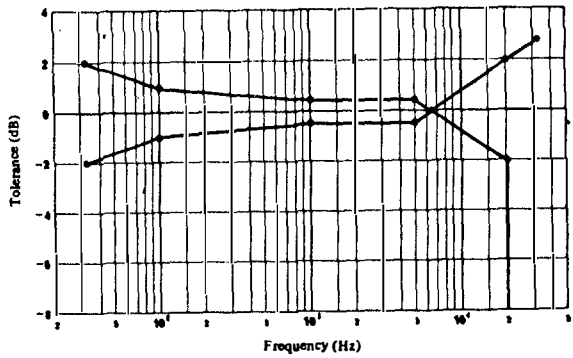


FIGURE 2 - Maximum tolerances for the frequency response of the weighting network and the amplifier

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

TABLE II

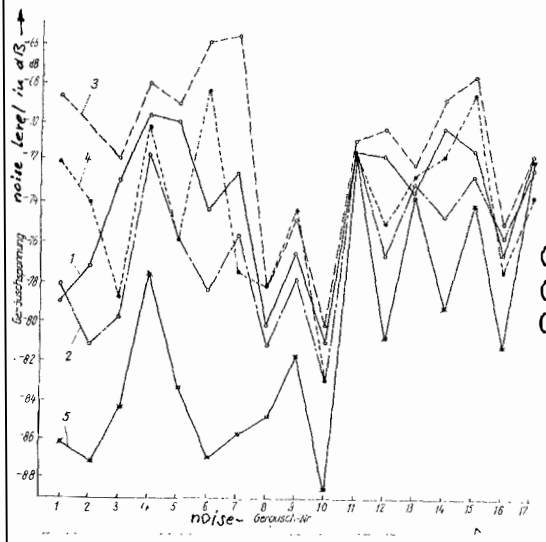
Burst duration (ms)		1[1]	2	5	10	20	50	100	200
Amplitude reference steady signal reading	(%)	17.0	26.6	40	48	52	59	68	80
	(dB)	-15.4	-11.5	-8.0	-6.4	-5.7	-4.6	-3.3	-1.9
Limiting values									
- lower limit	(%)	13.5	22.4	34	41	44	50	58	68
	(dB)	-17.4	-13.0	-9.3	-7.7	-7.1	-6.0	-4.7	-3.3
- upper limit	(%)	21.4	31.6	46	55	60	68	78	92
	(dB)	-13.4	-10.0	-6.6	-5.2	-4.4	-3.3	-2.2	-0.7

(1) The Administration of the U.S.S.R. intends to use burst durations > 5 ms.

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

TABLE III

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



(1) weighting network
(2) integration time
(3) difference between max. and minimum value

(1)	(2)	(3)
1. CCIR	t_{IT} 23ms	11,4 dB
2. DIN	t_{IT} 23ms	13,27 dB
3. CCIR	t_{DIN}	14,4 dB
4. DIN	t_{DIN}	14,55 dB
5. IEC (A)	t_{IT} 23ms	18,6 dB

Figure 3: Perceptibility thresholds for 17 different noise types, determined subjectively, in an OIRT-reference listening room, and measured objectively by different weighting curves (1) and integration times (2)

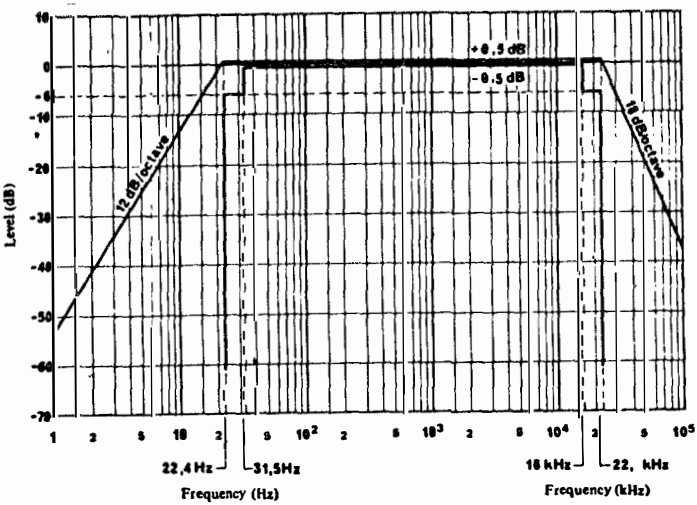


FIGURE 4

Fig. 4 UNWEIGHTED MEASUREMENT

The frequency response shall be within the limits

TABLE IV- Main parameters of listening rooms for high-quality monophonic and stereophonic listening
(See / CCIR, 1974-78b and c /)

Parameters	Values
1. Volume (V)	120 ± 30 m³ (1)
2 Optimum side ratio (central part of the Bolt range, other recommended ratios, see [CCIR, 1974-78c])	1.9 1 4 : 1 0
3 Reverberation time (T) (tolerance ± 0.05 s in frequency range 125 to 6300 Hz about the chosen nominal value)	0.25 s ... 0.40 s
4. Optimum base angle	70°
5. Width of base (b)	3.0 to 4.5 m
6 Listening distance (h)	1 5 to 6.7 m preferable 3 ± 0.5 m
Optimum, i e. reference listening point	$h \approx 0.7\ b$

(1) 90 m³ is allowed for monophonic use only

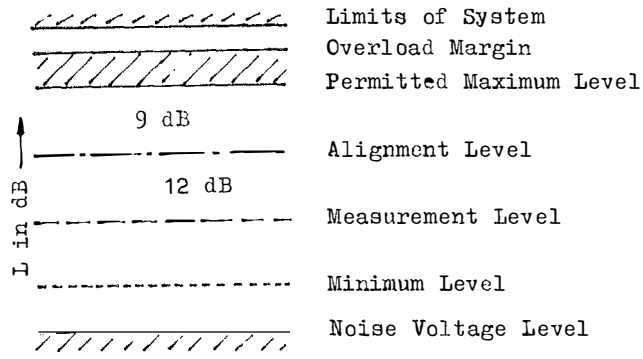


Figure 5: Level profile
(Proposal by IWP 10/6 - CCIR)