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PROCEEDINGS OF THE SECOND INTERNATIONAL WORKSHOP ON SIGNAL PROCESSING OF HDTV, L'AQUILA (IT), 29 FEBRUARY-2 MARCH, 1988 'CHIARIGLIONE, CSELT, TORINO (IT), J. VAN DER MEER ET AL: "MOVEMENT PROCESSING FOR AN HDTV-MAC CODING SYSTEM"' , PAGES 337-344

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Description

The invention relates to a method and apparatus for encoding a television picture signal as defined in the preambles of claims 1 and 2. The invention further relates to a method and apparatus for decoding an encoded television picture signal as defined in the preambles of claims 3 and 4.

Such a television system is described in the Proceedings of the Second International Workshop on Signal Processing of HDTV, 29 February to 3 March 1988, L'Aquila, Italy, in a paper of M.R. Haghiri et al., entitled "Motion Compensated Interpolation applied to HD-MAC pictures encoding and decoding." For television the introduction of high-definition television (HDTV) for home use is described. Based on what is commonly referred to as the MAC-system (Multiplexed Analog Components) with its limited bandwidth a compatible high-definition system (HD-MAC) is described. In the description it is assumed that there must be a balance between the best HD-MAC picture available for specific receivers and the capability of preserving an acceptable quality for existing MAC-receivers. To that end it is proposed to use in the encoder circuit and the complementary, i.e. inversely operating, decoder circuit three picture signal channels having a shortest, a medium and a longest picture signal refresh period, the shortest period being equal to 20 ms. Depending on a motion estimation result one of the three channels is utilized locally in the picture. When the motion exceeds 3 picture elements per picture period (20 ms), the channel having the shortest period is used. For motion between 3 and 0.5 picture elements per picture period the channel having the medium period is used and motion vectors are transmitted to allow for a motion compensated interpolation in a decoder. For motion not exceeding 0.5 picture elements per picture period the channel having the longest period is used. Thus, to achieve the picture signal bandwidth reduction, use is made of splitting the picture into sub-pictures which are stationary or evidence some motion or much motion, respectively. The above-mentioned system has as drawback a rather costly decoder.

it is inter alia an object of the invention to provide a system which allows for a cheaper decoder. To this end, a first aspect of the invention provides an encoding method as defined in claim 1. A second aspect of the invention provides an encoding apparatus as defined in claim 2. A third aspect of the invention provides a decoding apparatus as defined in claim 3. A fourth aspect of the invention provides a decoding method as defined in claim 4.

The invention is inter alia based on the recognition that normally it is not necessary to provide in a chrominance part of a decoder for a picture signal channel having the medium picture signal refresh period and providing a medium resolution, since the eye is not very sensitive to shortcomings in chrominance resolution anyway. As a result of this, a costly chrominance motion vector compensated interpolation section can be avoided. However, if the picture signal originates from film, an optimum picture quality can be obtained by rendering that picture signal channel inoperative that has a picture signal refresh period less than a film frame period. In this situation, it is possible to provide for a simple medium resolution chrominance decoding, since a medium resolution film picture can be obtained by simply combining two received medium resolution fields belonging to the same film frame. The reason of this is that if the picture signal originates from film, no motion vector compensation is necessary because the temporal resolution provided by the film picture signal is low anyway. Due to the resulting mutually different processing operations in the decoder depending on whether the picture signal originates from film or not, it has now become necessary to inform the decoder about the origin of the picture signal.

It is already known per se from the Proceedings of the Second International Workshop on Signal Processing of HDTV, 29 February to 3 March 1988, L'Aquila, Italy, in a paper of J. van der Meer et al. entitled "Movement Processing for an HD-MAC coding system", that in a non motion vector compensated HD-MAC system an optimum picture quality can be obtained by rendering that picture signal channel inoperative that has a picture signal refresh period less than a film frame period. In that system it is however not necessary to inform the decoder about the origin of the picture signal, since the selection signal though only comprising information about the selected picture signal channel, comprises all assistance information necessary to decode the HD-MAC signal.

These and other (more detailed) aspects of the invention and its advantages will now be described and elucidated in greater detail by way of non-limitative example with reference to the accompanying drawings, in which

Fig. 1 is a block circuit diagram of a picture signal source suitable for use in a high-definition television system in accordance with the invention for color television and

Fig. 2 is a block circuit diagram of a high-definition picture display device suitable therefore.

In the block circuit diagram shown in Fig. 1 of a high-definition picture signal source according to the invention, DSS denotes a, for example, digital signal source. Let it be assumed that the picture signal source of Fig. 1 is suitable for use in a HD-MAC color television system, which is illustrated by means of a MAC-encoder circuit MAC ENC and by the designation 1250/50/2:1 at the signal source DSS. The number 1250 indicates the number of television lines per picture period, wherein 50 single interlaced (2:1)

fields form 25 pictures. A television line period, not shown, is equal to 32 µs. The signal source DSS would further be capable of producing a non-interlaced picture signal with which the designation 1250/50/1:1 is associated. The picture signal source DSS supplies, for example, picture signals originating from a television camera or a telecine device with which original 24 Hz film pictures are converted into 25 Hz television pictures. The original film frame period of 41.66 ms is substantially equal to the television picture period of 40 ms and is converted therein, which is indicated by means of a film-television picture period. OT denotes an output of the picture signal source of Fig. 1 which via a picture signal transmission path, not further shown, is coupled to an input IT, shown in Fig. 2, of a high-definition picture display device according to the invention. The connection OT-IT may include a picture signal storage device instead of a transmission channel. Independent of the structure of the connections OT-IT it is assumed that it has a bandwidth which is more limited than the picture signal bandwidth. An example thereof is a transmission or storage bandwidth of 6.75 MHz for a television system 625/50/2:1, whereas an original maximum picture signal bandwidth of 27 MHz is present. This original bandwidth of 27 MHz is present at a luminance signal Y0 which is sampled at a sampling rate of 54 MHz, which is indicated by Y0 (54 MHz). Chrominance signals U0 and V0 having a bandwidth of 13.5 MHz are sampled at a sampling rate of 27 MHz, which is indicated by U0 and V0 (27 MHz). Further sampling rates are designated by (13.5 MHz) and (6.75 MHz). The source DSS is followed by an encoder circuit according to the invention in which a processed luminance signal Y1 (13.5 MHz) and processed chrominance signals U1 and V1 (6.75 MHz) are applied to the encoder circuit MAC ENC. In addition, data signals are applied to the circuit MAC ENC from an encoding circuit DATV ENC, wherein DATV stands for "Digitally Assisted TV", and an applied data signal and sound signal are denoted by DS, SS. In known manner the circuit MAC ENC provides a signal compression and a simultaneous-sequential conversion of the picture signals applied.

In Fig. 1 the luminance signal Y0 is applied to a Y-signal processing circuit PCY, whereas the chrominance signals U0 and V0, respectively, are applied to a similarly structured U0- and V0-signal processing circuit PCU and PCV, respectively. The circuit PCY is further shown in detail with three parallel picture signal channels PC1, PC2 and PC3 which are coupled by a time-division multiplex circuit MUX1 and are connected to the MAC ENC circuit via this multiplex circuit.

The picture signal channel PC1 is shown in the drawing as including a series arrangement of a low-pass filter LPF1, a sampling circuit SC1 which is shown as a switching circuit and to which a sampling clock pulse signal CS is applied and a line shift circuit LS1. The frequency of the clock pulse signal CS is equal to half the luminance sampling rate. The known line shift is illustrated by a solid and a dotted line and an arrow. The circuits SC1 and LS1 provide in known manner a frequency reduction by a factor of four. The channel PC2 is structured in a similar manner with a low-pass filter LPF2, a sampling circuit SC2 and a line shift circuit LS2. The picture signal channel PC3 includes a switching circuit SC4 to which a switching signal VS, occurring with a picture period, is applied, a low-pass filter LPF3 and a sampling circuit SC3 to which the sampling clock pulse signal CS is applied. The switching signal VS provides that the Y0-signal is processed for one field period during each picture period.

The output of the low-pass filter LPF3 is coupled to an input of a motion estimator Mot Est. The motion estimator Mot Est is shown as having three portions wherein 0->0.5, 0.5-> 12 and 12-> illustrate that motion signals S80, S40 and S20, respectively, are supplied as motion estimating results if a motion is detected which is less or greater than a threshold value of 0.5 or 12 picture elements per 40 ms picture period. A dot-and-dash line indicates that in given circumstances, more specifically in a film mode, the motion estimator Mot Est is only operative with a threshold of 0.5 picture elements per picture period, so that also for motion exceeding 12 picture elements per picture period the motion signal S40 contains the information "motion". In addition, the motion estimator Mot Est has an output which is coupled to the encoder circuit DATV ENC for the supply of motion vectors VR thereto, associated with the detection of the threshold values 0.5 or 12 picture elements per picture period being exceeded.

The motion signals S80 and S40 are applied directly and the motion signal S20 via a change-over circuit SC5 to the encoder circuit DATV ENC, the time-division multiplex circuit MUX1 and to two time-division multiplex circuits MUX2 and MUX3. The circuits MUX2 and MUX3 are coupled to outputs of the circuits PCU and PCV. For simplicity, the circuits MUX are shown in the drawing as mechanical switches each having three input terminals T20, T40 and T80 and an output terminal TO, but in practice they operate as electronic switches. When the motion signal S20, S40 or S80 is applied, the terminal T20, T40 or T80, respectively, is through-connected to the terminal TO and signals Y20, U20, V20; Y40, U40, V40 and Y80, U80, V80, respectively, are conveyed. Picture signal refresh periods equal to 20, 40 and 80 ms, respectively, are denoted by 20, 40 and 80. By way of example the values for the shortest, medium and longest picture signal refresh periods are mentioned. More periods and other time durations are possible. The terminals TO are coupled to inputs of the encoder circuit MAC ENC. In the described,

known manner the signals Y1, U1 and V1 are obtained and are applied to the encoder circuit MAC ENC.

In accordance with a feature of the invention the switching circuit SC5 is present which is controlled from a manual or an automatic film mode circuit Film Mod Man or Aut, respectively, more specifically via a selector switch SW1. The circuit Film Mod Aut is supplied with the luminance signal Y0, wherein it is detected that motion is only present per picture period. Instead of this detection which follows from the use of a telecine-signal source, the circuit Film Mod Man can be operative when the use of the film mode is previously known. Instead of a separate circuit Film Mod Man such a circuit might be provided in the signal source DSS. In all three cases there is at the circuit output a film mode information FM which is applied to an output terminal TO of the selector switch SW1 via an input terminal TA or TM. In the drawing, at the selector switch SW1, a free, unconnected terminal TT is shown which in the non-cine film mode is connected to the terminal TO. The terminal TO of the selector switch SW1 is not only coupled to the switching circuit SC5 but also to the encoder circuit DATV ENC, the motion estimator Mot Est and the time-division multiplex circuits MUX2 and MUX3. The film information FM is encoded in the circuit DATV ENC into, for example, one film mode information bit which occurs in the signal at the output OT. In addition, the film information FM shifts the threshold value of 12 picture elements per picture period at the motion estimator Mot Est so that the information "motion" also occurs in the motion signal S40 at higher values. Then a free, unconnected terminal TAM is connected in the switching circuit SC5 to an output terminal TO, instead of an input terminal TT to which the motion signal S20 is applied. It appears that in the film mode the motion signal S20 is suppressed when the circuits MUX are controlled and coding is effected in the circuit DATV ENC. For a design of the motion estimator Mot Est reference is made to the non-prepublished Netherlands' Patent Application 8800452 (PHN 12,453), corresponding to EP-A-0 330 269. To obtain an optimum estimation result in the film mode, reference is made to the non-prepublished Netherlands' Patent Application 8801347 (PHN 12,576), corresponding to EP-A-0 343728. Herein the film information does not only shift the threshold value of 12 picture elements per picture period, but also the estimation of motion is adapted to a further extent by the choice of predetermined fields.

Depending on the fact whether film information FM is applied or not applied to the time-division multiplex circuits MUX2 and MUX3 these circuits operate in different manners. If the film information FM is applied and the motion signal S20 is suppressed at the same time, the circuits MUX2 and MUX3 (and MUX1) operate with picture signal refresh periods equal to 80 and 40 ms. If no film information FM is applied but all three motion signals S80, S40 and S20 are applied to the circuits MUX2 and MUX3, these circuits only operate with picture signal refresh periods equal to 80 and 20 ms. Thus, during a non-film mode (SW1, TT) a luminance encoding circuit (PCY, MUX1) is operative with all three picture signal channels PC1, PC2 and PC3, while chrominance encoding circuits (PCU, MUX2) and (PCV, MUX3) operate with the shortest and longest picture signal refresh periods, respectively, of 20 ms and 80 ms, respectively. During a film mode (SW1, TA, TM) the luminance encoding circuit (PCY, MUX1) and the chrominance encoder circuits (PCU, MUX2) and (PCV, MUX3) all three operate with the longest and the medium picture signal refresh periods of 80 and 40 ms, respectively,

In the block circuit diagram of the high-definition picture display device of Fig. 2, the input IT is coupled to an input of a decoder circuit MAC DEC which operates in a manner complementary to, and the inverse of the encoder circuit MAC ENC of Fig. 1. References used in Fig. 1 are used in a similar manner or in the same manner provided with an accent in Fig. 2. The circuit MAC DEC produces data signals and sound signals DS′, SS′, a luminance signal Y1′ and chrominance signals U1′ and V1′. An output of the circuit MAC DEC is coupled to an input of a decoder circuit DATV DEC which operates in a manner which is complementary to and the inverse of that of the encoder circuit DATV ENC. The circuit DATV DEC produces data signals DS′, motion vectors VR′, a film information FM′ and signals S80, S40 and S20 in the non-film mode (SW1, TT).

In the film mode (SW1, TA, TM) described with reference to Fig. 1, the signals S20 do not occur, which is illustrated in Fig. 2 by the fact that S20 is deleted there. A time-division multiplex circuit MUX11, the operation of which follows that of the circuit MUX1 of Fig. 1, is supplied with the signals S80 and S40. The signal S80 is applied to time-division multiplex circuits MUX12 and MUX13, the absence of this signal S80 implying an information (S40). For the sake of clarity, the information (S40) is denoted at the film information FM′.

Fig. 2 shows an Y-signal processing circuit PCY′ comprising three signal channels PC11, PC12 and PC13. The channels PC11 and PC12 operate in a manner complementary and inversely to the channels PC1 and PC2 of Fig. 1. The channel PC1 comprises a series arrangement of a line shift circuit LS11, a sample insertion circuit SC11 and a low-pass filter LPF11. Inserting the samples is denoted at the circuit SC11 by "0" and a change-over switch. The channel PC12 is of an identical structure comprising circuits LS12 and LSC12 and a filter LPF12. In the film mode (SW1, TA, TM) only the output signals of signal channels PC11 and PC13 are employed, which are indicated by Y80′ and Y40′.

The signal channel PC13 includes a sample insertion circuit SC13 and a subsequent low-pass filter LPF13. An output of the filter (LPF13) is coupled to inputs of a change-over circuit SC14, an interpolation circuit Int and a memory circuit MEM40 having a memory period equal to a 40 ms picture period. An output of the circuit MEM40 is coupled to a further input of the interpolation circuit Int, to a control input of which the motion vectors VR' are applied. An output of the interpolation circuit Int is coupled to a further input of the switching circuit SC14, to a switching input of which a signal VS' is applied. The switching circuit SC14 and the circuits Int and MEM40 operate complementary and inversely to the switching circuit SC4 of Fig. 1. This results in a signal Y40' being supplied by the signal channel PC13. A processed luminance signal Y0' (54 MHz) is obtained via the time-division multiplex circuit MVX11 for application to a high-definition picture display device HDTV suitable for a (1250/50/2:1) display. In the presence of a low-definition picture display device, not shown, the signals produced by the MAC DEC decoder circuit can directly be utilized for the display. A compatibility between the high- and the low-definition display are here present. The circuit components between the circuit MAC DEC and the picture display device HDTV effect a bandwidth reduction decoding to the high definition.

Fig. 2 shows a U1'-signal processing circuit PCU' in detail, it being assumed that a V1'-signal processing circuit PCV' is of a similar structure. Comparable to the signal channel PC11, a signal channel PC21 is provided with a line shifting circuit LS21, a sample insertion circuit SC21 and a low-pass filter LPF21 and supplies a signal U80'. A signal channel PC22 comprises circuits LS22 and SC22 and a low-pass filter LPF22, of which however an output is coupled to an input of a switching circuit SW11 which further forms part of a signal channel PC23. In the signal channel PC23 the signal U1' is applied to a further input of the switching circuit SW11 via a sample insertion circuit SC23 and a low-pass filter LPF23. T20 and T40 denote input terminals of the circuit SW11 which are connectable to an output terminal TO under the control of the film information FM' (S40). In this situation, the switching circuit SW11 has a film mode position (SW11, T40) and a non-film mode position (SW11, T20). Fig. 2 illustrates that during the film mode (SW1, TA, TM) of Fig. 1 and (SW11, T40) of Fig. 2, the signal channels PC21 (80 ms) and PC23 (40 ms) are operative in a chrominance decoder circuit (PCU', MUX12), during the non-film modes (SW1, TT) of Fig. 1 and (SW11, T20) of Fig. 2, the signal channels PC21 (80 ms) and PC22 (20 ms) being active. At the circuits MUX12 and MUX13 this is shown in greater detail by means of terminals T80 and T20,40. The same as the circuit PCU' produces the signals U80' and U40' during the film mode (SW1, TA, TM) and (SW11, T40), the circuit PCV' produces the signals V80' and V40'. As signals U0' and V0' (27 MHz) these signals are applied to the high-definition picture display device HDTV. Thus, the signals Y0', U0' and V0' are applied via a synchronized time-division multiplex circuit (MUX11, 12, 13) to the picture display device HDTV, under the control of the signals S80, S40 and, possibly, S20, which are obtained from the estimation results. It is achieved that the system as shown in Figs. 1 and 2 operates with a film mode (SW1, TA, TM) and (SW11, T40) and a non-film mode (SW1, TT) and (SW11, T20). During the film mode the picture signal source of Fig. 1 and more specifically the source DSS therein supplies a picture signal associated with a film having frames between which motion is present in the pictures, more specifically periodically with a film frame period of approximately 40 ms. During the film mode the picture signal channel (for example PC2) in the encoder circuit (for example PCY, MUX1) and the picture signal channel (for example PC12) in the decoder circuit (for example PCY', MUX11) having the picture signal refresh period of 20 ms, is in operative.

The detailed structure, shown in Fig. 2, of the circuits PCU' and MUX12 may be provided in Fig. 1, operating in the complementary, inverse mode, instead of the structure including the circuit PCU and MUX2.

In the foregoing numerous aspects are described in detail, which aspects are based on the following:

When the picture signal refresh periods equal to 80, 40 and 20 ms are used, the algorithm also implies a 25 Hz film mode in which the 20 ms signal channel is eliminated, as a result of which the picture resolution increases significantly in all aspects.

During the chrominance coding, no motion compensation is employed and two picture signal processing channels are active. During a 50 Hz mode, the 80 ms and 20 ms channels are used and during the 25 Hz film mode the 80 ms and 40 ms channels are used. Basically, the chrominance channels are identical to the luminance channels, comprising filters, sampling circuits and line shift circuits, but are operative for U and V input signals sampled at 27 MHz, producing a multiplex UV output signal. The film mode is indicated by one information bit.

During the motion estimation with the two threshold values 0.5 and 12 picture elements per 40 ms, only exceeding the threshold value at 0.5 picture element per 40 ms is taken into account during the 25 Hz film mode.

Claims

1. Method of encoding a television picture signal to obtain an encoded television picture signal, comprising the steps of:

   determining (Mot Est) motion vectors (VR) relating to motion between subsequent pictures

of said television picture signal,

selecting (MUX1, MUX2, PCY, PCU, PCV) one bandwidth reduction operation mode out of a plurality of possible bandwidth reduction operation modes on said television picture signal in dependence upon a bandwidth reduction operation mode selection signal (S80, S40, S20) obtained from said television picture signal, to obtain a bandwidth reduced television picture signal (Y1, U1, V1),

digitally encoding (DATV ENC) said bandwidth reduction operation mode selection signal (S80, S40, S20) and said motion vectors (VR) to obtain an assisting signal (DATV) to inform a decoder which one of said plurality of bandwidth reduction operation modes has been selected and about said motion vectors (VR), and

encoding (MAC ENC) said bandwidth reduced television picture signal (Y1, U1, V1) and said assisting signal (DATV) to obtain.said encoded television picture signal,

characterized

by furnishing (Film Mod Aut/Man) a film mode information signal (FM) indicating whether said television picture signal originates from cine film,

in that said selecting step (MUX1, MUX2, PCY, PCU, PCV) depends upon both said bandwidth reduction operation mode selection signal (S80, S40, S20) and said film mode information signal (FM), and

by digitally encoding (DATV ENC) said film mode information signal (FM) to obtain a digitally encoded film mode information signal, said assisting signal (DATV) also comprising said digitally encoded film mode information signal to inform said decoder whether said television picture signal originates from cine film.

2. Apparatus for encoding a television picture signal to obtain an encoded television picture signal, comprising:

motion control means (Mot Est) for receiving said television picture signal and for determining motion vectors (VR) relating to motion between subsequent pictures of said television picture signal, and for furnishing a bandwidth reduction operation mode selection signal (S80, S40, S20),

means (MUX1, MUX2, PCY, PCU, PCV) for selecting one bandwidth reduction operation mode out of a plurality of possible bandwidth reduction operation modes on said television picture signal in dependence upon on said bandwidth reduction operation mode selection signal (S80, S40, S20), to obtain a bandwidth reduced television picture signal (Y1, U1, V1),

means (DATV ENC) for digitally encoding said bandwidth reduction operation mode selection signal (S80, S40, S20) and said motion vectors (VR) to obtain an assisting signal (DATV) to inform a decoder which one of said plurality of bandwidth reduction operation modes has been selected and about said motion vectors (VR), and

means (MAC ENC) for encoding said bandwidth reduced television picture signal (Y1, U1, V1) and said assisting signal (DATV), to obtain said encoded television picture signal,

characterized

by means (Film Mod Aut/Man) for furnishing a film mode information signal (FM) indicating whether said picture signal originates from cine film,

in that said selecting means (MUX1, MUX2, PCY, PCU, PCV) are coupled to said furnishing means to receive said film mode information signal (FM) to select said one bandwidth reduction operation mode in dependence upon both said bandwidth reduction operation mode selection signal (S80, S40, S20) and said film mode information signal (FM), and

by means for digitally encoding said film mode information signal (FM) to obtain a digitally encoded film mode information signal, said assisting signal (DATV) also comprising said digitally encoded film mode information signal to inform said decoder whether said television picture signal originates from cine film.

3. Apparatus for decoding an input television picture signal to obtain a decoded television picture signal, comprising:

means (MAC DEC) for decoding said input television picture signal to obtain a television picture signal to be processed (Y1', U1', V1') and an assisting signal (DATV) including a bandwidth reduction decoding operation mode selection signal (S20, S40, S80) and a motion vector information signal (VR'),

means (MUX11, MUX12, PCY', PCU', PCV') coupled to said decoding means to receive said bandwidth reduction decoding operation mode selection signal (S20, S40, S80) and said motion vector information signal (VR'), for selecting one bandwidth reduction decoding operation mode out of a plurality of possible bandwidth reduction decoding operation modes (PC11, PC12, PC13) on said television picture signal to be processed (Y1', U1', V1') in dependence upon said bandwidth reduction decoding operation mode selection signal (S20, S40, S80), at least one (PC13) of said plurality of possible bandwidth reduction decoding operation modes (PC11, PC12, PC13) including a motion vector compensated interpolation using said motion vector information signal (VR'),

characterized in that

said selecting means (MUX11, MUX12, PCY', PCU', PCV') are adapted to also receive a film mode information signal (FM') included in said assisting signal (DATV) and indicating whether said input television picture signal originates from cine film, to select one bandwidth reduction decoding operation mode in dependence upon both said bandwidth reduction decoding operation mode selection signal (S20, S40, S80) and said film mode information signal (FM').

4. A method of decoding an input television picture signal to obtain a decoded television picture signal, comprising the steps of:

decoding (MAC DEC) said input television picture signal to obtain a television picture signal to be processed (Y1', U1', V1') and an assisting signal (DATV) including a bandwidth reduction decoding operation mode selection signal (S20, S40, S80) and a motion vector information signal (VR'),

selecting (MUX11, MUX12, PCY', PCU', PCV') one bandwidth reduction decoding operation mode out of a plurality of possible bandwidth reduction decoding operation modes (PC11, PC12, PC13) on said television picture signal to be processed (Y1', U1', V1') in dependence upon said bandwidth reduction decoding operation mode selection signal (S20, S40, S80), at least one (PC13) of said plurality of possible bandwidth reduction decoding operation modes (PC11, PC12, PC13) including a motion vector compensated interpolation using said motion vector information signal (VR'),

characterized in that

said selecting step (MUX11, MUX12, PCY', PCU', PCV') is in dependence upon both said bandwidth reduction decoding operation mode selection signal (S20, S40, S80) and a film mode information signal (FM') included in said assisting signal (DATV) to indicate whether said input television picture signal originates from cine film.

Patentansprüche

1. Verfahren zum Codieren eines Fernsehbildsignals zum Erhalten eines codierten Fernsehbildsignals, wobei dieses verfahren die nachfolgenden Verfahrensschritte umfaßt:

das Bestimmen (Mot Est) von Bewegungsvektoren (VR), die sich auf Bewegung zwischen aufeinanderfolgenden Bildern des genannten Fernsehbildsignals beziehen,

das Selektieren (MUX1, MUX2, PCY, PCU, PCV) nur einer Bandbreitenverringerungsbetriebsart aus vielen möglichen Bandbreitenverringerungsbetriebsarten in dem genannten Fernsehsignals abhängig von einem Bandbreitenverringerungsbetriebsartselektionssignal (S80, S40, S20), erhalten von dem genannten Fernsehbildsignal zum Erhalten eines bandbreitenverringerten Fernsehbildsignals (Y1, U1, V1),

das digitale Codieren (DATV ENC) des genannten Bandbreitenverringerungsbetriebsartsignals (S80, S40, S20) und der genannten Bewegungsvektoren (VR) zum Erhalten eines Hilfssignals (DATV) zum Informieren eines Decodierers, welche der genannten Anzahl Bandbreitenverringerungsbetriebsarten selektiert worden ist und über die genannten Bewegungsvektoren (VR), und

das Codieren (MAC ENC) des genannten bandbreitenverringerten Fernsehbildsignals (Y1, U1, V1) und des genannten Hilfssignals (DATV) zum Erhalten des genannten codierten Fernsehbildsignals,

gekennzeichnet

durch die Lieferung (Film Mod Aut/Man) eines Filmbetriebsartinformationssignals (FM), wobei angegeben wird, ob das genannte Fernsehbildsignal von einem Film herrührt,

dadurch, daß der genannte Selektionsschritt (MUX1, MUX2, PCY, PCU, PCV) von dem genannten Bandbreitenverringerungsbetriebsartselektionssignal (S80, S40, S20) sowie dem genannten Filmbetriebsartinformationssignal (FM) abhängig ist, und durch digitale Codierung (DATV ENC) des genannten Filmbetriebsartinformationssignals (FM) zum Erhalten eines digital codierten Filmbetriebsartinformationssignals, wobei das genannte Hilfssignal (DATV) ebenfalls das genannte digital codierte Filmbetriebsartinformationssignal enthält zum Informieren des genannten Decoders, ob das genannte Fernsehbildsignal von Film herrührt.

2. Anordnung zum Codieren eines Fernsebildsignals zum Erhalten eines codierten Fernsehbildsignals, mit:

Bewegungssteuermitteln (Mot Est) zum Empfangen des genannten Fernsehbildsignals und zum Bestimmen der Bewegungsvektoren (VR), die sich auf Bewegung zwischen aufeinanderfolgenden Bildern des genannten Fernsehbildsignals beziehen, und zum Liefern eines Bandbreitenverringerungsbetriebsartselektions signals (S80, S40, S20),

Mitteln (MUX1, MUX2, PCY, PCU, PCV) zum Selektieren nur einer Bandbreitenverringerungsbetriebsart aus einer Anzahl möglicher Bandbreitenverringerungsbetriebsarten in dem genannten Fernsehbildsignals abhängig von dem genannten Bandbreitenverringerungsbe-

triebsartselektionssignal (S80, S40, S20), zum Erhalten eines bandbreitenverringerten Fernsehbildsignals (Y1, U1, V1),

Mitteln (DATV ENC) zum digitalen Codieren des genannten Bandbreitenverringerungsbetriebsartselektionssignals (S80, S40, S20) und der genannten Bewegungsvektoren (VR) zum Erhalten eines Hilfssignals (DATV) zum Informieren eines Decoders, welche der Anzahl Bandbreitenverringerungsbetriebsarten selektiert worden ist und über die genannten Bewegungsvektoren (VR), und

Mitteln (MAC ENC) zum Codieren des genannten bandbreitenverringerten Fernsehbildsignals (Y1, U1, V1) und des genannten Hilfssignals (DATV), zum Erhalten des codierten Fernsehbildsignals,

gekennzeichnet

durch Mittel (Film Mod Aut/Man) zum Liefern eines Filmbetriebsartinformationssignals (FM), das angibt, ob das genannte Bildsignal von Film herrührt,

dadurch, daß die genannten Selektionsmittel (MUX1, MUX2, PCY, PCU, PCV) mit den genannten Lieferungsmitteln gekoppelt sind zum Empfangen des genannten Filmbetriebsartinformationssignals (FM), und

durch Mittel zum digitalen Codieren des genannten Filmbetriebsartinformationssignals (FM) zum Erhalten eines digital codierten Filmbetriebsartinformationssignals, wobei das genannte Hilfssignal (DATV) ebenfalls das genannte digital codierte Filmbetriebsartinformationssignal enthält um dem Decoder mitzuteilen, ob das genannte Fernsehbildsignal von Film herrührt.

3. Anordnung zum Decodieren eines Eingangsfernsehbildsignals zum Erhalten eines decodierten Fernsehbildsignals, wobei diese Anordnung die nachfolgenden Elemente umfaßt:

Mittel (MAC DEC) zum Decodieren des genannten Eingangsfernsehbildsignals zum Erhalten eines zu verarbeitenden Fernsehbildsignals (Y1', U1', V1') sowie eines Hilfssignals (DATV) mit einem Bandbreitenverringerungsdecodierungsbetriebsartselektionssignals (S20, S40, S80) und einem Bewegungsvektorinformationssignal (VR'),

Mittel (MUX11, MUX12, PCY', PCU', PCV'), die mit den genannten Decodierungsmitteln gekoppelt sind, zum Empfangen des genannten Bandbreitenverringerungsdecodierungsbetriebsartselektionssignals (S20, S40, S80) und des genannten Bewegungsvektorinformationssignals (VR') zum Selektieren eines Bandbreitenverringerungsdecodierungsbetriebsart aus einer Anzahl möglicher Bandbreitenverringerungsdecodierungsbetriebsarten (PC11, PC12, PC13) in dem genannten zu verarbeitenden Fernsehbildsignal (Y1', U1', V1') abhängig von dem genannten Bandbreitenverringerungsdecodierungsbetriebsartselektionssignals (S20, S40, S80), wobei wenigstens eine (PC13) der genannten Anzahl möglicher Bandbreitenverringerungsdecodierungsbetriebsarten (PC11, PC12, PC13) mit einer bewegungsvektorkompensierten Interpolation das genannte Bewegungsvektorinformationssignal (VR') benutzt,

dadurch gekennzeichnet, daß

die genannten Selektionsmittel (MUX11, MUX12, PCY', PCU', PCV') dazu vorgesehen sind, ebenfalls ein Filmbetriebsartinformationssignal (FM') innerhalb des genannten Hilfssignals (DATV) zu empfangen, das angibt, ob das genannte Eingangsfernsehbildsignal von Film herrührt, zum Selektieren einer Bandbreitenverringerungsdecodierungsbetriebsart abhängig von dem genannten Bandbreitenverringerungsdecodierungsbetriebsartselektionssignal (S20, S40, S80)und von dem genannten Filmbetriebsartinformationssignal (FM').

4. Verfahren zum Decodieren eines Eingangsfernsehbildsignals zum Erhalten eines decodierten Fernsehbildsignals, wobei dieses Verfahren die nachfolgenden Verfahrensschritte umfaßt:

das Decodieren (MAC DEC) des genannten Eingangsfernsehbildsignals zum Erhalten eines zu verarbeitenden Fernsehbildsignals (Y1', U1', V1') und eines Hilfssignals (DATV) mit einem Bandbreitenverringerungsdecodierungsbetrieb sartselektionssignal (S20, S40, S80) und einem Bewegungsvektorinformationssignal (VR'),

das Selektieren (MUX11, MUX12, PCY', PCU', PCV') einer Bandbreitenverringerungsdecodierungsbetriebsart aus einer Anzahl möglicher Bandbreitenverringerungsdecodierungsbetriebsarten (PC11, PC12, PC13) in dem genannten zu verarbeitenden Fernsehbildsignal (Y1', U1', V1') anhängig von dem genannten Bandbreitenverringerungsdecodierungsbetriebsartselektionssignal (S20, S40, S80), wobei wenigstens eine (PC13) der genannten Anzahl möglicher Bandbreitenverringerungsdecodierungsbetrieb sarten (PC11, PC12, PC13) mit einer bewegungsvektorkompensierten Interpolation das genannte Bewegungsvektorinformationssignal (VR') benutzt,

dadurch gekennzeichnet, daß

der genannte Selektionsschritt (MUX11, MUX12, PCY', PCU', PCV') abhängig ist von dem genannten Bandbreitenverringerungsdecodierungsbetriebsartselektionssignal (S20, S40, S80) sowie von einem Filmbetriebsartsignal (FM') in dem genannten Hilfssignal (DATV) um anzugeben, ob das genannte Eingangsfernseh-

bildsignal von Film herrührt.

Revendications

1. Procédé de codage d'un signal image de télévision pour obtenir un signal image de télévision codé, comprenant les étapes suivantes :

on détermine (Mot Est) des vecteurs de mouvement (VR) se rapportant au mouvement entre des images successives dudit signal image de télévision;

on sélectionne (MUX1, MUX2, PCY, PCU, PCV) un mode opératoire de réduction de largeur de bande parmi une pluralité de modes opératoires de réduction de largeur de bande possibles sur ledit signal image de télévision en fonction d'un signal de sélection de mode opératoire de réduction de largeur de bande (S80, S40, S20) obtenu dudit signal image de télévision, pour obtenir un signal image de télévision à largeur de bande réduite (Y1, U1, V1);

on code numériquement (DATV ENC) ledit signal de sélection de mode opératoire de réduction de largeur de bande (S80, S40, S20) et lesdits vecteurs de mouvement (VR) pour obtenir un signal d'assistance (DATV) en vue d'informer un décodeur au sujet de celui de ladite pluralité de modes opératoires de réduction de largeur de bande qui a été sélectionné et desdits vecteurs de mouvement (VR), et

on code (MAC ENC) ledit signal image de télévision à largeur de bande réduite (Y1, U1, V1) et ledit signal d'assistance (DATV) pour obtenir ledit signal image de télévision codé,

caractérisé en ce que :

on fournit (Film Mod Aut/Man) un signal d'information de mode film (FM) indiquant si ledit signal image de télévision provient d'un film de cinéma;

ladite étape de sélection (MUX1, MUX2, PCY, PCU, PCV) dépendant à la fois dudit signal de sélection de mode opératoire de réduction de largeur de bande (S80, S40, S20) et dudit signal d'information de mode film (FM), et

on code numériquement (DATV ENC) ledit signal d'information de mode film (FM) pour obtenir un signal d'information de mode film codé numériquement, ledit signal d'assistance (DATV) comprenant également ledit signal d'information de mode film codé numériquement pour informer ledit décodeur si ledit signal image de télévision provient d'un film de cinéma.

2. Appareil de codage d'un signal image de télévision pour obtenir un signal image de télévision codé, comprenant :

des moyens de commande de mouvement (Mot Est) pour recevoir ledit signal image de télévision et pour déterminer des vecteurs de mouvement (VR) se rapportant à un mouvement entre des images successives dudit signal image de télévision, et pour fournir un signal de sélection de mode opératoire de réduction de largeur de bande (S80, S40, S20);

des moyens (MUX1, MUX2, PCY, PCU, PCV) pour sélectionner un mode opératoire de réduction de largeur de bande parmi une pluralité de modes opératoires de réduction de largeur de bande possibles sur ledit signal image de télévision en fonction d'un signal de sélection de mode opératoire de réduction de largeur de bande (S80, S40, S20) pour obtenir un signal image de télévision à largeur de bande réduite (Y1, U1, V1);

des moyens (DATV ENC) pour coder numériquement ledit signal de sélection de mode opératoire de réduction de largeur de bande (S80, S40, S20) et lesdits vecteurs de mouvement (VR) pour obtenir un signal d'assistance (DATV) pour informer un décodeur au sujet de celui de ladite pluralité des modes opératoires de réduction de largeur de bande qui a été sélectionné et desdits vecteurs de mouvement (VR), et

des moyens (MAC ENC) pour coder ledit signal image de télévision à largeur de bande réduite (Y1, U1, V1) et ledit signal d'assistance (DATV) pour obtenir ledit signal image de télévision codé,

caractérisé par :

des moyens (Film Mod Aut/Man) pour fournir un signal d'information de mode film (FM) indiquant si ledit signal image de télévision provient d'un film de cinéma;

en ce que des moyens de sélection (MUX1, MUX2, PCY, PCU, PCV) sont couplés auxdits moyens de fourniture pour recevoir ledit signal d'information de mode film pour sélectionner ledit mode opératoire de réduction de largeur de bande en fonction dudit signal de sélection de mode opératoire de réduction de largeur de bande (S80, S40, S20) et dudit signal d'information de mode film (FM), et

des moyens pour coder numériquement ledit signal d'information de mode film (FM) pour obtenir un signal d'information de mode film codé numériquement, ledit signal d'assistance (DATV) comprenant également ledit signal d'information de mode film codé numériquement pour informer ledit décodeur si ledit signal image de télévision provient d'un film de cinéma.

3. Appareil de décodage d'un signal image de télévision d'entrée pour obtenir un signal image de télévision décodé, comprenant :

des moyens (MAC DEC) pour décoder le-

dit signal image de télévision d'entrée pour obtenir un signal image de télévision à traiter (Y1', U1', V1') et un signal d'assistance (DATV) comprenant un signal de sélection de mode opératoire de décodage de réduction de largeur de bande (S20, S40, S80) et un signal d'information de vecteurs de mouvement (VR'), et

des moyens (MUX11, MUX12, PCY', PCU', PCV') couplés audits moyens de décodage pour recevoir ledit signal de sélection de mode opératoire de décodage de réduction de largeur de bande (S20, S40, S80) et ledit signal d'information de vecteurs de mouvement (VR') pour sélectionner un mode opératoire de décodage de réduction de largeur de bande parmi une pluralité de modes opératoires de décodage de réduction de largeur de bande possibles (PC11, PC12, PC13) sur ledit signal image de télévision à traiter (Y1', U1', V1') en fonction dudit signal de sélection de mode opératoire de décodage de réduction de largeur de bande (S20, S40, S80), au moins l'un (PC13) de ladite pluralité de modes opératoires de décodage de réduction de largeur de bande (PC11, PC12, PC13) comprenant une interpolation compensée par vecteur de mouvement utilisant ledit signal d'information de vecteurs de mouvement (VR'),

caractérisé en ce que :

lesdits moyens de sélection (MUX11, MUX12, PCY', PCU', PCV') sont à même de recevoir un signal d'information de mode film (FM') compris dans ledit signal d'assistance (DATV) et indiquant si ledit signal image de télévision d'entrée provient d'un film cinématographique, pour sélectionner un mode opératoire de décodage de réduction de largeur de bande en fonction dudit signal de sélection de mode opératoire de décodage de réduction de largeur de bande (S20, S40, S80) et dudit signal d'information de mode film (FM').

4. Procédé de décodage d'un signal image de télévision d'entrée pour obtenir un signal image de télévision décodé, comprenant les étapes suivantes :

on décode (MAC DEC) ledit signal image de télévision d'entrée pour obtenir un signal image de télévision à traiter (Y1', U1', V1') et un signal d'assistance (DATV) comprenant un signal de sélection de mode opératoire de réduction de largeur de bande (S20, S40, S80) et un signal d'information de vecteurs de mouvement (VR'), et

on sélectionne (MUX11, MUX12, PCY', PCU', PCV') un mode opératoire de décodage de réduction de largeur de bande parmi une pluralité de modes opératoires de décodage de réduction de largeur de bande (PC11, PC12, PC13) sur ledit signal image de télévision à traiter (Y1', U1', V1') en fonction dudit signal de sélection de mode opératoire de décodage de réduction de largeur de bande (S20, S40, S80), au moins l'un de ladite pluralité de modes opératoires de décodage de réduction de largeur de bande possibles (PC11, PC12, PC13) comprenant une interpolation compensée par vecteur de mouvement utilisant ledit signal d'information de vecteurs de mouvement (VR'),

caractérisé en ce que :

ladite étape de sélection (MUX11, MUX12, PCY', PCU', PCV') est fonction à la fois dudit signal de sélection de mode opératoire de décodage de réduction de largeur de bande (S20, S40, S80) et d'un signal d'information de mode film (FM') compris dans ledit signal d'assistance (DATV) pour indiquer si ledit signal image de télévision d'entrée provient d'un film de cinéma.

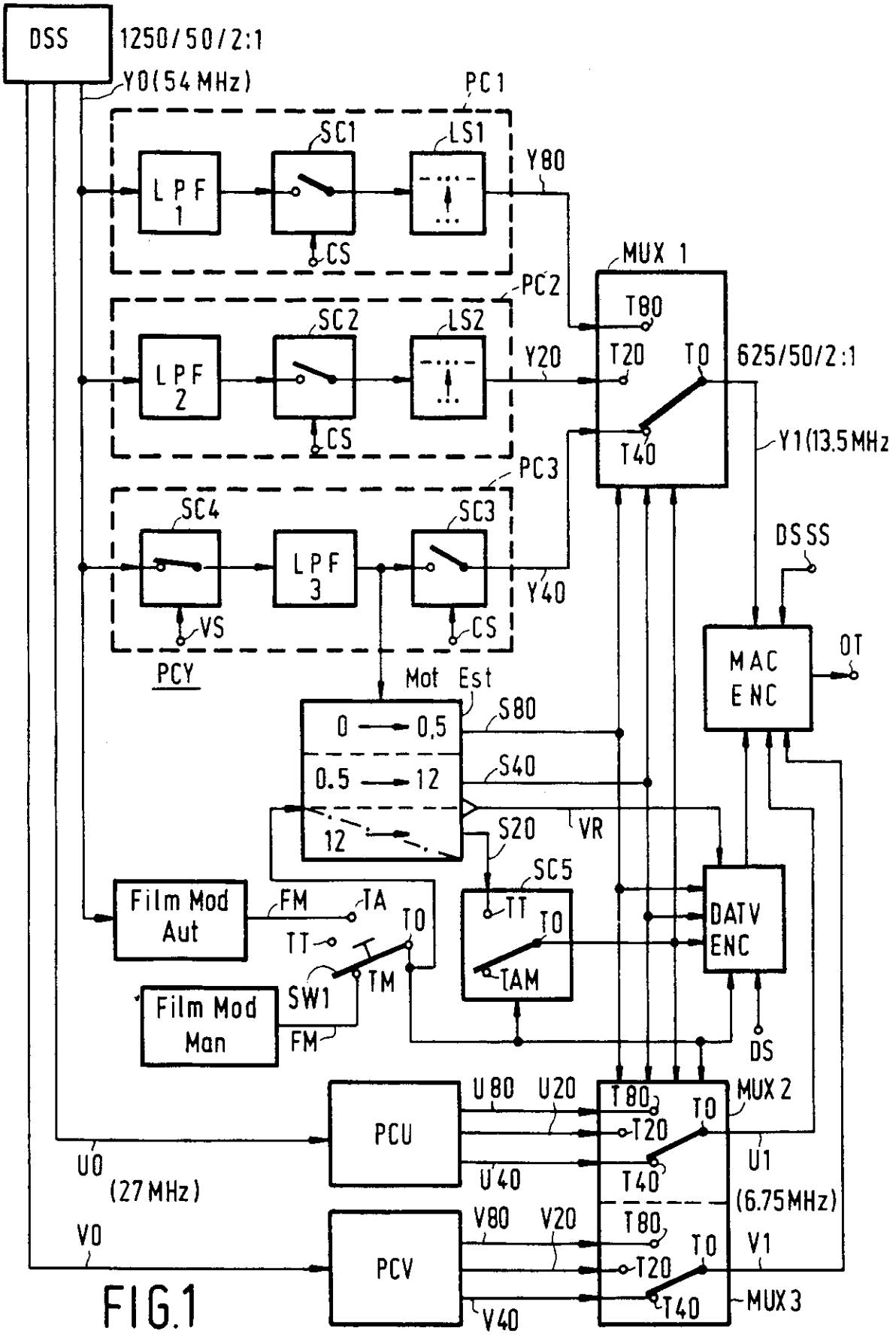
DSS
1250/50/2:1
Y0(54 MHz)
PC1
SC1
LS1
LPF 1
Y80
CS
PC2
SC2
LS2
LPF 2
Y20
CS
PC3
SC4
SC3
LPF 3
Y40
VS
CS
PCY
MUX 1
T80
T20
T0
625/50/2:1
T40
Y1(13.5MHz
DSSS
MAC ENC
OT
Mot Est
0 → 0,5
S80
0.5 → 12
S40
12
S20
VR
SC5
TT
T0
TAM
Film Mod Aut
FM
TA
TT
T0
SW1
TM
Film Mod Man
FM
DATV ENC
DS
PCU
U80
U20
U40
U0
(27 MHz)
MUX 2
T80
T20
T0
T40
U1
(6.75MHz)
PCV
V80
V20
V40
V0
T80
T20
T0
T40
V1
MUX 3

FIG.1

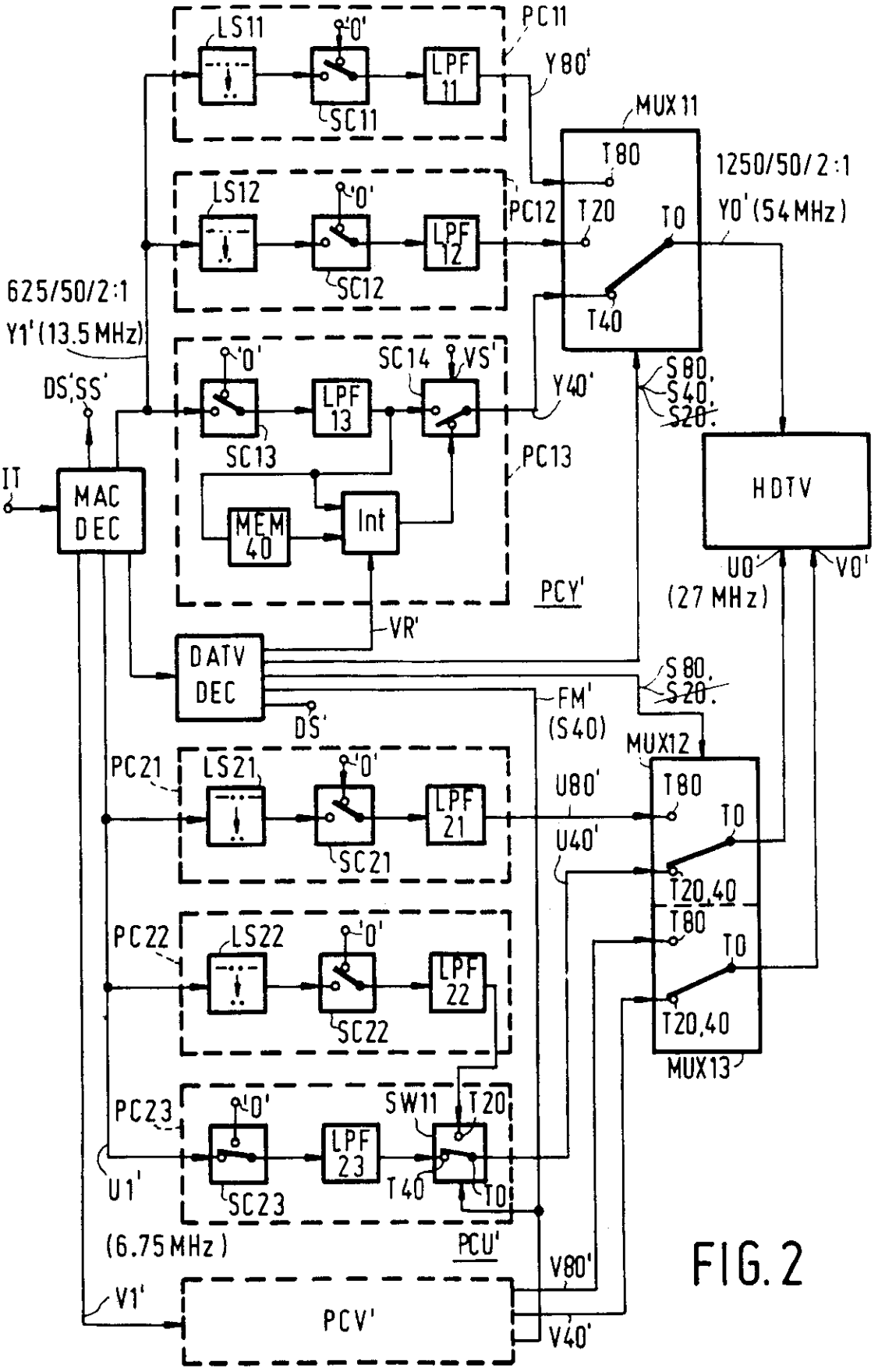
LS11
'0'
PC11
LPF 11
Y80'
SC11
MUX11
T80
1250/50/2:1
Y0'(54MHz)
LS12
'0'
PC12
T20
T0
LPF 12
SC12
625/50/2:1
Y1'(13.5MHz)
T40
'0'
SC14
'VS'
S80,
S40,
S20
DS,SS'
LPF 13
Y40'
SC13
PC13
IT
MAC DEC
MEM 40
Int
HDTV
U0'
V0'
(27 MHz)
PCY'
VR'
DATV DEC
S80,
S20
FM'
(S40)
DS'
MUX12
PC21
LS21
'0'
U80'
T80
T0
LPF 21
SC21
U40'
T20,40
PC22
LS22
'0'
T80
T0
LPF 22
SC22
T20,40
MUX13
PC23
'0'
SW11
T20
LPF 23
T40
T0
U1'
SC23
(6.75MHz)
PCU'
V80'
V1'
PCV'
V40'

FIG. 2

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