Letterbox television signal decoding.

The invention relates to a method and apparatus for decoding a letterbox television signal, *i.e.* a standard aspect ratio television signal comprising a wide aspect ratio center part and black bars at the upper and lower sides of the center part, whereby the center part and the upper and lower black bars together constitute the standard aspect ratio television signal, in order to furnish a wide aspect ratio output picture. More specifically, the invention relates to an efficient memory architecture for use in the letterbox television decoding.

The article "Neue Fernseher noch dieses Jahr", Funkschau 13/1994, pp. 54-57, discloses a letterbox television signal decoder of the type described above. In the article, a diagram shows a first serial video processor SVP1 for furnishing center part luminance signals Y and chrominance signals U, V, as well as a second serial video processor SVP2 for combining the center part luminance signal Y and a vertical resolution helper luminance signal Yh from a helper demodulator into an output luminance signal of a wide aspect ratio output picture. The second serial video processor SVP2 also upconverts the center part chrominance signals U, V into an output chrominance signal of the wide aspect ratio output picture. The article gives no details about any memories required for storing the center part luminance signals Y and the vertical resolution helper luminance signals Yh to furnish input luminance signals for the combining operation in the second serial video processor SVP2.

It is, *inter alia,* an object of the invention to provide a very efficient use of required memory. To this end, a first aspect of the invention provides a method as defined in claim 1. A second aspect of the invention provides a apparatus as defined in claim 2.

According to the invention, in a method of decoding a letterbox television signal which comprises a wide aspect ratio center part and upper and lower black bars located at the respective upper and lower sides of the wide aspect ratio center part, the wide

aspect ratio center part and the black bars together constituting a standard aspect ratio television signal, the black bars conveying additional signals for increasing a vertical resolution of the center part, additional signals from the upper black bar and a lower half of the center part are stored in a first memory, and an upper half of the center part and additional signals from the lower black bar are stored in a second memory. Subsequently, the upper black bar additional signals and the upper half of the center part are combined to form an upper half of a wide aspect ratio output picture, and the lower black bar additional signals and the lower half of the center part are combined to form an lower half of the wide aspect ratio output picture. This mixed and crossed storage of the upper black bar additional signals and lower half of the center part on the one hand, and of the upper half of the center part and the lower black bar additional signals on the other hand, provides the advantage that both memories can be read out sequentially and do not need to be addressable. Consequently, a cost advantage is obtained. The invention can advantageously be used for decoding PALplus television signals, whereby the black bar signals and the center part signals are combined as prescribed by the PALplus standard.

These and other aspects of the invention will be apparent from and elucidated with reference to the embodiments described hereinafter.

In the drawing:

Fig. 1 illustrates an embodiment of a letterbox television signal decoder in accordance with the present invention.

The left-hand side of Fig. 1 illustrates a letterbox television signal with an upper black bar BB1, a center part CP, and a lower black bar BB2. The center part luminance and chrominance signals of this letterbox signal may be provided by the first serial video processor SVP1 shown in the article "Neue Fernseher noch dieses Jahr", Funkschau 13/1994, pp. 54-57, incorporated herein by reference. The first serial video processor SVP1 has thus carried out a motion-adaptive "colorplus" decoding to furnish luminance and chrominance signals with reduced cross-artifacts. The black bars BB1, BB2 convey additional vertical resolution helper luminance signals for increasing the vertical resolution of the center part luminance signals. A combining filter CF combines the center part luminance signal and the vertical resolution helper luminance signals to form an output luminance signal of an output picture OP. The video lines of the center part luminance signal and the vertical resolution helper luminance signals have to be supplied to the combining filter CF in a

suitable manner such that it can easily combine corresponding center part and vertical resolution helper luminance information components.

In accordance with the present invention, the vertical resolution helper luminance signals in the upper black bar BB1 are stored in a first field memory FM1, center part luminance signals of an upper half CP1 of the center part CP are stored in a second field memory FM2, center part luminance signals of a lower half CP2 of the center part CP are stored in the first field memory FM1, and the vertical resolution helper luminance signals in the lower black bar BB2 are stored in the second field memory FM2. By simply serially reading the stored information components from the field memories FM1, FM2, the combining filter CF can now easily combine mutually corresponding vertical resolution helper luminance signals from the upper black bar BB1 and center part luminance signals from the upper half CP1 of the center part CP in order to form an upper half OP1 of the output picture OP. Further, by simply serially reading the stored information components from the field memories FM1, FM2, the combining filter CF can now easily combine mutually corresponding vertical resolution helper luminance signals from the lower black bar BB2 and center part luminance signals from the lower half CP2 of the center part CP in order to form a lower half OP2 of the output picture OP. This is illustrated in the middle and right-hand parts of Fig. 1. The field memories FM1, FM2 have thus each a capacity which is sufficient for storing one of the black bars BB1 or BB2, and one half CP1 or CP2 of the center part CP.

It should be noted that the above-mentioned embodiments illustrate rather than limit the invention, and that those skilled in the art will be able to design many alternative embodiments without departing from the scope of the appended claims. In the claims, any reference signs placed between parentheses shall not be construed as limiting the claim. The invention can be implemented by means of hardware comprising several distinct elements, and by means of a suitably programmed data processor. While the chrominance signals of the center part CP are not combined with any corresponding helper information components from the black bars BB1, BB2, they have to be upconverted in order to increase the frame line number from about 430 (center part only) to about 576 (full height of the picture), and they have to be stored to provide a delay corresponding to that in the luminance signal processing path. As this bears no relation with the aspect of the letterbox television signal decoder dealt with by the present invention, no further details on the chrominance signal processing are given in this application.

Claims:



1. A method of decoding a letterbox television signal comprising a wide aspect ratio center part (CP) and upper (BB1) and lower (BB2) black bars located at the respective upper and lower sides of the wide aspect ratio center part (CP), the wide aspect ratio center part (CP) and the black bars (BB1, BB2) together constituting a standard aspect ratio television signal, the black bars (BB1, BB2) conveying additional signals for increasing a vertical resolution of said wide aspect ratio center part, the method comprising the steps of:

receiving the letterbox television signal to provide a sequence of television lines sequentially corresponding to said upper black bar (BB1), said wide aspect ratio center part (CP), and said lower black bar (BB2);

storing additional signals from said upper black bar (BB1), and a lower half (CP2) of said wide aspect ratio center part (CP) in a first memory (FM1);

storing an upper half (CP1) of said wide aspect ratio center part (CP), and additional signals from said lower black bar (BB2) in a second memory (FM2);

combining said upper black bar additional signals (BB1) and said upper half (CP1) of said wide aspect ratio center part (CP) to form an upper half (OP1) of a wide aspect ratio output picture (OP); and

combining said lower black bar additional signals (BB2) and said lower half (CP2) of said wide aspect ratio center part (CP) to form an lower half (OP2) of said wide aspect ratio output picture (OP).

2. An apparatus for decoding a letterbox television signal comprising a wide aspect ratio center part (CP) and upper (BB1) and lower (BB2) black bars located at the respective upper and lower sides of the wide aspect ratio center part (CP), the wide aspect ratio center part (CP) and the black bars (BB1, BB2) together constituting a standard aspect ratio television signal, the black bars (BB1, BB2) conveying additional signals for increasing a vertical resolution of said wide aspect ratio center part, the apparatus comprising:

means for receiving the letterbox television signal to provide a sequence of television lines sequentially corresponding to said upper black bar (BB1), said wide aspect ratio center part (CP), and said lower black bar (BB2);

first memory means (FM1) for storing additional signals from said upper black bar (BB1), and a lower half (CP2) of said wide aspect ratio center part (CP);

second memory means (FM2) for storing an upper half (CP1) of said wide aspect ratio center part (CP), and additional signals from said lower black bar (BB2);

means (CF) coupled to said first (FM1) and second (FM2) memory means for combining said upper black bar additional signals (BB1) and said upper half (CP1) of said wide aspect ratio center part (CP) to form an upper half (OP1) of a wide aspect ratio output picture (OP), and for combining said lower black bar additional signals (BB2) and said lower half (CP2) of said wide aspect ratio center part (CP) to form an lower half (OP2) of said wide aspect ratio output picture (OP).

