

SECTION 11B: ANCILLARY TELEVISION SERVICES

REPORT 802-3 *

ADDITIONAL SERVICES USING BROADCASTING CHANNELS

(Question 29/11, Study Programmes 29A/11, 29C/11 and 29H/11)

(1978-1982-1986-1990)

1. Introduction

Many countries are now broadcasting information and other services in a television channel, in addition to normal television services. Most of these use digital data broadcasting, and probably the most widely-known at the present time are the teletext systems described in Annex I to Recommendation 653. Systems which use analogue techniques, or a combination of digital and analogue techniques, are also within the scope of this report.

A classification of additional services is given in Table I, which, for completeness, also includes services using sound-broadcasting channels.

The sections of this report are as follows:

- section 2 deals with multiplexing and organizational methods for data broadcasting;
- section 3 deals with the services which use data broadcasting systems;
- section 4 deals with systems to provide conditional access to services;
- section 5 is concerned with still-picture television broadcasting (SPTV).

2. Digital data broadcasting systems2.1 Multiplexing methods within the television channel

Recent work on defining methods for broadcasting television, sound and data signals in one satellite channel, has led to the description of new multiplexing systems and the adaptation of one of these to terrestrial broadcasting has been reported [CCIR, 1986-90a]. For ease of reference, and association with other CCIR reports, the various methods are referred to under the application for which they were first developed.

* This Report should be brought to the attention of the CCITT.

2.1.1 Methods for terrestrial broadcasting

a) Time division multiplexing (TDM)

At present, most systems use this method, inserting the data signals into television lines in the field blanking time, (data lines), or into the line blanking time of the video signal. The teletext systems described in Annex I to Recommendation 653 use data lines which, in the absence of television picture signals, may extend throughout the active field time as well as the field blanking time; though the television line and field synchronizing signals are preserved.

Some possibilities for incorporating the sound information in the video signal in terrestrial broadcasting are given in Report 958. An estimated capacity corresponding to four high-quality sound channels could be obtained in 625-line systems. Such a technique may provide an opportunity for broadcasting data.

The influence of the data signal on television protection ratios is under study and some results are available in Recommendation 653 for 625-line B or G/PAL television. Some recent results concerning the protection of a data broadcasting service for television system L are quoted in [CCIR 1982-86a].

b) Frequency division multiplexing (FDM)

Several European administrations have selected the NICAM 728 system [CCIR, 1986-90b, and c; BBC/IBA, 1987] which is recommended for television systems B, G, H and I in Recommendation 707 for use when multi-channel sound transmission for terrestrial television services is introduced. This system uses an extra digitally modulated carrier to provide two high-quality digital sound channels and a small amount of additional data capacity. The two sound channels may be used to transmit a single stereophonic signal or two independent monophonic signals. Alternatively, one or both sound channels may be used for transparent transmission of data (see Report 795).

2.1.2 Methods of multiplexing for satellite broadcasting

Information on this topic is available from other CCIR Reports as follows:

- Report 632: "Broadcasting-satellite service (sound and television) - *Technically suitable methods of modulation*"

Although the main topic of this Report is *modulation* methods, some information is given on multiplexing.

- Report 954: "Multiplexing methods for the emission of several digital audio signals and also data signals in broadcasting"

This describes two multiplexing methods known as "system A" or "continuous" which is an FDM system and "system B" or "interrupted" which is a TDM system.

- Report 1073: "Television standards for the broadcasting-satellite service"

This describes several well-developed systems providing for data broadcasting and known as C-MAC/packet, D2-MAC/packet, B-MAC and digital sub-carrier/NTSC.

These systems provide for sharing of the entire WARC-BS-77 channel capacity among the different services. Means for assisting users to access the different services possible within one WARC channel, and the different WARC channels, are provided. Further information on this aspect is given in § 3.2.2 below.

TABLE I – A classification of identified additional services which may be provided by data broadcasting systems

Additional services ⁽¹⁾	Television broadcasting channel multiplex		⁽²⁾ Sound broadcasting channel multiplex
	Time division multiplex (TDM)	Frequency division multiplex (FDM)	AM or FM channel
1. Teletext	Reports 802 (§ 3.1), 956; Recommendations 653, 655		
2. Sub-titling	Reports 802 (§ 3.2.1), 1080; Recommendation 653		
3. Service and programme identification	Reports 802 (§ 3.2.2), 1073; Recommendation 653		Report 463 ⁽³⁾ ⁽⁴⁾
4. Programme delivery control	Reports 802 (§ 3.2.3), 1073; Recommendation 653; Report 1226		Report 463 ⁽⁴⁾
5. Speech-quality sound	Report 802 (§ 3.2.4.1); Report 958; Report 954, Report 632; Report 1073	Report 795 ⁽²⁾ ⁽³⁾ ; Report 954; Report 632 ⁽³⁾	Report 632 ⁽³⁾
6. Synthesized sound	Report 802 (§ 3.2.4.2); Recommendation 653		
7. Broadcast audiography	Report 802 (§ 3.2.5)		Report 463 ⁽³⁾ ⁽⁴⁾
8. Data for processing (includes "telesoftware")	Report 802 (§ 3.2.6)		Report 1061
9. Broadcasting of time and date in coded form	Reports 802 (§ 3.2.6.1), 1073 and 1078; Recommendation 653		
10. Independent data services	Reports 802 (§ 3.2.7) and 1073; Recommendation 653	Report 1073	Report 463 ⁽⁴⁾
11. Broadcast facsimile	Report 802 (§ 3.2.8)	Report 795 ⁽²⁾ ⁽³⁾	Report 463 ⁽⁴⁾
12. Still picture television	Report 802 (§ 4) ⁽³⁾		Report 463 ⁽³⁾ ⁽⁴⁾

Note. – The modulation is assumed to be digital, unless otherwise stated.

⁽¹⁾ Conditional-access techniques may be used with television and sound and any of the additional services 1-12 (see § 3.3 of this Report, Reports 1073, 1079 and Recommendation 653).

⁽²⁾ The systems for these services are being studied by Study Group 10.

⁽³⁾ Service may partly be provided using analogue modulation.

⁽⁴⁾ Report 463 while not referring to "teletext" does deal with the transmission of supplementary information including text using FM sound broadcasting.

a) *Time division multiplexing (TDM)*

Report 1073 describes several TDM systems:

C-MAC/packet : A radio-frequency multiplexing system: available bit rate approximately 3 Mbit/s.

D-MAC/packet: A baseband multiplex using duobinary coding: available bit rate approximately 3 Mbit/s.

D2-MAC/packet: A baseband multiplex using duobinary coding: available bit rate approximately 1.5 Mbit/s.

B-MAC : A baseband multiplex system using quaternary coding with an available bit rate of approximately 1.6 Mbit/s.

Baseband representation of member of the MAC/packet family (D, D2, HD) may be distributed over digital links. Where these links make use of data compression techniques it is important that channel coding schemes are transparent to all TDM structures including field interval and full field data. One proposal [CCIR, 1986-90c] has been made for channel coding in the 140 Mbit/s hierarchical level.

While it is expected that satellite data broadcasting services will progressively make use of a digital sound/data multiplex, during a transitional period, present data standards may be adapted to the transmission in the field blanking interval of any television signal. This may be desirable for the provision of certain multilingual subtitling services at the outset but rapid adoption of teletext transmitted in the sound/data multiplex as proposed [CCIR, 1986-90a] will facilitate the compatible introduction of HD-MAC.

In Germany (Federal Republic of) data broadcasting transmission tests were carried out with a 20.48 Mbit/s system originally intended for sound-only broadcasting via satellite channels in the 12 GHz band. With this system (see Report 215-6, Annex II) 16 stereophonic or 32 monophonic high-quality sound channels may be conveyed. One or more of these channels can be used for data broadcasting purposes. Each monophonic channel offers one 352 kbit/s highly protected capacity (for C/N = 12 dB the BER is $8.1 \cdot 10^{-3}$) together with 96 kbit/s of unprotected data capacity. Under typical receiving conditions the BER is negligible [Assmus, U., 1989].

b) *Frequency division multiplexing (FDM)*

Report 1073 describes a system known as digital sub-carrier/NTSC which uses a digitally-modulated sub-carrier giving an available bit rate of approximately 2.0 Mbit/s.

2.2 *Organization of the multiplex*

The organization of the data multiplex is defined by a certain number of characteristics and parameters concerning the available resource and sharing mode:

- available resource;
- method of multiplexing data from different sources;
- identification of a data channel;
- number of available data channels;
- specification of a data channel.

General descriptions of the data broadcasting systems that have been used primarily for the teletext service are given in Annex I to Recommendation 653. The use of a packet transmission technique for broadcasting data is described on the basis of the lowest four layers of the ISO reference model for open system interconnection.

Similarly, the sound/data multiplex of the MAC/packet direct satellite broadcasting systems described in Report 1073 uses a packet multiplexing structure to allocate the available digital resource to the various sound and data sources.

2.3 Digital interfaces and protocols for transmission and reception

In general, it is necessary to provide interfaces to permit the transmission of digital data from a number of different sources. Since broadcasting is a unidirectional transmission medium, it is not possible to adapt the characteristics of the transmission to comply with the requirements of the receiving equipment in each case. It is therefore necessary to adapt the transmission speed of each source to the available bit rate, taking into account the relative priority of each source. For example, sound may have the highest priority, and sub-titles a higher priority than teletext. Such an interface has been defined in [Blineau *et al.*, 1980], the regulation of the bit rate being achieved by the use of a "hand-shaking" procedure at the sending end.

Furthermore, the interface, and compatibility, with other data networks must often be considered. For example, the interfacing of an SPTV system with several telephone data channels is described in [CCIR, 1982-86 a].

It has been shown that by defining the General Purpose Data (GPD) type of MAC/packet component [CCIR, 1986-90e] only at OSI layers II and III, interworking with other types of telecommunications networks may be facilitated by the use of end-to-end protocols [BSB, 1989]. The uni-directional nature of broadcasting makes existing "connectionless" end-to-end protocols appropriate.

3. Additional broadcasting services using the capacity within a television channel

3.1 *The teletext service*

The definition of the teletext service is as follows:

A digital data broadcasting service which may be transmitted either within the structure of an analogue television signal or by using digital modulation systems. The service is primarily intended to display text or pictorial material in two-dimensional form reconstructed from coded data on the screens of suitably equipped television receivers.

Four teletext systems are recommended for international adoption in Recommendation 653. They are described in Annex I to Recommendation 653 where they are referred to as systems A, B, C and D, viz:

System A : the system proposed by France

System B : the system proposed by the United Kingdom

System C : the system proposed by Canada

System D : the system proposed by Japan

There is now extensive literature describing the development of these systems and an overview is given in [Cominetti, 1985]. Many further references are given in the Bibliography. The results of field trials and theoretical studies, in particular, are given in Report 956. (Volume XI - Part 1, XVIth Plenary Assembly, Dubrovnik 1986).

Exchange between and combination of pages from different teletext data sources may be required when a programme of a particular content or structure is to be composed, for example a regional programme which is to include parts of a nationwide teletext programme. Besides the use of different data lines in the field blanking interval of the television signal for different teletext programmes or the interconnection of two or more teletext computers through data links, a "teletext combiner" device might be used to combine pages from several input cycles, exchange predefined pages and suppress unwanted pages. The combiner also allows for an uncomplicated insertion of "on-tape" sub-titles in an existing programme cycle [CCIR, 1982-86b].

3.2 *Systems for other new services*

The services listed below also rely upon data broadcasting. The number of these services is increasing. Some may also be provided by use of teletext systems.



3.2.1 *Sub-titling (closed-captions)*

Sub-titling services associated with teletext services or the dedicated "line-21" system [Lentz *et al.*, 1978] have been in operation for several years. Improved operational methods and equipment have been developed [Holmberg *et al.*, 1981; Lambourne, 1983; Baker *et al.*, 1984]. Sub-titling provided through data broadcasting can be multi-language and multi-level [CCIR, 1978-82a; Sechet 1980a, and b]. In France, multilingual sub-titling equipment, with independent language management has been produced and presented [Renoullin and Pinon, 1985]. This possibility is particularly important with the advent of broadcasting satellites.

The number of languages that can be provided simultaneously is limited in practice only by the transmission resource, but a reasonable maximum corresponds to about 10 to 20 languages or levels in normal operating conditions.

The transfer of sub-title data for transmission may either be rapid and directly in the form in which it is immediately to be transmitted, or at a lower data rate. In the latter case, a minimum serial data rate of 130 bytes/s is required for the transfer – or recording – of sub-titles in one language concurrently with the main programme material [CCIR, 1982-86c]. If a small increase in the minimum inter-sub-title time could be accepted, then the transfer – or recording – could employ the "user bits" of the EBU time code [EBU, 1982] for a single sub-title channel (i.e. 100 bytes/s).

Some statistics relating to sub-title services by means of teletext systems A and B are also presented in [CCIR, 1982-86c].

The international exchange of television programmes containing sub-titling data is dealt with in [CCIR, 1982-86d].

3.2.2 *Service and programme identification*

Where many broadcast transmissions can be received, especially when an RF channel might carry several services, programmes or independent information items, the need arises for the broadcasting of data that will help the user by:

- facilitating access to the desired RF channel;
- defining actual organization of the different signal components within the RF channel (if this is varied from time to time);
- facilitating access to a desired service which is one of several services within an RF channel. (A service may have several components of different types.)

In direct satellite broadcasting, a large number of transmissions are likely to be receivable at each point. For each transmission, several services are likely to be available. It is therefore desirable to adopt a common and comprehensive identification system within the geographical area which is served in accordance with a regional plan, such as that established by the WARC-BS-77.

As an example, the EBU service identification system within the MAC/packet family of systems is based on the use of a dedicated data channel within the digital sound/data multiplex, together with the sending of RF channel and TDM control data in line 625. The processing of the RF channel and TDM configuration data allows the receiver to separate the analogue part of the TDM multiplex, that is to say, the picture, from its digital part, which is the packet multiplex. The processing of the information conveyed by the dedicated channel gives access to the various services and to the various components of each service, and to programme items within each service. Such a system could also be the basis for a service and programme identification system for terrestrial broadcasting.

3.2.3 Programme delivery control

The programme delivery control system facilitates the recording of programming by video recorders. The service should comprise information enabling the preselection by the viewer of programmes for recording, and information for the video recorder which identifies when the programmes are actually broadcast.

The EBU has harmonized work undertaken in Germany (Federal Republic of) on the system known as VPS (Video Programming System) which uses 2.5 Mbit/s bi-phase coded data [CCIR, 1982-86e] and similar functions included in the specification of teletext system B which operates at a rate of approximately 7 Mbit/s but includes additional means of error protection. The operational principles of the EBU system and its specification [CCIR, 1986-90f] are summarized in CCIR Report 1226.

3.2.4 *Sound*

3.2.4.1 *Speech-quality sound*

An experimental system has been developed in Italy [Ardito *et al.*, 1980; CCIR, 1978-82b] to provide a commentary channel to a teletext programme, or auxiliary speech channels to a television programme for multilingual purposes.

The sound commentary is time-multiplexed with the teletext programme and makes use of the same structure of the data signal. In the proposed system, speech pauses are exploited in order to reduce the average channel occupation.

3.2.4.2 *Synthesized sound*

This type of service may be provided, for example, by means of teletext systems B and D (see Annex I to Recommendation 653) and allows text and graphics to be accompanied by synthesized music if required. The addition of this facility to the other teletext systems (§ 3.1) is planned.

3.2.5 *Broadcast audiography*

A service called "audiography" [CCIR 1974-78a] is still the subject of studies in France but no operational service has yet been introduced. It is proposed that services should contain sound with associated graphics information, which enables a drawing in course of execution to be reconstituted (teledrawing or telewriting).

Possible applications could include the broadcasting of educational programmes (in the form of lecture) consisting of a lecturer's comments, diagrams, formulae, etc., drawn on a blackboard. The receiving system's television screen would thus act as a distant "electronic blackboard".

3.2.6 *Data for processing*

These services are rapidly growing in importance. They involve the broadcasting of data which is intended for machine processing but not primarily for the purpose of producing an image on the user's television screen. The best-known example of this type of service is "Telesoftware". In general, "Telesoftware" services provide computer programs for use with personal computers in the hands of the general public.

"Telesoftware" services, broadcast as part of a teletext service, were the subject of experiments several years ago [Vivian and Overington, 1978] and there are now public services in some countries [CCIR, 1982-86g].

A system for broadcasting computer programs and data files by FM sound channels at the rate of 4 800 baud, as an alternative to the main sound programme, has been introduced in Italy by the RAI [Amato *et al.* 1987; CCIR 1986-90g]. This system called Radiosoftware, now in operation on the third FM radio network is based on a communication protocol [CCIR, 1986-90h] structured according to the ISO-OSI model, whose flexibility allows the use of the system on other broadcasting media, such as digital sub-carriers associated with television or radio channels. These applications are under study.

The Radiosoftware system has also been tested on the two-carrier sound system for television in Italy [CCIR Report 795]. The results of laboratory tests [CCIR, 1986-90i] have shown that, during the transmission of monophonic sound accompanying television programmes, the second sound channel can be used to transmit data at 4.8 kbit/s without affecting the picture and sound quality on domestic television receivers.

Other services under the general heading of "data for processing" may be intended for the remote control of machines (but excluding programme delivery services). An example is the broadcasting of low data-rate signals, for remote-control switching (see Report 1061).

3.2.7 *Broadcasting of time and date in coded form*

Time and date is an important item of information in broadcasting. When broadcasting across time-zone boundaries, especially from broadcasting satellites, a common convention for broadcasting time and date in coded form is desirable. Recommendations 457 and 460 provide such a convention, and its use in broadcasting is proposed in [CCIR, 1982-86g] Report 1078 deals further with this matter.

3.2.8 *Independent data services*

The independent data services make use of the data broadcasting systems to broadcast various types of data intended for suitable terminals connected to data receivers and commonly require conditional access facilities (see § 4.0). In this case, unlike that of the other services, the organization of the data is the responsibility of the user. Examples of services that have already been used operationally are the transmission of:

- news agency bulletins;
- lists of stolen credit cards;
- educational software for schools.

The system of data packet broadcasting which is in operation in France and known as DIDON [CCIR, 1974-78b; Noirel, 1975; Blineau *et al.*, 1980] is currently being used for such services.

The BBC has provided a service of data broadcasting in the United Kingdom since 1985 under the BBC Trade Mark 'DATACAST'. Although it can be used with any form of encipherment and conditional access capable of use over a one-way transparent data link, a particular system [Wright, 1987] has been developed for this application. Further information is given in Report 1079.

ORACLE-AIRCALL has provided a data broadcasting service in the United Kingdom since 1985, associated with the teletext service using Teletext System B, broadcast on the IBA transmitter network of the United Kingdom. From the wide range of applicable techniques, this service has selected a particular form of data scrambling and access control. Both page organized and independent data is carried by the service. Further information is given in Report 1079.

At the inception of BSS operations in the United Kingdom the distribution of general data to open or closed user groups will use the General Purpose Data (GPD) type MAC/packet service component [CCIR, 1986-90e].

A service for the transmission of data with a high degree of reliability in the analogue TV signal for various users is described in [CCIR, 1986-90j].

3.2.9 *Broadcast facsimile*

A broadcasting facsimile system in which the signal is multiplexed with a television sound channel using the second sub-carrier, has been developed in Japan. In this system, both analogue and digital facsimile signals can be transmitted to the receiver [CCIR, 1986-90k, see Report 795].

4. Systems to provide conditional access to services

The conditional access facility may be applied to all services, including the television services. Methods for controlling access required the use of encryption techniques in conjunction with scrambling. A conditional access television service was introduced in France in November 1984. It is operated over a national terrestrial broadcasting network using bands I and III for the main transmitters. The scrambling techniques are pseudo-random delay of the wanted line part for video and spectrum reversal for sound [Marti and Mauduit, 1975]. Access entitlement control and management operations are effected simultaneously by providing a personal code to each subscriber and introducing the code in the decoder by means of a keyboard.

France is implementing BSS operations, and in particular on the TDF 1 satellite, using the D2-MAC/packet system and the Eurocrypt conditional access system [CCIR, 1986-90 1]. A general description of this system is given in Report 1079, Annex II.

In the United Kingdom, British Satellite Broadcasting is implementing BSS operations using the D-MAC/packet system and the Eurocypher conditional access system [CCIR, 1986-90m].

The Eurocrypt and Eurocypher systems can be used with all members of the MAC/packet family of systems to provide access to television, teletext, sound, and data services.

5. Still-picture television (SPTV) broadcasting systems using a television or narrow-band channel

Still picture broadcasting systems are being studied in a number of countries. These studies include both digital and analogue systems for transmission over television or narrow band channels. The analogue systems are further subdivided into full field and line multiplex types.

5.1 Studies in the USSR

Studies have been conducted in the USSR [CCIR, 1978-82c] into the transmission of digital SPTV signals over narrow-band channels.

A possible application of the system is the broadcasting of signals from a public information centre to a large number of users.

← Other applications (e.g. conference communications, subscriber video services etc.), are envisaged which are being studied by the CCITT. Broadcasting of the information is based on the use both of time and frequency multiplexing techniques in television and/or sound-broadcasting channels.

Investigations of various technical parameters have been carried out with particular reference to the number of picture elements per line, number of bits per picture element, change-over time and bit rate and their influence on the service quality [Minashin *et al.*, 1979]. Concerning transmission aspects, it has been shown that to reduce the effect of errors, particularly when methods of reducing redundancy are used, codes must be employed to correct both single and multiple errors [Braude-Zolotarev *et al.*, 1979].

Experiments conducted in the USSR on still-picture transmission using non-switched connection lines of urban telephone networks have shown that effective correction of errors of various structures can be assured by the use of convolutional auto-orthogonal codes and an optimized threshold decoding algorithm. This technique makes it possible to transmit still-picture digital signals virtually error-free on channels having an error probability of as much as 5×10^{-3} [Braude-Zolotarev and Krasnoselsky, 1982; CCIR, 1982-86h].

5.2 Studies in Japan

The full-field multiplex type can transmit many programmes using a frequency band allocated to one TV channel. The signal consists of a one-frame composite video signal and a digitally encoded sound signal which are transmitted by TDM [CCIR, 1974-78c; Yamane *et al.*, 1980]. The transmission tests using the broadcasting satellite were carried out [CCIR, 1978-82d; Hasegawa *et al.*, 1980]. On-air experiments with UHF TV were carried out at Beijing in cooperation between Japan and China [Kang *et al.*, 1987].

The line multiplex type can transmit a few programmes keeping compatibility with a normal TV. The video signal is multiplexed on the field blanking interval of a main TV signal line by line and accompanying sound signal is multiplexed by the additional carrier [CCIR, 1974-78d; Harada, 1976].

A digitally coded multiplex type still picture system using a data channel of satellite broadcasting TV [CCIR, 1986-90j] has been developed. A service by digitally coded still pictures of HDTV and high quality PCM sound is being studied [CCIR, 1986-90n].

5.3 Further studies

Particular attention must also be paid to the protection of the control and still-picture synchronizing signals. Detailed information is given in [CCIR, 1978-82e]. Further studies are required on more efficient methods of coding both of SPTV signals and the accompanying sound signal. Further study is also required of means to enhance noise immunity.

The results of these studies must be drawn to the attention of CCITT Study Groups XV and XVIII concerning coding and compatibility with the integrated services digital networks (ISDN).

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- [1986-90]: a. 11/14 (France); b. 11/44 (Sweden); c. JIWP 10-11/5-41 (UK); d. JIWP 10-11/5-36 (EBU); e. JIWP 10-11/3-115 (UKIBA); f. JIWP 10-11/5-66 (EBU); g. 10/74 (Italy); h. 10/75 (Italy); i. 11/470 (Italy); j. 11/420 (Japan); k. 11/423 (Japan); l. JIWP 10-11/3-116 (France); m. JIWP 10-11/3-117 (UKIBA); n. 11/576 (Japan)

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REPORT 958-1*

**POSSIBILITIES FOR INCORPORATING THE SOUND INFORMATION
IN THE VIDEO SIGNAL IN TERRESTRIAL TELEVISION**

(Question 1/11, Study Programme 1H/11)

(1982-1986)

1. Introduction

At some time in the future it may be possible to implement a new system in terrestrial television in which the sound information is incorporated in the video signal. The implementation of such a system while at the same time maintaining compatibility with existing television broadcasting systems, poses many problems which must still be resolved. The present Report is a first response to § 1 of Study Programme 1H/11.

2. Compatibility requirements

The EBU [CCIR, 1978-82a] has taken into consideration the various items mentioned in Study Programme 1H/11 and has come to the conclusion that in terrestrial television the following requirements must be fulfilled to ensure compatibility with existing systems:

- the inserted digital sound signal should not cause any unacceptable interference with the performance of existing receivers;
- the new system should at least allow for the use of either two independent high quality channels, or stereophony, or four to six independent speech channels, and switching to those various modes should be made automatic;
- the reception quality of a transmitter should be limited by the degradation of the picture and *not* by that of the sound signals.

The last requirement seems to be fulfilled if the new system will allow for a sound quality definitely better than the corresponding vision quality, in all reception conditions where the vision quality is at least grade 1.5 (in a 5-grade scale) [CCIR, 1982-86].

It is felt desirable that the new technology be developed with a view to achieving a single overall system suitable for satellite as well as for terrestrial broadcasting applications and that this be done in such a way that the configuration for terrestrial television forms a compatible sub-system of the overall system [CCIR, 1978-82b].

3. Compatibility tests with existing receivers

In order to study the feasibility of integrating sound information into the video signal, preliminary tests with system M have been carried out in Japan [CCIR, 1978-82c], to investigate the compatibility with existing television receivers in the case of pulse signals inserted into the line blanking interval and of line synchronizing signals modified as shown in Fig. 1.

* This Report is also of interest to Study Group 10 and the CMTT.