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REPORT ON THE C.C.I.R MEETING—OSLO

INTRODUCTION

THE C.C.I.R IS AN ORGAN of the International Telecommunications Union (ITU), the United Nations specialized agency for telecommunications. To quote the official text: "The duties of the C.C.I.R shall be to study technical and operating questions relating specifically to radiocommunications and to issue recommendations on them." The C.C.I.R thus establishes agreed technical foundations for international co-operation. The C.C.I.R collaborates with other international organizations, such as the International Broadcasting Union (UIR) and the International Scientific Radio Union (URSI). On broadcasting matters the C.C.I.R receives valuable contributions from the European Broadcasting Union (EBU) and the International Radio and Television Organization (OIRT).

The work of the C.C.I.R is divided amongst fourteen Study Groups and one joint C.C.I.R/C.C.I.T.T Study Group C.M.T.T. The C.C.I.T.T is a sister organization, the International Telegraph and Telephone Consultative Committee. Broadcasting and associated matters are dealt with by Study Groups X, XI and XII and the C.M.T.T.

As a guide to C.C.I.R documentation, problems to be studied are defined by Questions, and the details of investigations that need to be carried out are contained in Study Programmes, usually related to particular Questions. As studies proceed, Reports are prepared on the interim results obtained and finally, when work is complete, a Recommendation is issued.

The national working groups of Member Administrations look into the problems in hand and submit contributions to the Director of the C.C.I.R. After approval by the appropriate international Study Group chairman they are distributed as Documents to other members for consideration. These contributions, together with those from international organizations such as the EBU, form the basis for discussions at Study Group Meetings. The content of new or revised Questions, Study Programmes, Reports and Recommendations having been agreed in draft, texts are prepared for submission to the Plenary Assembly for formal approval. All currently valid C.C.I.R documents are published by the I.T.U in a series of volumes following each Plenary Assembly.

Meetings of the Study Groups are held at the beginning of each Plenary Assembly, usually every three years. Most Study Groups in addition hold an Interim Meeting between the Plenary Assemblies, and where pressure of work or urgency demands, further special meetings of a Study Group may be held.

COLOUR TELEVISION

Choice of System

The most important and pressing problem facing Study Group XI has been that of achieving a common colour television standard at least for Europe and preferably for the world. Since the last Plenary Assembly at Geneva in 1963 the Administrations, broadcasting organizations and manufacturers of many countries, together with the EBU and OIRT, have collaborated in extremely comprehensive laboratory investigations and field trials of the three proposed colour systems, NTSC, SECAM III and PAL. The current results were considered at a special Colour Television Meeting in London in 1964, and again at the Interim Meeting in Vienna in 1965, without agreement being reached as to which system should be recommended. With some twelve countries in Europe planning to start colour television broadcasting in 1967 and some ten more by 1969, it was clear that the Meeting at

Oslo would present the last opportunity of reaching agreement.

At Oslo, a questionnaire, completed at the request of the Chairman at an early meeting of Study Group XI, showed that countries remained divided on their choice of colour system. To facilitate discussion a small subgroup was formed of delegates from ten countries to consider what basis of agreement or compromise might be reached. It was concluded that a single world standard was not attainable since the 525-line NTSC standard already in use was not generally acceptable elsewhere. Attempts were then made to find agreement at least amongst countries employing the 625-line standards. Unanimous agreement could not be reached on the PAL system, put forward at this time as an international system, for although invented in the Federal Republic of Germany it contained elements of both the NTSC and SECAM III systems, and had been improved in the course of work done in a number of countries. A proposal was next made for the adoption of the new and relatively untried SECAM IV system. It was proposed, briefly, that countries planning for colour in 1967 should delay the start of their colour service whilst this system was jointly perfected. This and other conditions attached to the proposal made it unacceptable to some delegations and it was withdrawn.

Thus, despite the untiring efforts of the Chairman of Study Group XI, the outcome was that a Report would be issued, giving the parameters of the colour systems which would be used, rather than the hoped-for Recommendation for a common standard.

Relative Performance of NTSC, SECAM III and PAL

The results of the investigations into the three systems are contained in a detailed Report, much of which is based on the work of the EBU. The Report shows, to summarize very briefly, that all three systems are capable of producing satisfactory colour pictures under good conditions of transmission and reception. They are, however, differently affected by various distortions in the overall transmission path. NTSC is affected by variations of phase with amplitude (differential phase distortion), whilst both NTSC and PAL are more affected by amplitude non-linearity (differential gain distortion) than is SECAM III. When certain combinations of distortion are present together, SECAM may be more affected than NTSC or PAL. PAL is relatively immune to assymetric sideband distortion of the subcarrier, as may occur with attenuation of the higher frequencies of the vision signal.

As to compatibility with monochrome receivers, when a NTSC or PAL colour transmission is viewed on a monochrome receiver, the colour subcarrier signal is seen as a regular pattern in coloured areas of the scene. In the case of SECAM irregular patterns are visible over the whole picture, and this effect is less acceptable to some observers.

Video-tape recording of NTSC signals requires a full complement of auxiliary colour equipment, whereas SECAM signals can be satisfactorily recorded on good-quality black-and-white video-tape recorders. Recordings of PAL signals on recorders equipped for NTSC give better pictures than are obtained with NTSC signals.

As far as scope for future development is concerned, the NTSC system seems more adaptable to the single-gun display tube, with PAL a little less, and SECAM III still less, adaptable. NTSC preserves vertical resolution in colour to a greater extent than does SECAM III, with the PAL system intermediate.

An Annex to the Report gives data on the cost of SECAM III and PAL colour receivers relative to the cost of an NTSC receiver. Differing estimates from five countries are quoted, the figure for a SECAM III receiver ranging from 0·35% less to 5% more, and for a PAL receiver from 3·5% more to 5·7% more than the cost of an NTSC receiver.

TELEVISION STANDARDS

Characteristics of Monochrome Television Systems

A revision of Report 308, which lists the characteristics of the world's television systems, was adopted. The revisions include changes in tolerances of pedestal level for the 625-line Systems B, G, H, I and L, and changes in pulse timings for the 525-line System M and 625-line Systems D and K. At the request of some countries interested in increasing the vision-to-sound power ratio, the entry for this parameter was amended to show the range 5 : 1 to 10 : 1 for Systems M, B and G.

A new system, K1, is included, arising from the African VHF/UHF Broadcasting Conference, 1963, and a list of African countries is added to the Annex of the Report. System K1 differs from System K in having an increased r.f bandwidth of 8·5 MHz and a vestigial sideband increased to 1·25 MHz. New designations, 'first field' and 'second field', are adopted in the Report to replace the terms 'even field' and 'odd field'.

International Exchange of Programmes

A particular task of Study Groups X and XI is to find

means of facilitating the exchange of television programmes between countries having different television transmission standards. In the case of the various 625-line systems the differences are comparatively small, and it would be feasible for these systems to be brought into line with a unified standard. Agreement on the 625-line parameters to be used for programme exchange has been sought as a first step.

625-line Monochrome Standard for Programme Exchange

A new Report, replacing the existing Report 310, contains parameters of a monochrome television standard which Administrations using 625-line standards have agreed to adopt for the international exchange of programmes. Features of the new parameters include a tighter tolerance of line frequency, $\pm 0{\cdot}05\%$, some minor changes in pulse rise-times and tolerances, and a clear presentation of tolerances generally.

Standards Conversion

For the direct exchange of programmes between countries having television standards with differing line or field frequencies standards conversion is required. A new Report includes further information on standard converters of the 'line-store' type, developed by the BBC and now in service. These are used to convert, in both directions, between the 405- and 625-line 50-field systems. Line-store converters are capable of converting television signals from one line standard to another where the field frequencies can be synchronized. They contain no moving parts, valves or cathode-ray devices, and a much better picture quality and a higher order of reliability and stability is achieved than in conventional converters.

Further work in the U.K and in Japan is directed to the development of converters capable of conversion of signals having different line and field frequencies by an extension of the storage and interpolation principles employed in the line-store converter. Such converters would permit direct conversion between the 525-line 60-field and 625-line, 50-field systems.

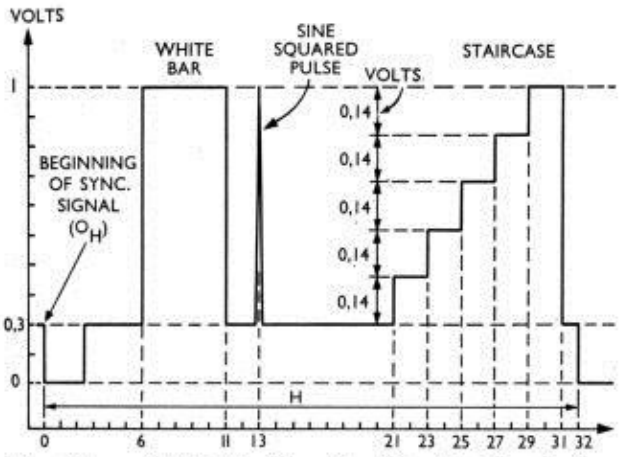

Fig. 1. The new field-blanking interval Test Signal for international transmission.

Stereoscopic Television

Two contributions from the U.S.S.R on encoding and decoding techniques for stereoscopic television, permitting a reduction in the amount of information to be transmitted, are added to the references in a revised Report related to Study Programme 118(C): 'Constitution of a System of Stereoscopic Television'.

TRANSMISSION AND INTERFERENCE

Attenuation of Unwanted Sideband

Doubts that the vestigial sideband attenuation characteristics contained in Recommendation 212 were satisfactory resulted in a Report, a Question and two associated Study Programmes on this subject being adopted. The Report deals firstly with low-power transmitters and points out that given a sufficiently low radiated power and a great enough geographical separation, a double-sideband transmission would not cause interference greater than that permitted by C.C.I.R Recommendations if the effective radiated power were 20 dB below the permitted maximum given in Recommendations 417 and 418. On this point the Report concludes that a modification to Recommendation 212 would seem to be indicated.

The Report then refers to the possibility of relaxing the vestigial sideband attenuation characteristic in Bands IV and V. If the worst case of interference, from an upper channel to the adjacent lower channel television transmission, occurred when the wanted and unwanted field strengths were equal, then, taking account of receiver antenna directivity, the wanted signal would exceed the unwanted signal by 16 dB. Under these conditions the vestigial sideband attenuation can be less than that given by Recommendation 212. The Report proposes that for the 625-line standards G, H, I, K and L used in Bands IV and V, the unwanted sideband should be attenuated so that the radiated field is reduced by at least 20 dB at 3 MHz and 30 dB at 4·4 MHz below the vision-carrier frequency. More severe attenuation might be necessary where interference to other services might occur.

One new Study Programme is aimed at finding an attenuation characteristic that satisfies frequency planning requirements for Bands IV and V, for both colour and monochrome, and at the same time permits an

economical transmitter design. A second Study Programme has a similar objective but in relation to lower-power transmitters, and is not confined to Bands IV and V.

Distortion due to Vestigial Sideband Transmission

A Report was adopted giving details of theoretical and experimental investigations of the linear (group delay) and non-linear (quadrature) distortions caused by vestigial sideband transmission of television signals. Whilst the theoretical results are somewhat at variance, experimental evidence from the OIRT was that broadening of the vestigial sideband from the 0·75 MHz of Recommendation 212 to 1·0 MHz in general brings an improvement in picture quality, assessed subjectively. The Report also gives results of tests in the Federal Republic of Germany of distortion precorrection. These show that the improvement obtained by group-delay correction is slightly greater than the further improvement obtained by the addition of quadrature correction. Reference is also made to tests in France on the precorrection of group delay errors in receivers. Whilst some improvement was noted, it was felt that additional non-linear precorrection was desirable.

Antennae

A new Question and associated Study Programme were adopted dealing with the problem of ghost images which can be caused by the location of television transmitting antennae in the vicinity of other antenna structures. The object of the Study Programme is to determine what ratio of direct to delayed (reflected) signal is necessary for satisfactory service, taking into account the polarity and displacement of the ghost image. A further new Question is directed to the establishing of recommended characteristics for television receiving antennae. It is felt that the receiving antenna is an important element in the transmission chain that has not been sufficiently studied.

Protection Ratio

The existing Recommendation 418 includes a curve showing the protection required for 625-line systems against c.w or sound signal interference up to 5·0 MHz above the vision-carrier frequency. Recent work in the U.K has shown, however, that for System I, protection of up to 43 dB is required in the region of the sound carrier at 6 MHz. An extension of the existing curve to show this requirement was agreed.

Minimum Field Strength to be protected

Investigations in the rural districts of Australia have shown that it is possible to plan for lower median field strengths in a sparsely populated region where better recivers and aerials are likely to be used than envisaged in Recommendation 417. The figures adopted in Australia are +46 dB for Band I and +49 dB for Band III relative to 1 μV/m, at a height of 10 m above ground level. It is found that when the field strength falls below +40 dB the public lose interest in installing receivers. It was agreed to embody the Australian figures in a Report as being of interest to other Administrations concerned with similar areas.

OTHER TELEVISION TOPICS

Signals in the Field Blanking Interval

Study Programme 177, which is concerned with the insertion of special signals in the field blanking interval of a television signal, was amended to cover more specifically the positions to be occupied in the field blanking of signals for measuring the characteristics of television networks and of signals associated with control functions and the transmission of operational information. The question of the best encoding system for these latter signals has been added to the items for study. An existing Report was revised in the light of the latest contributions. One proposal referred to is that a line, or part of a line, in each field should be reserved for the measurement or monitoring of signal-to-noise ratio. Work in this field is dealt with jointly by Study Group XI and the C.M.T.T.

An important change was agreed in the test signal specified in Recommendation 420 for the supervision of signal level in international transmissions. The single 10 μS bar has been replaced by a composite signal consisting of a bar, a sine-squared pulse of 180 nS half-amplitude duration and a five-riser staircase signal (Fig. 1). Proposals were also made for the insertion in the field-blanking interval of a colour television test signal and of a 'multiburst' signal for frequency response measurements. It was decided, however, to carry forward these proposals to the period 1966–69.

Assessment of the Quality of Television Pictures

A revised Report gives further references on standardized methods of assessment of picture quality that are, as far as possible, objective. Another Report, on subjective assessment, gives an outline of the main features of some existing methods of assessing impaired pictures under laboratory conditions.

Reduction of Channel Capacity required

Study Programme 119 was established with a view to

finding methods of reducing the channel capacity required for a television signal without reducing perceptibly the quality of the picture. This is not, however, an area in which rapid progress could be expected. A new Report, replacing that adopted at Geneva 1963, lists two new contributions, from the U.S.S.R and Australia, and two further references to the literature.

Direct Broadcasting from Space Satellites

The rapid advances in satellite technology, and in particular the successful use of satellites to relay television programmes, has led to an increasing interest in the possibility of direct sound and television broadcasting to the public by satellite-borne transmitters. The many new technical problems that arise are being studied by Study Groups IV, X and XI.

A major problem is that of achieving the necessary transmitter power as shown in a Report by Study Group IV. For maximum coverage, about one-third of the earth's surface, the vision transmitter power is estimated at 427 kW, with a transmitting antenna gain of 19·3 dB in addition, for a frequency of 650 MHz. To cover an area about the size of Europe would require a transmitter power of 69 kW with an antenna gain of 30 dB. Other aspects under study by this group are the most satisfactory orbits, achievable positioning accuracy, available primary power and the probable working life of a satellite.

The questions of optimum transmission characteristics and the choice of frequency bands, especially in relation to the sharing of bands with terrestrial services, are to be jointly studied by Study Groups X and XI. A new Study Programme allocated to Study Group XI sets out to establish the new single television standard that might be desirable if frequency bands, not at present used for broadcasting, could be exploited for satellite broadcasting. One question that arises is whether or not colour information should be transmitted within the vision band. A second Study Programme is concerned with the changes to receivers that might be necessary to receive satellite broadcasts, assuming that a unified 625-line standard is used on existing frequency bands. Both Study Programmes refer to the provision of a number of sound channels to accompany each vision channel, as would be required to provide for the language differences within the wide coverage area of satellite transmitters.

FILM AND VIDEO RECORDING

Film Standards for Programme Exchange

The list of film types for programme exchange given in Recommendation 264 has been increased to include 16 MUTE and 35 MUTE as primary standards and 16 SEPDUMAG and 35 COMMAG as secondary standards. The use of secondary standards requires the agreement of the organizations concerned. Recommendation 265, which contains film definitions and standards, has been revised to cover the additional film types. It also now includes amongst other revisions, optimum film (diffuse) densities. The density range for areas to be faithfully reproduced is 1·6, whilst the density corresponding to television white level should be 0·25 to 0·35 above film-base density. The total density for white level in the case of dyed-base film should not exceed 0·5. Excluding special effects the density corresponding to human faces should be between 0·2 and 0·5 higher than the density corresponding to white level. Associated work on optimum telecine transfer characteristics is not yet complete.

Video Tape-recording Standards

Report 295 was revised to include information on the latest practices, with data on the high-band frequencies used by various organizations. The objective of the work by Study Group X is to reach agreement on a 525-line, 60-field and on a 625-line, 50-field recording standard, suitable for both monochrome and colour, and on standard replay characteristics for video and sound.

SOUND RECORDING

Optical Sound Standards

According to a new Study Group X Question, satisfactory sound reproduction is not always obtained from films intended for television programme exchange having optical sound tracks. Also, signals from optical sound have noticeably different characteristics to those from other sources. Compression is invariably used to obtain a satisfactory signal-to-noise ratio. Subjects for investigation thus include recording and reproducing characteristics, preferred types of optical track, optimum compression characteristics, and whether volume expansion in reproduction could reduce the difference in sound quality from optical tracks and other sources.

Standards for Sound Recording on Tape

In a revision of Recommendation 261, covering single-track tapes, a number of items such as hub and spool dimensions, recording characteristics and measurement of magnetization have been removed and reference made instead to the relevant international I.E.C Standards (I.E.C Publication 94). An important further change is that the reproducing time constant for the $7\frac{1}{2}$ in./s speed is reduced to 70 μS.

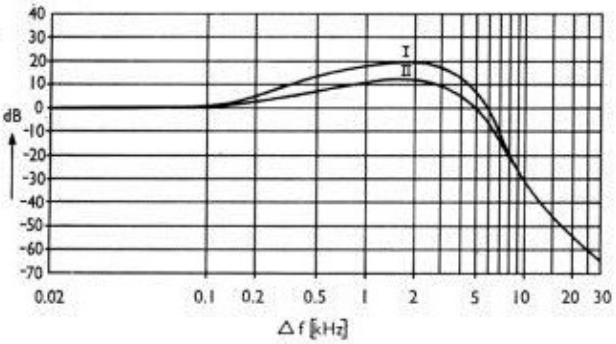

Fig. 2. Relative r.f protection required in a.m broadcasting as a function of frequency separation between wanted and unwanted signals.
Curve I: limited degree of modulation compression.
Curve II: high degree of modulation compression.

SOUND BROADCASTING

R.F Protection Ratio in L.F and M.F Broadcasting

After a long period of study a Recommendation was approved on r.f protection ratio in l.f/m.f broadcasting. This should be 40 dB for co-channel transmissions (± 50 Hz) when the wanted and unwanted signals are stable, as under ground-wave conditions. With the unwanted signal fluctuating, as under sky-wave conditions, the protection ratio should be 40 dB at midnight for at least 50% of the nights of the year. The minimum field strength to which this ratio applies varies with region and frequency and is of the order of 1 mV/m in Europe. An associated Recommendation gives a pair of curves (Fig. 2) showing the protection ratio required relative to the 40 dB co-channel figure as a function of the carrier-frequency spacing of the wanted and unwanted signals. Definitions of a.f and r.f protection ratios in a.m sound broadcasting are contained in one further Recommendation, and the method of presenting results of protection ratio measurements in another.

L.F and M.F Transmitting Antennae

A contribution from the U.S.A on an anti-fading antenna and one from the U.K on the effect of ground conductivity on vertical radiation patterns are summarized in a Study Group X Report. The antenna consists of a sectionalized tower, and the 'fading-zone' relative to the ground-wave service area is reduced from approximately 500% to about 30%. The U.K contribution shows in a series of curves that at low vertical angles the radiation decreases rapidly as ground conductivity worsens. Further curves of receiver input voltage as a function of distance show a considerable increase in signal strength when medium-conductivity soil is replaced by sea water.

According to an Australian contribution a substantial reduction in sky-wave field strength can be produced by transmitting an elliptically-polarized wave (orthogonal transmission) without altering the horizontal radiation pattern, and a new Question is directed to an investigation of this technique.

Polarization of Radiation in F.M Broadcasting

Tests carried out in the U.S.A show that there are advantages in radiating a vertically polarized signal in addition to the usual horizontally polarized one. This would provide a better signal for receivers employing vertical antennae, such as in automobiles, and, furthermore, the tests show that the horizontally polarized component of the field is substantially improved in the presence of shadowing or diffraction effects in areas of very low signal strength. This is the subject of a new Question.

STEREOPHONIC BROADCASTING

Recommended Systems

In recent years tests on six stereo systems have been conducted in the U.S.A and the EBU has co-ordinated tests on ten systems in Europe. Tests have also been carried out by the OIRT. Study Group X has been studying the results of these tests and other contributions and conclude that the pilot-tone system (at one time called the Zenith-GE system) and the polar-modulation system are equally satisfactory. Both systems therefore appear in a new Recommendation. The pilot-tone system was developed in the U.S.A and is in use there and in a number of other countries. The polar-modulation system was developed and is in use in the U.S.S.R and is the preferred system in Eastern European countries.

A third system, the f.m/f.m compressor/expander system developed in Sweden, is referred to in a footnote to the Recommendation as being considered suitable for countries which find it essential to use a stereo system also capable of transmitting two separate monophonic programmes. A Report gives performance data based on results of the tests referred to, on the pilot-tone, polar-modulation and f.m/f.m compressor/expander systems, and the specification also for the latter. A Question on techniques for checking the essential modulation characteristics of stereo systems has so far only produced limited results, contained in a further Report.

INTERNATIONAL TELEVISION LINKS

Long-distance Television Connections

The C.M.T.T has revised Recommendation 421 which

specifies performance requirements for long-distance international cable and radio links for the various national standards. Some requirements for colour television in Japan have been added, and references to the 405-line System A used in the U.K have been removed, as links designed for the 625-line System I, which will in time replace it, will be satisfactory for System A. The requirements for System I are contained in a separate Recommendation because these have been established since the previous revision and are based on newer techniques, such as the use of sine-squared pulse and bar measurements for both monochrome and colour. A new C.M.T.T Study Programme aims at establishing a single set of performance standards and testing techniques for international circuits which would be satisfactory for the majority of television standards.

Automatic Monitoring of Television Chains

A C.M.T.T Report reviews the current position in relation to automatic monitoring techniques based on contributions from a number of countries. This Report covers sampling methods whereby a low-frequency analogue of a test signal can be sent to a supervision point by use of telephone lines, and associated display or documentary recording techniques. It also deals with the detection of departures from tolerance of particular parameters, and the transmission of discrete values obtained from automatic measurement of test signals.

Time Difference between Sound and Vision Signals

Although in the early days of long-distance television transmission the fact that vision and sound were carried on different routes presented problems of synchronism, these problems have now been largely overcome. However, satellite communications have revived interest in this subject, and a C.M.T.T Report has been prepared which contains some new data. According to tests carried out in the U.S.A. and Canada a 'just noticeable impairment' is produced for 50% of observers when the sound is delayed 140 ms relative to vision, and when the vision is delayed 70 ms relative to the sound.