Gofaizen O.V.
(UKRAINE, UNIIRT)

# OPTIONS OF ENHANCED SECAM TV TRANSMISSION SYSTEM

## Introduction

The questions of transition from analogue to digital TV in countries, using analogue TV SECAM transmission system are discussed in this report with consideration of its enhancement in accordance with conception of EQTV systems.

The transition period is characterized with that in its beginning infrastructure and park of TV sets are analogue. At the beginning of transition period TV broadcasting is mainly analogue, and a number of digital TV sets is minimal, and apparently for a long time analogue and digital TV will co-exist. Simultaneously with implementation of digital TV analogue TV has to be supported and enhanced [1].

The issues of compatibility of new digital and old analogue TV are extremely important, and here the main consideration is attended to them.

## 1 The position of analogue enhanced quality television in the period of transition to digital television

We have to take into consideration that the main event of the present in television is the transition to digital TV.

Nevertheless, this transition may continue in some countries for long time enough. All this depends on many factors – relationship between the cost of digital sets (tuners, set top boxes) and of analog ones, real term for change from analog to digital infrastructure and the affordablence of this change, purchasing power of viewers community, presence and condition of used equipment. It is quite possible, that in some countries this transition would come in a quite short time, in others this transition would continue for decades.

The important argument which has to be considered at the time of planning of further development of TV broadcasting technology, is the compatibility of new systems and means with working TV broadcasting infrastructure, particularly, with used park of many millions of SECAM TV sets, many of which are designed for reception of PAL programs also. In view of this it seems real simultaneously with introduction of digital TV use analogue TV in some countries for a long time with use of analogue SECAM and PAL systems.

At that use of enhanced television will allow to create possibility to realize enhancement of broadcasting service with use of enhanced TV sets, which would have better compatibility with digital TV tuners (i.e. wide screen, digital stereo/multilanguage sound, enhanced reproduction of video and audio etc.) without violation of working TV broadcasting infrastructure. Such TV sets will provide more effect during digital TV programs reproduction than conventional analogue TV sets. So enhanced television may become the bridge between analog and digital television and it may be effective considering that if customer would consequently buy enhanced TV set and digital TV tuner/set top box, he will not bear additional losses besides of cost of enhanced TV decoder.

In some cases it may be practical to use of separate elements of enhanced systems. For example the automatic system for correction of linear distortions (echo cancellation) may be used not necessarily in TV receivers, but also they may be used in separate parts of TV transmission chain.

The use of enhanced television may be effective in combined analog-digital networks, in which primary distribution is realized in digital format and secondary distribution – in analog format.

In this connection into the base of fundamental Ukrainian documents has been put the conceptual principle of the transition from analogue to digital TV, consisting in simultaneous use of analogue and digital TV systems, at that in the transition period the use of SECAM and PAL systems is possible as well as use of their enhanced variants ENHANCED SECAM/PALplus. This principle is realized in national standards in considerable degree.

Such an approach allows to maintain the principle of maximal compatibility of new technologies with old and to realize technical progress without damage for main part of Ukrainian people in provision of TV broadcasting.

The transition to new TV systems is aimed for essential TV broadcasting enhancement and for creation of new possibilities for broadcasting services, making them more attractive for TV viewers.

To a number of the most important features of EQTV belong:

– Compatibility with working analogue systems and infrastructure, i.e. use of this systems allows to use working sets and infrastructure without any changes and to keep traditional, and sometimes enhanced quality of broadcasting;

– Widescreen 16:9 image, compatible with digital TV and with 4:3 usual TV transmission on the base of use of “letter box” method;

– Possibility of image distortion automatic correction of image distortion, accumulated at the process of transmission TV signal in overall TV channel;

– Use of digital coders and decoders of composite video signal, allowing to realise high quality luminance/chrominance separation;

– Reduced number of line intervals busy with colour recognition signals in SECAM system, what allows to bring teletext transmission rate to the rate provided in PAL system;

– General enhanced quality of video signal forming at the transmission end and enhanced quality of image reproduction and of sound reproduction at the receiving end.

EQTV system provides standard broadcasting quality with usual sets and essentially enhanced quality with EQTV sets.

The use of widescreen image and enhanced quality of broadcast signal forming, on one side, and enhanced quality of image and sound reproduction, on the other side, are common for EQTV and digital TV. Essentially, these modules bring main contribution into the cost of transmitting equipment and of TV receiver.

So, it may be expected in transition period of possible use of SECAM/PAL/ENHANCED SECAM/PALplus/MPEG-2 receiver, able to receive programs of all the systems. The most expensive part of such a receiver will be reproduction system. The use of multi-system HF part and of multi-system decoder potentially has not to carry in great contribution into receiver cost.

All the ensemble of programs may include the packets of usual TV programs, EQTV programs and digital TV programs. The usual TV and EQTV programs will be directly available, and digital TV programs will be available for usual TV and EQTV receivers through tuner.

## 2 International standardization of analogue EQTV systems

### 2.1 Standardization of modules of EQTV systems

For present time it seems actual to use simultaneously with conventional systems in period of transition to digital television, first of all, for countries, in which the period of transition to digital TV will be long enough, both EQTV systems and their modules, considering, that every element, taken separately, may appear economically effective and play a vital part in broadcasting quality enhancement. International EQTV systems standardization and standardization of their elements is mainly accomplished in nineteen years of twenties century.

In this subsection the attention is paid to international documents, in which main elements, composing the main point of image enhancement in EQTV systems, are specified

#### 2.1.1 General enhancements for enhanced systems

General enhancements for enhanced systems are presented in Recommendations ITU-R BT.796, 797-1, 1117-2, 1118-1 [2-5].

Enhancements, that may be used in ENHANCED SECAM and ENHANCED PAL TV transmission systems, are specified in Recommendation ITU-R BT.796 [2]. Equivalent enhancements are specified in Recommendation ITU-R BT.797-1 [3] applied to ENHANCED NTSC (CLEARVISION) TV transmission system, used in Japan. The development of these Recommendations is Recommendation ITU-R BT.1118-2 [5]. In Recommendation ITU-R BT.1117-2 [4] studio parameters for EQTV systems are specified.

These Recommendations are fundamental, and they are the bases for Recommendations recommending characteristics of ENHANCED PAL ? ENHANCED NTSC TV transmission systems.

#### 2.1.2 Wide-screen reproduction

Wide-screen image transmission is provided in enhanced 625-lines PAL and SECAM systems, compatible with conventional television, in which 16:9 image is transmitted in “letter box” format inside conventional 4:3 system signal. For provision of this Wide-screen Signaling Signal (WSS) is specified in Recommendation ITU-R BT.1119-1 [6] and European standard EN 300 294 [7].

WSS is foreseen for wide-screen reproduction control in EQTV receiver together with other options of EQTV receiver.

Information, used for signalization, method of coding and method of inclusion of control information into TV signal are specified.

Wide-Screen Signaling information contains:

- Information on transmitted image sides rate and image position in frame;
- Information on use camera or cine as a signal source;
- Information on colour coding or decoding mode (standard or ? ? ? ? (Motion Adaptive Colour Plus));
- Information on helper signal, bringing information of image vertical HF components n;

- Information on transmission of sub-titles and on method of sub-titles transmission inside teletext information;

- Information on surround sound transmission;

- Copyright information.

So the Recommendation and the European standard specify main modules of EQTV system and the method of controlling these functions.

Conventional system receiver will ignore this control information, and EQTV receiver may respond to control information or to any part of control information in dependence of functions realized.

### 2.1.3 Automatic distortion compensation in then receiver

The possibility of video signal distortion, appearing due to echo effect when signal transmission through broadcasting chain, is provided.

The responses of Ghost Cancellation Reference (GCR) signals of systems A, B, C for use in different regions are specified in Recommendation ITU-R BT.1124-2 [8]. The system C signal is recommended as preferable for new applications.

The system C signal is specified also for use in new European broadcasting services in European standard ETS 300 732 [9]. This signal is specified for video bandwidth of 5 MHz.

For systems with video bandwidth of 6 MHz it would be natural to use GSR signal designed for automatic distortion cancellation in this bandwidth. The parameters of this signal together with analysis its possibilities are presented in the Report ITU-R BT.2018 [10], based on Ukrainian contribution [11]. As it is pointed in the Report, the effective correction of not only echoes, but of also any types of distortion is possible.

The situations are possible when video bandwidth of 5 MHz and 6 MHz inside single TV broadcasting service is used. For this situations the introduction of corresponding signalization may be useful.

The use of automatic linear distortion cancellation may lead to significant enhancement of quality of TV broadcasting. For this purpose the block of GCR signal inclusion into video signal in SECAM/PAL coder has to be introduced, and corresponding corrector has to be introduces in the receiver.

If to come from that automatic linear distortion compensation in analogue TV signal will be enough widely and for enough long time used, it seems expediently to add accordingly the Recommendation ITU-R BT.1124-2 and European standard ETS 300 732.

### 2.1.4 Digital sound

Digital Sound System (DSS) in analogue television is specified in Recommendation ITU-R BS.707-4 [11] for B,D1,G,H,L/PAL and D,K,K1,L/PAL systems. Particularly, for D,K,K1 systems the parameters of DSS are specified on the basis of c9ontributions of Ukraine and of France [12, 13].

European standard ETS 300 163 [14] specifies the DSS for B,G,H,L,K1,L systems. It is evident that it is needed the addition of this standard (concerning D1/PAL and D,K/SECAM systems) in accordance with the Recommendation ITU-R BS.707-4.

The Recommendation and the standard provide NICAM 72 system digital sound together with data transmission. They specify the organization of transmission system. In this system, particularly, the informa-

tion MPEG-2 “Audio” coded information may be transmitted in a data stream, that may be a basis for multi-channel sound transmission, mono or stereo, compatible with digital TV sound transmission system and with digital sound broadcasting.

Use of digital sound is provided together within traditional analogue sound, what provides full compatibility with usual TV reception.

Digital sound in TV may be used as

- High quality sound;
- Stereo sound;
- Around sound.

Use of DSS may essentially affect on quality of analogue TV broadcasting and may play a significant role in an environment of analogue broadcasting for the period, in which it will be used, but all this is of interest if this environment will be wide enough and if this period will be long.

### 2.2 PALplus system

PALplus system is a wide-screen EQTV system, compatible with conventional composite PAL system. It is specified in Recommendation ITU-R BT.1197 [15] and in European standard ETS 300 731 [16].

In this system the transmission of wide-screen 16:9 image transmission is specified. Main elements of EQTV system are used, i.e. the compatibility of wide-screen television with conventional television is provided with use of “letter box” transmission of wide-screen image inside PAL signal, transmission of helper signal carrying vertical HF image components information, digital signal processing in coder and in decoder, providing high-quality luminance/chrominance separation, transmission of reference signals for precision signal level provision in decoder, GCR signal.

All his elements together with use of digital sound provide quality of broadcasting in PALplus system, much better than in PAL system.

In this system sampling frequency of source video signal of 13,5 MHz with image format 16:9 is used, and this leads to limitation of horizontal sharpness of image in comparison with PAL system.. It is possible that such decision is made in connection that video bandwidth corresponds to PAL system. In other case it would be needed to widen bandwidth with decreasing the degree of compatibility, or to add transmission of additional horizontal HF components, for example, like it is made in CLEARVISION system, but it would lead to complication of coding and decoding algorithms.

In order to advantages of this system would be evidently noticeable in comparison with conventional television, special attention has to be paid to building of high quality reproducing system without what the effect of use of this system as well as any other new systems, such as EQTV systems as well as digital systems, may be not unvalued by users.

Considering that traditionally in the SECAM world PAL/SECAM receivers are used, the elements, used in PALplus system, are of great interest for use them in ENHANCED SECAM system form point of view of concept of building the receiver of enhanced systems PALplus/ENHANCED SECAM.

### 2.3 Enhanced NTSC system

Enhanced NTSC (CLEARVISION) system is an EQTV system, compatible with conventional NTSC system. It is specified in Recommendation ITU-R BT.1298 [16].

In the system the transmission of 4:3 image is provided. The elements of EQTV system are used, i.e. the transmission of helper signal bringing additional information on vertical and horizontal HF components, digital signal processing in coder and in decoder providing high quality luminance/chrominance separation, GCR signal transmission.

Important merit of Enhanced NTSC is that as a result of used methods of digital signal processing iis this system it has better resolution without widening video bandwidth, and this confirms its name-CLEARVISION.

### 2.4 Enhanced SECAM system

Enhanced SECAM system is EQTV system, compatible with conventional SECAM system. Activity for its international standardization began in 1995.

The demonstration of this system in France in November 1995, organized by TDF, has shown its advantages before SECAM system, first of all, better image and sound quality and better service quality.

In early 1996, a Summit on ENHANCED SECAM was conducted by the EBU [22].. This meeting has historical significance because it was the first meeting of PAL and SECAM experts on enhanced systems. The different strategies representing viewpoints of manufacturers, broadcasters and network operators were discussed. The meeting was expected to serve as an initial step towards the harmonization of principal solutions in both systems as much as possible.

A significant progress on the introduction of ENHANCED SECAM has been achieved in France. The main features of the system (e.g. enhanced Teletext HI-Text 2.5, Electronic Program Guide, Program Delivery Control) are currently envisaged to improve quality of service, in addition to the existing features (e.g. 16:9 aspect ratio and WSS, NICAM and Dolby Pro-Logic).

Some manufacturers have indicated doubts concerning the marketing potential of enhancements in signal processing in PAL and SECAM coders and decoders without the introduction of apparent improvements such as 16:9 screens and stereo sound and others. It is obvious that significant picture quality improvement will be achieved only if responses of all parts of TV chain "from light to light" are improved and overall performance can be optimized.

Since in PAL and SECAM countries multi-standard TV-sets and VCRs are usually available, it seems appropriate to introduce equivalent improvements in both systems. It seems, that SECAM countries are likely to support the specification of new ENHANCED SECAM systems for the future development of ENHANCED SECAM/ENHANCED PAL multi-standard receivers.

The results of studies were published in ITU-R documents and were accordingly studied by WP 11A. The methods of SECAM system enhancement were proposed by France, Russia and Ukraine [11-13, 18-21, 23-27, 30-33, 34, 36, 37, 40, 41, 43].

#### 2.3.1 ITU documents on EQTV systems

The activity on international standardization of ENHANCED SECAM system is reflected in documents [23-47], related different aspects and stages of its study.

On the base of presented contributions and discussions WP 11A) succeeded in 1998 to formulate the texts of WP 11A Preliminary Draft Recommendation and Draft Report on this system. In the texts of this documents were considered all the objections and all the wishes of Administrations, and so kept only the statements which cannot raise doubts, because they are based on ITU-R Recommendations in force.

Here are presented last versions of Draft Report and Preliminary Draft Recommendation related ENHANCED SECAM system.

### 2.3.2 Draft Report on Enhanced SECAM system

Characteristics of ENHANCED SECAM system that are the subject of study at present time, are published in last version of Draft Report [45].

The Table 1 contains main essential elements of the system and may be used as a guide for choice of its characteristics in standardization process. The tables 2-5 contain additional information, which may be used for further study.

TABLE 1

**Main modules of the ENHANCED SECAM system**

| **MODULES** | **ENHANCED SECAM TRANSMISSIONS** | | |
|---|---|---|---|
| | **B, G, H** | **K1 ,L** | **D, K** |
| 1.1 Difference between analogue sound and video carriers (MHz) | 5.5 | 6.5 | 6.5 |
| 1.2 Difference between digital sound and video carriers (MHz) | 5.85 | 5.85 | 5.85 |
| 1.3 Bandwidth of luminance signal (MHz) | 5.0 | **Mode 1:** Using only analogue sound: 6.0<br>**Mode 2:** Using analogue and digital sound: 5.1 | Mode 1: Using only analogue sound: 6.0 [1)2)]<br>**Mode 2:** Using analogue and digital sound: 5.1 [1)2)] |
| 1.4 Level of digital sound carrier, dB | -20 | -27 | -27 |
| 1.5 4:3 and 16:9 image format compatibility | "Letter-box" using facilities of wide screen signalling system | | |
| 1.6 Digital sound emission system (if used) | NICAM, Recommendation ITU-R BS.707 | | |
| 1.7 Signalling method | Recommendation ITU-R BT.1119 | | |
| 1.8 GCR signal | Recommendation ITU-R BT. 1124, system C [3)] | | |

[1)] For expansion of luminance bandwidth when transmitting on the channel with 6 MHz bandwidth may be used a horizontal helper signal, which expand luminance signal bandwidth, when decoding in receiver, up to $6\frac{16:9}{4:3}=8$ MHz (mode 1) and $5{,}1\frac{16:9}{4:3}=6{,}8$ MHz (mode 2). Is studied in Ukraine at present time;

[2)] For this case represents interest the studying of possible use besides 13,5 MHz sampling frequency adopted in PALplus system (Part A Rec. ITU-R BT.601) also 18 MHz sampling frequency (Part B Rec. ITU-R BT.601) for making possibility of enhanced resolution realisation;

[3)] Used 5 MHz bandwidth; 6 MHz bandwidth is under study.

TABLE 2

**Additional modules of the ENHANCED SECAM system (under study)**

| MODULES | ENHANCED SECAM STANDARD |
|---|---|
| | **B, D, G, H, K, K1, L** |
| 2.1 Vertical helper signal transmission | **Mode 1:** As in ENHANCED PAL system, with some additional signal processing at the transmitting and receiving ends of TV chain [1)]<br>**Mode 2:** VSB-AM technique applied to two SECAM line-alternating subcarriers having "zero" frequencies of 4.25 MHz and 4.40625 MHz, retaining phase switching laws adapted in the SECAM system. Modulation depth of AM should be so adjusted that residual subcarrier amplitudes correspond to the SECAM specifications |
| 2.2 Transmission of horizontal helper signal | Spectrum in the range of 6-8 (or 5-6,8) MHz is transferred into range of approximately 1-3 MHz and imposed onto spectrum of vertical helper signal. The division of spectra is made by choice of polarities altering in adjacent frames (fields) [2,3)] |
| 2.3 Law of colour subcarrier phase insertion in sequential lines | **Mode 1:** As in SECAM system<br>**Mode 2:** 0, 0, 0, $\pi$, $\pi$, $\pi$,... |
| [1)] The use of balanced AM for vertical helper transmission requires special theoretical and experimental study of visibility of helper interference in the black letterbox borders in conventional SECAM TV sets.<br>[2)] Used only at high S/N ratio (for example, 40 dB). For this purpose the measurement is used for control switching of horizontal helper signal.<br>[3)] See also footnote[2)] in table 1. | |

TABLE 3

**Proposed performance items of enhanced video emission system**

**(These items require study)**

| PERFORMANCE | TRANSMISSION TECHNIQUES | RESULTS |
|---|---|---|
| 3.1 Horizontal and vertical luminance definition, quality of Y/C separation | As in SECAM system | Limited horizontal definition related to spectrum rejection in luminance signal encoder and decoder Approximately standard horizontal definition if adaptive methods of Y/C separation are used in the decoder |
| | Use of vertical helper signal | Restoration of nominal vertical definition of wide screen SECAM picture, using signal processing techniques as in ENHANCED PAL |

| | | |
|---|---|---|
| | Use of horizontal helper signal | Increasing horizontal resolution up to EDTV level |

| | | |
|---|---|---|
| | Use of enhanced MACP method as in ENHANCED PAL system | Standard definition for almost all scenes. Distortion for some cases of video camera transmission |
| | Use of enhanced colour plus - method with additional motion and colour content adaptive comb filtering | Standard definition always without additional distortion |
| 3.2 Horizontal colour definition | As in SECAM system | Blurring of colour transitions with high colour saturation |
| | SECAM without clipping the pre-emphasised colour difference signals | Standard colour definition |
| | Colour transition correction in the decoder | Improvement of colour definition |
| 3.3 Vertical colour definition and interference due to colour signal sub-sampling | As in SECAM system | Colour interline flicker. Distortion of vertically moving horizontal colour boarders in image. Colour moire. This may be reduced using vertical-temporal pre-filtering in the coder and post-filtering in the decoder. |
| | Using quincunx structure [1)] of colour difference information sampling. | Distortion may be decreased using two-dimensional pre- and post-filtering. This will give less reduction of colour definition in comparison with usual SECAM sampling structure. Possible arising of pick-to-pick colour subcarrier signal after HF-pre-emphasis amplitude desired to be limited to avoid an arise of its pick amplitude levels |
| 3.4 Y/C interference (in conventional SECAM TV sets) and horizontal luminance definition | As in SECAM system | Luminance signal distortion |
| | New method of Y/C interference reduction by using the amplitude of chrominance signal to control the clipping level of Y signal components in the vicinity of colour subcarrier | Less distortions of luminance signal, especially in the vicinity of colour transitions |
| | Use of a linear-phase subcarrier trap in the encoder luminance channel | Improvement of the luminance channel transient response |
| 3.5 C/Y interference | See item 3.1 | |

[1)] The use of quincunx structure of colour difference information sampling requires special theoretical and experimental study of compatibility with conventional TV sets

TABLE 4

**Performance items of sound emission system**

| PERFORMANCE | TRANSMISSION TECHNIQUES | RESULTS |
|---|---|---|
| 4.1 Quality of sound | Analogue transmission as in existing emission system | Noise, non-linear and linear distortion |
| | Digital transmission | Quality of digital sound. Possibility of a) transmission of stereo sound signal, or b) two/mono sound signals, or c) other surround sound |
| 4.2 Possibility of transmitting multi-language sound, use of stereo effects, etc. | See item 4.1 | |

TABLE 5

**Performance items of additional data (teletext) emission system**

**(These items require study)**

| PERFORMANCE | TRANSMISSION TECHNIQUES | RESULTS |
|---|---|---|
| 5.1 Number of line intervals in the field blanking interval available for teletext | Recommendation ITU-R BT.470-4 | Limited |
| | Possible changes of Recommendation ITU-R BT470-4 (cancelling post-equalisation pulses, reduction of the number of lines of colour identification signal in field blanking period) | The potential number of lines in each field blanking interval is identical to PAL system |

### 2.3.3 Preliminary Draft Recommendation on Enhanced SECAM system

???? ?????????? ????? ??????? ???????????? [48].

DRAFT NEW RECOMMENDATION [DOC. 11/28]

**ENHANCED WIDE-SCREEN SECAM TV TRANSMISSION SYSTEMS**

(Question ITU-R 42-2/11)

The ITU Radiocommunication Assembly,

*considering*

a) that the 16:9 aspect ratio provides an enhanced viewing experience, particularly on large screen receivers, and is likely to be adopted for new digital services;

b) that there are indications that the public interest in the new 16:9 aspect ratio is growing;

c) that the SECAM services will continue for the foreseeable future, whatever new services are introduced;

d) that ENHANCED SECAM systems can provide high quality 16:9 pictures for wide-screen receivers with digital sound and enhanced teletext service whilst maintaining compatibility with 4:3 receivers (using 16:9 letterbox);

e) that Recommendation ITU-R BT.1118 recommends that when enhancements to existing television system are made, some or all of modular enhancements and features listed in this Recommendation should be used;

f) that the signaling system required by SECAM for compatible wide-screen transmission using letterbox has been recommended in Recommendation ITU-R BT.1119;

g) that multichannel digital sound capacity can be added to SECAM transmission using NICAM system specified in Recommendation ITU-R BS.707;

h) that ghost cancellation enhancement can be added to SECAM transmission using the reference signal specified for 625-line television systems in Recommendation ITU-R BT.1124;

j) that the above enhancement modules (wide-screen signaling, NICAM, GCR) can be used both with PAL and SECAM television systems, and they are generally integrated by manufacturers in enhanced multistandard PAL/SECAM receivers,

*recommends*

that when administrations or broadcasters wish to enhance the delivery of conventional definition SECAM television with,

- compatible 16:9 wide-screen;
- digital multi-channel sound;
- ghost cancellation;

– increased capacity for additional information (teletext);

an ENHANCED SECAM system should be based on the conventional SECAM system described in ITU-R Recommendation BT.470, with additions taken from the following tables.

TABLE 1

**Modules for implementing ENHANCED SECAM**

| Enhancement | Implementation |
|---|---|
| Wide-screen compatible 16:9 transmission using wide-screen signalling | Recommendation ITU-R BT.1119 |
| Digital sound | NICAM<br>Recommendation ITU-R BS.707 |
| Ghost cancellation | Recommendation ITU-R BT.1124 |
| Additional data capacity increased | Limiting (or removing) the number of SECAM field colour identification signals. The extent to which this can be done depends on national circumstances |

TABLE 2

**Main parameters of ENHANCED SECAM television systems**

| PARAMETER | ENHANCED SECAM TRANSMISSIONS | | |
|---|---|---|---|
| | **B, G, H** | **L, K1** | **D, K** |
| 1 Analogue sound carrier frequency relative to vision carrier frequency (MHz) | +5.5 | +6.5 | +6.5 |
| 2 Digital sound carrier frequency relative to vision carrier frequency (MHz) | + 5.85 | + 5.85 | +5.85 |
| 3 Bandwidth of luminance signal (MHz) | 5.0 | **Mode 1**: Using only analogue sound: 6.0<br>**Mode 2**: Using analogue and digital sound: 5.1 | **Mode l**: Using only analogue sound: 6.0<br>**Mode 2**: Using analogue and digital sound: 5.1 |
| 4 Ratio of effective radiated powers of digital sound and peak vision carriers (dB) | -20 | -27 | -27 |
| 5 4:3 and 16:9 image format compatibility | "Letter-box" using facilities of widescreen signalling system | | |
| 6 Digital sound emission system | NICAM<br>Recommendation ITU-R BS.707 | | |
| 7 Signalling method | Recommendation ITU-R BT.1119 | | |
| 8 GCR signal | Recommendation ITU-R BT.1124, system C | | |

## 3 National standardization of enhanced TV in Ukraine

### 3.1 National Ukrainian standards

Next national standards are worked up and introduced into practice in Ukraine from 01.01.2000:

– DSTU 3837-99 "Broadcasting television. The system of analogue television of conventional resolution. Main parameters. Measurement methods",

– DSTU 3836-99 "Broadcasting television. Reference test signal for correction of linear distortion in TV chain. Main parameters"

They are aimed for evolution and perfection of used national TV analogue broadcasting system.

DSTU 3837-99 is extended to conventional analogue TV systems SECAM and PAL, used in Ukraine, and establishes main parameters of national versions these systems.

National versions of SECAM and PAL systems are designed for video bandwidth of 6 MHz in the case of use only analogue sound and for video bandwidth 5,1 MHz in the case of use both analogue and digital sound. In the case of use digital sound the analogue sound is used for compatibility with TV sets, designed for use of analogue sound only.

### 3.2 Digital sound

Digital sound is organized with use of NICAM 728 system, transmitting two-channel sound transmission with NICAM source coding or sound transmission together with additional data transmission, at that additional data stream may be used for example, for transmission of MPEG coded sound.

### 3.3 Signal for automatic linear distortion cancellation

The possibility of use of GCR signal, specified in national standard DSTU 3686 for 5 MHz and 6 MHz, is foreseen for automatic linear distortion cancellation

### 3.4 Colour synchronization

Two variants of building of field and color synchronization signal are specified:

– traditional;

– in SECAM system modified for the purpose of increasing place for additional information transmission (excluded post-equalizing pulses, excluded last four color identification line signals in each field).

### 3.5 Line intervals information arrangement in field blanking interval

The arrangement of line intervals information in field blanking interval for transmission of synchronization, telemetry and service information is presented in Table 1.

### 3.6 Format of composite signal in field blanking interval

Two formats of composite signal in SECAM system in field blanking intervals, specified by the standard are presented in Figures 2 and 3, first – traditionally used in this system, and others – with reduced number of lines, containing colour identification signal, to 5. This and other measures allowed to free place for use by teletext service for commensurable with provided in PAL system.

### 3.8 Spectra of video and sound signals

The band of frequencies of broadcasting TV and nominal sideband responses of video and sound channels for the case of use only analogue sound are shown in picture 3.

**Table 1 – The arrangement of line intervals in field blanking interval for transmission of signals of synchronization, of telemetry and of service information**

| Line | SECAM system | | PAL system | |
|---|---|---|---|---|
| | Main variant | Modified variant | Main variant | Modified variant |
| 4,5 | Post-equalizing pulses | – | Post-equalizing pulses | – |
| 6 | Reference signal of time and frequency | | | |
| 7–10 | Field colour identification signals | – | – | – |
| 11–15 | Field colour identification signals | | – | – |
| 16 | Signal V for identification of point of introduction of test signals of control lines, introduced in studio | | | |
| 17 | Test signal of control line I, introduced into video signal of studio | | | |
| 18 | Test signal of control line II, introduced into video signal of studio | | | |
| 19 | Signal V for identification of point of introduction of test signals of control lines, introduced for control of work of sections of TV chain | | | |
| 20 | Test signal of control line I, introduced for control of work of sections of TV chain | | | |
| 21 | Test signal of control line II, introduced for control of work of sections of TV chain | | | |
| 22 | Signal for signal/noise ratio measurement | | | |
| 23 | [1] | [1] | [1] | [1] |
| 316, 317 | Post-equalizing pulses | – | Post-equalizing pulses | – |
| 318 | ?????? GCR | | | |
| 319–323 | Field colour identification signals | – | – | – |
| 323–328 | Field colour identification signals | | – | – |
| 329 | Telecontrol and telemetry signals | | | |
| 330 | Test signal of control line III introduced into video signal of studio | | | |
| 331 | Test signal of control line IV introduced into video signal of studio | | | |
| 332 | Telecontrol and telemetry signals | | | |

| | | | | |
|---|---|---|---|---|
| 333 | Test signal of control line III, introduced for control of work of sections of TV chain | | | |
| 334 | Test signal of control line IV, introduced for control of work of sections of TV chain | | | |
| 335 | Signal for signal/noise ratio measurement | | | |
| 623 | [1)] | [1)] | [1)] | [1)] |

[1)] Lines 623 ? 23, intended for transmission for video signal transmission, may be used for transmission of service information instead video signal.

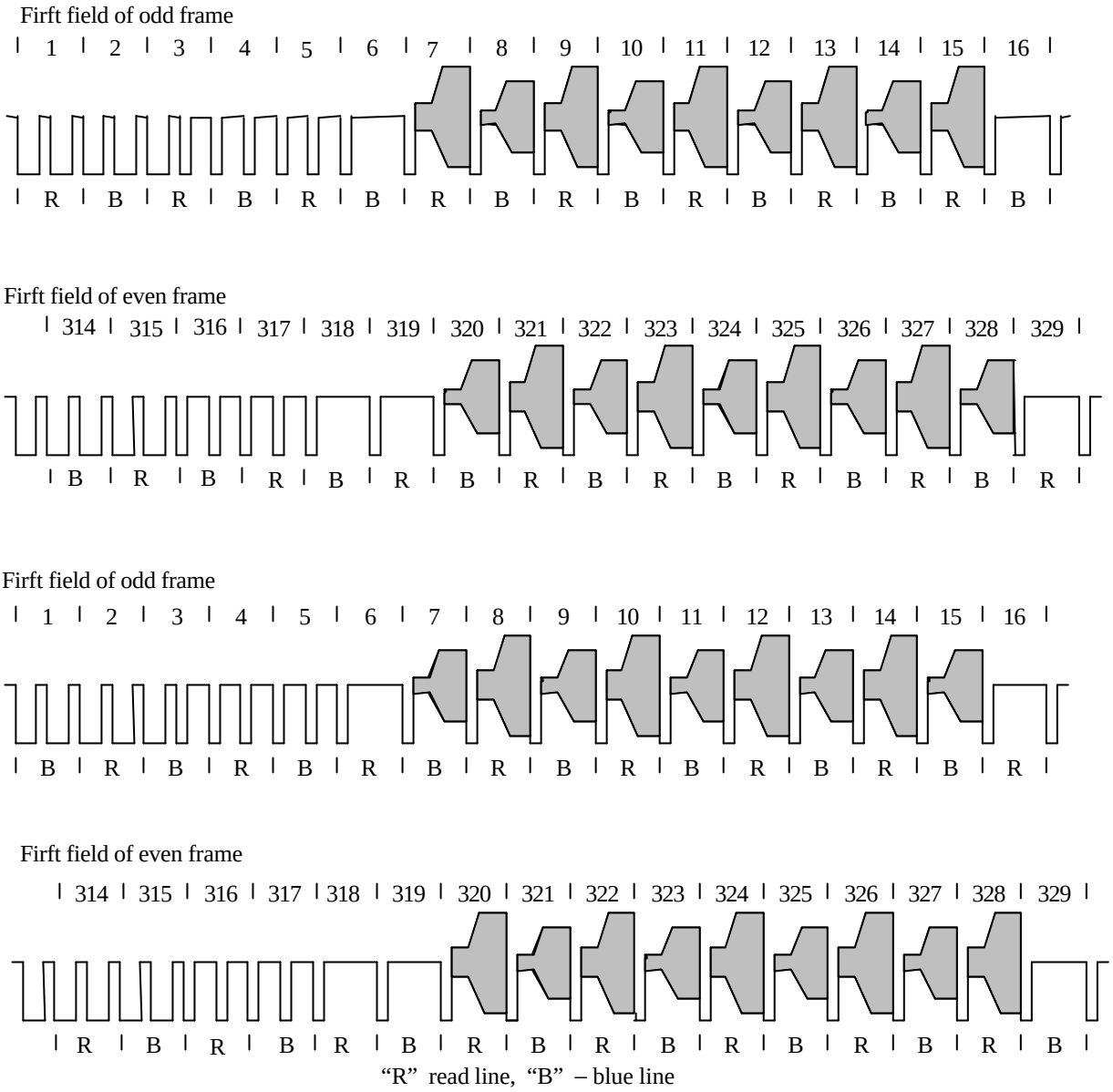


**Figure 1 – Colour field identification signals in SECAM system**

**(Traditional variant)**

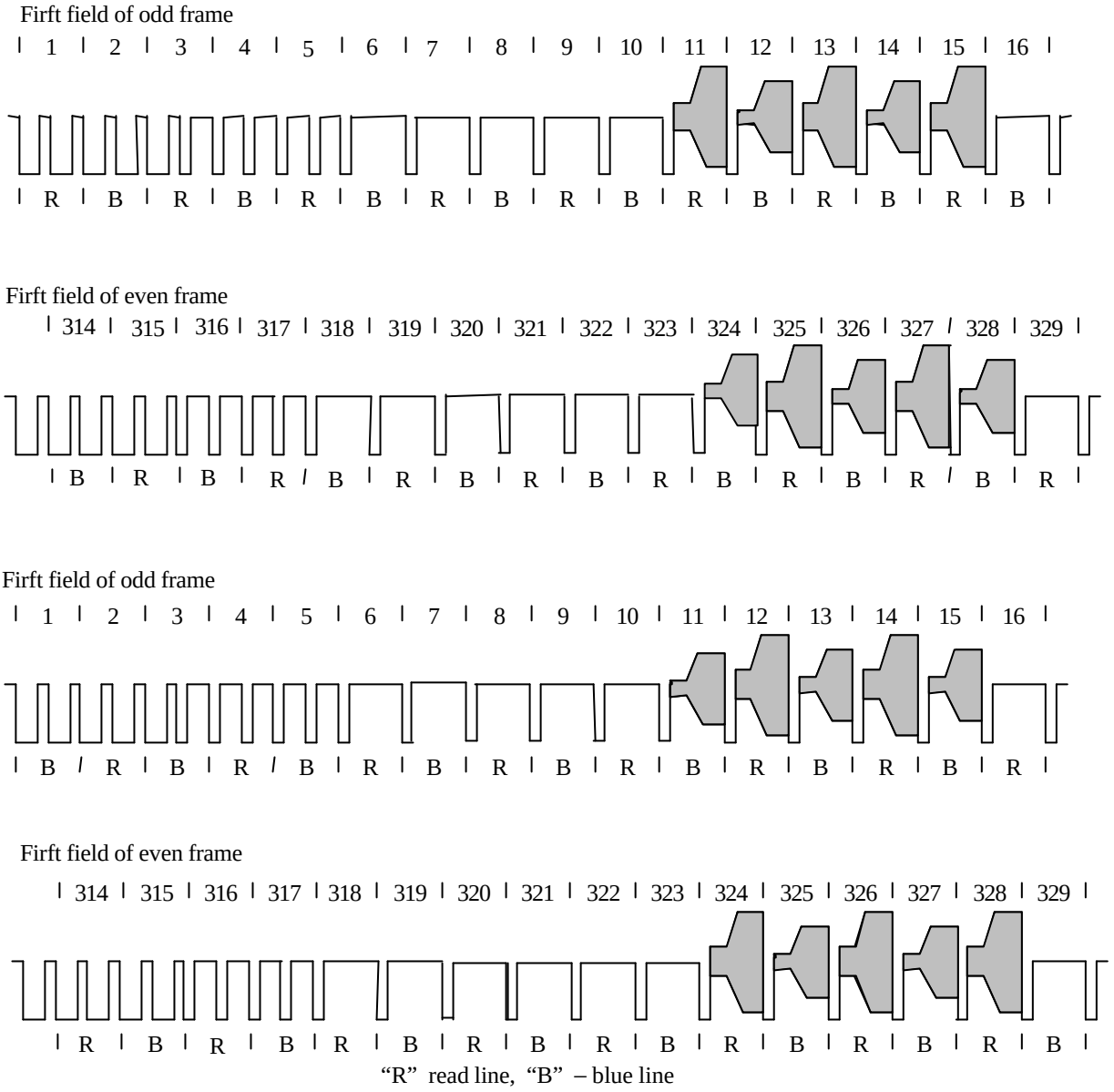


**Figure 1 – Colour field identification signals in SECAM system**

**(Modified variant)**

Bandwidth of broadcasting TV radiochannel and nominal side bands frequency response of TV transmitter in the case of use of analogue and digital sound is presented on Figure 4.

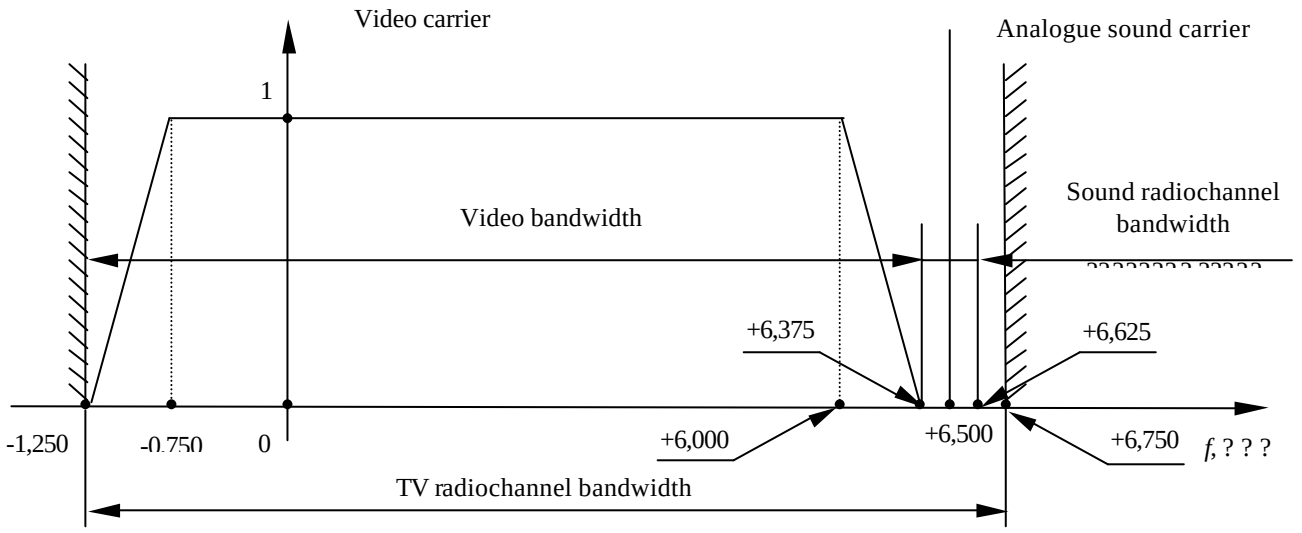


**Figure 3 – Bandwidth of broadcasting TV radiochannel and nominal characteristics of side bands of video and sound channels in the case of use of analogue sound**

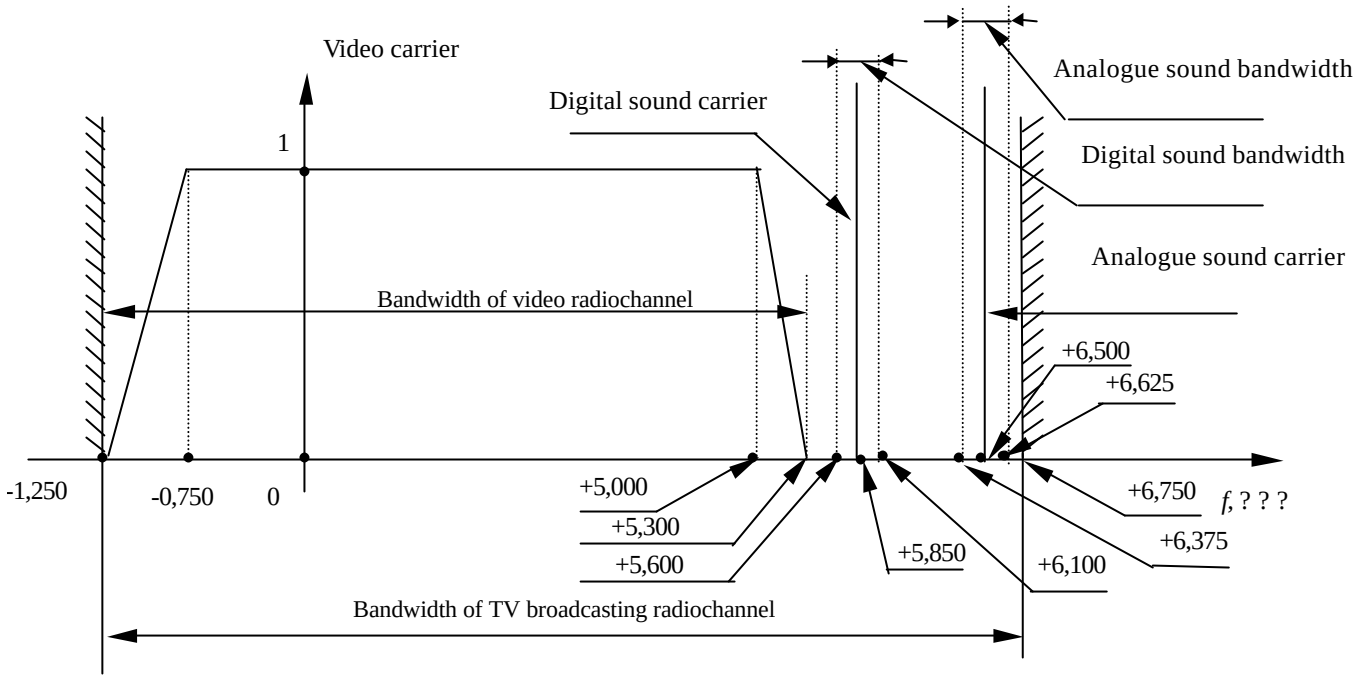


**Figure 4 – Bandwidth of broadcasting TV radiochannel and nominal side bands frequency response of TV transmitter in the case of use of analogue and digital sound**

## CONCLUSION

The analysis, presented in this report, shows general situation of use, elaboration and international standardization of ENHANCED SECAM system on general background of use of EQTV systems.

Presented analysis allows to make next conclusions.

1 Main dimension of technical progress in television is transition from analogue to digital TV.

2 Transition period is characterized with common use of analogue and digital TV, relationship between which changes in time. This period for some countries may be very short and for other countries may be very long

3 In transition period simultaneously with digital television it is needed to support analogue television, and in countries, for which this period will be long, it may be expedient to use enhanced television, entirely compatible with analogue television and being the bridge between analogue and digital television

4 The use of enhanced TV will allow, without violation working infrastructure of TV broadcasting, to make possible enhancement of analogue TV with use of enhanced TV sets which may be better compatible with digital TV tuners (set top boxes).

5 Enhanced TV may be economically effective, since TV viewer, who will consequently bye enhanced TV set and digital TV tuner (set top box), will not bring additional charges, besides of buying EQTV decoder

6 In some cases it may appear advisable the use of separate elements of enhanced systems

7 Is seems advisable to finish Recommendation and Report on ENHANCED SECAM system on the base of WP 11A drafts for the purpose of creation normative basis for introduction of enhancements in SECAM broadcasting in that cases where it will be expedient. Finishing this Recommendation would be finishing of ITU-R work for standardization enhanced analogue TV systems.

8 It seems needed to harmonize Recommendation ITU-R BS.707-4 and European standard ETS 300 163 by updating last with parameters of digital sound for D,K/SECAM systems and for D1/PAL system.

**9** If to come from that automatic correction of linear distortion in analogue TV signal will be used wide enough and long time enough, it seems needed to update Recommendation ITU-R BT.1124-2 and European standard ETS 300 732 with parameters of system C signal GCR, contained in Report ITU-R BT.2018, for systems with bandwidth 6 MHz, used with systems D,K.

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