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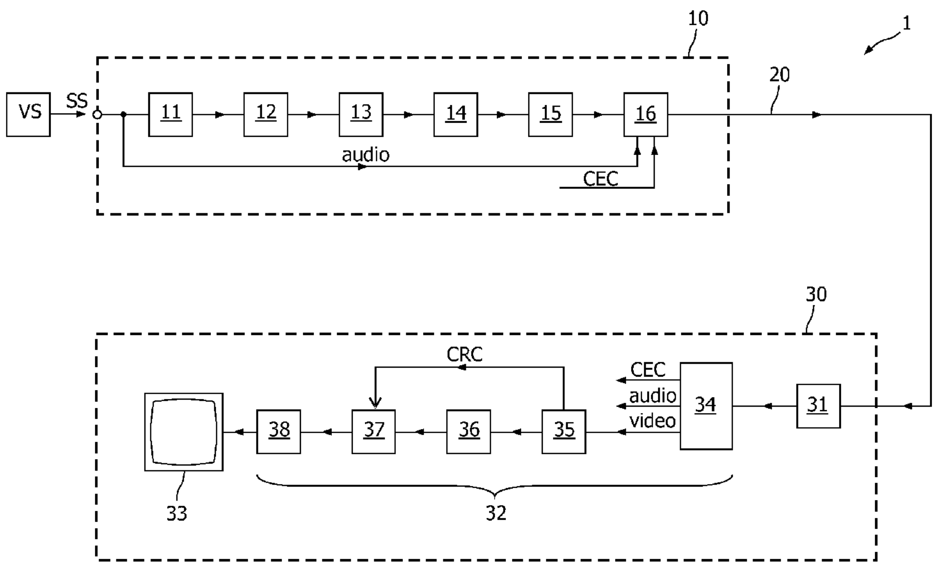
(54) Title: VIDEO TRANSMISSION OVER A DATA LINK WITH LIMITED CAPACITY



(57) Abstract: A video transmission system (1) comprises a transmitting station (10), a receiving station (30), and a data link (20) coupling these two stations. The transmitting station receives a source video signal (SS) for frames having size X 1,Y1, X1 and Y1 indicating the number of pixels in the horizontal and vertical dimension of the frames, each pixel being associated with nb bits of digital data; the pixel data are compressed such that the number of bits of the compressed data per frame is equal to X*Y*nb < X1 *Y1 *nb, wherein X and Y correspond to horizontal and vertical dimension of the frames of a target standard video format; the compressed data are formatted into an uncompressed target video signal corresponding to said target standard video format; the uncompressed target video signal is transmitted over the data link (20), which preferably is an HDMI link.

WO 2007/107948 A1

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

Video transmission over a data link with limited capacity

FIELD OF THE INVENTION

The present invention relates in general to a method for data transmission, particularly the transmission of video images over a data link between a transmitting station and a receiving station, which link may be wired but which particularly may be a wireless link.

In a particular example, the transmitting station receives video from a video source, for instance a video player or a television receiver, and the receiving station is a display device or screen, and the invention will be specifically explained for this example, but it is noted that this should not be considered as limiting the scope of the present invention.

BACKGROUND OF THE INVENTION

It is generally known that a digital video signal contains a certain amount of bits per second, on average, the precise amount depending on a number of factors, one of these factors being the video format. If this video signal is to be transferred over a data link, the data link should have a data transmission capacity that is at least equal to the average data rate (bit rate) of the video signal. In practice, however, a data link has a limited data transmission capacity, which may depend on the transmission protocol used and on the hardware used. In general, it can be said that a wireless link has a more limited capacity as compared to a wired link. On the other hand, video formats have been developed for increasing image quality, thus corresponding to an increased data rate.

If, in a transmission system comprising the combination of a transmitting station, a link, and a receiving station, the video signal to be transmitted has a data rate less than the capacity of the system, there is basically no problem: the signal can be transmitted without loss of quality. Problems arise if the video signal to be transmitted has a data rate higher than the capacity of the system.

For this problem, solutions have already been developed in the form of compression techniques, such as MPEG. Such compression techniques typically involve a loss of image quality, but they are designed such that the loss of information is hardly preceptible to the human eye.

The present invention aims to provide a different solution.

SUMMARY OF THE INVENTION

According to the present invention, the data of the video images are packed in a standard video format of a reduced size, this size being chosen such that the corresponding data rate is less than the transmission capacity of the link of the system. This conversion results in a "normal" video signal that can be transferred over the data link without loss. It is noted that the format of the transmission signal is a standard format, to assure that the hardware components involved are capable of handling this format: they should be, because the format used is a normal format which they should expect to handle. Of course, if the "normal" video signal as received by the receiving station is directly sent to a display screen, it would not result in "sensible" images, because the signal still contains transformed data. Thus, the receiving station first needs to unpack the received signal and generate a signal of the original format, which can be applied to the display screen.

Further advantageous elaborations are mentioned in the dependent claims.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other aspects, features and advantages of the present invention will be further explained by the following description of one or more preferred embodiments with reference to the drawings, in which same reference numerals indicate same or similar parts, and in which:

Figure 1 is a block diagram schematically illustrating a video transmission system according to the present invention;

Figure 2 illustrates the YUV segments after addition of CRC bytes according to the present invention;

Figure 3 illustrates multiplexing on a segment basis;

Figure 4 illustrates multiplexing on a pixel basis.

DETAILED DESCRIPTION OF THE INVENTION

Figure 1 is a block diagram schematically illustrating an exemplary embodiment of a video transmission system 1 according to the present invention. The system 1 comprises a first station 10, a second station 30, and a data link 20 coupling these two stations.

In this embodiment, the second station is a display station. It comprises a receiving section 31 receiving data from the link 20, a processing section 32 for processing the data received from the link 20 and generating a video signal for display, and a display device 33, for instance an LCD screen. It is noted, however, that the second station may also be a different type of station, for instance a recording station.

The first station 10 is a transmitting station, having an input for receiving a digital video signal from a video source VS. The video source may for instance be a generating device for generating video signals, such as a video camera. It may also be a reading device such as a video player for reading stored video signals from a storage device such as an optical disc. It may also itself be a receiving device for receiving broadcast signals. The origin of the video signal is not relevant for understanding or implementing the present invention. The digital video signal as provided by the video source VS will hereinafter be indicated as source signal SS.

In a particular embodiment, the system 1 as a whole may be considered to constitute a split-architecture type of television set, where the electronics is incorporated in the first station 10, to which all external connections are made. The display device may be connected to the first station through a single link only. Inside the first station 10, all the TV-related processing is done, while the display device needs to perform some basic backend processing only.

As should be clear to a person skilled in the art, a digital video signal contains a sequence of frames, each frame being constituted by a predefined number of pixels arranged in a rectangular array. In the following, the "size" of a frame will be defined as the number of pixels per frame. Frame size has been standardized, but there exists a relatively large number of standard sizes, one being more commonly used than the other. By way of example, some standard sizes will be mentioned, in which the first number indicates the number of pixels in the horizontal direction while the second number indicates the number of pixels in the vertical direction; further, the indication between brackets indicates the video format in which the frame size is typically implemented.

720 x 480 (DV NTSC / VGA)
768 x 576 (PAL)
1024 x 768 (XGA)
1280 x 720p (HDTV)
1920 x 1080p (HDTV)
2560 x 1440p

For each pixel, the video signal contains information regarding color and brightness. Normally, the brightness coding takes a predetermined number of bits per pixel (bpp), and the color coding takes a predetermined number of bpp. It should be clear that the image quality, expressed as a combination of the frame size and the color and brightness resolution, has a large influence on the number of bits that need to be processed. For instance, in the case of color and brightness being coded as 8 bpp each, and in the case of a frame repetition rate of 50 frames per second (fps), an XGA signal of size 1024 x 768 requires 629 Mbps, whereas an HDTV signal of size 1920 x 1080 requires 1659 Mbps. The recently developed size 2560 x 1440 even requires 2950 Mbps. The above example of calculation has not taken into account any additional information that needs to accompany the "bare" video information.

In a practical implementation, it is preferred that the capacity of the link is as high as possible. Further, it is preferred that the video signal on the link is copy-protected to prevent illegal copying of the content. Therefore, a suitable and preferred format of the link is HDMI. In an HDMI link, there are 3 video channels available for 3 video components (R, G, B), there is an audio channel available, and there is a bidirectional control channel available, as should be known to a person skilled in the art.

If the transmitting station 10 would transmit the video signal directly, the above numbers indicate the data rate transmitted over the link 20. However, transmission links have a predetermined transmission capacity, which has an upper limit depending, inter alia, on the type of link (electrical wire, optical fiber, wireless), but which in practice may be less than the upper limit because of circumstantial conditions (such as, for instance, the length of the link, or the link protocol itself, but also link devices in the chain can have limitations). Thus, in practice it may turn out that the link 20 is not capable of handling the data stream. For instance, if the link 20 has a capacity of 800 Mbps, the HDTV signal of size 1280 x 720 can be transmitted without problems but the size 1920 x 1080 or higher can not be transmitted without transmission errors.

Thus, the transmitting station 10 needs to perform some data processing such that the video information can be transmitted with a reduced data rate. A commonly used method for doing this is compression; well-known compression schemes are, for instance, MPEG2 and MPEG4. With such compression, however, loss of information occurs to some extent, possibly resulting in video artefacts on display. Further, the compression factor achieved is not constant but depends on picture content.

In the following example, it will be assumed that the input signal SS has a size 1920 x 1080.

The first station 10 comprises a conversion block 11 for converting received RGB signals of input signal SS to YUV signals, because generally a better compression can be achieved in YUV space as compared to RGB space.

The first station 10 further comprises a compression block 12 for compressing the video data using a Differential Pulse Code Modulation (DPCM) method. The method is intra field, and compresses the image line based. An inter field compression method would introduce too much latency. An advantage of the DPCM method is, besides its low complexity, that the compression factor may be guaranteed. Other methods, like JPEG, do not deliver a guaranteed compression.

In the compression method according to the present invention, each line is divided in segments of Np pixels, separate for each color component. A segment is formed by Nb consecutive bytes on a line. Compression may be done segment-wise. Each color component could be compressed with a different factor, as long as the overall compression factor is still ok.

The segment size of the compression method is selectable but best results are reached when using a segment size of around 128 pixels. In a practical embodiment, the segment size will be selected such that the active amount of pixels per line is a multiple of the segment size. If in the example the video source is 1920*1080p, segment size could be taken as 128.

In case the link 20 is a wireless link, the transmission may not be error-free. The wireless link already features an RS (Reed-Solomon) or LDPC (Low-Density-Parity-Check) error correction mechanism. It will be hard to improve the bit error rate by adding another correction method on top of these. Therefore, the present invention proposes to use an error detection method in combination with error concealment at the display.

As error detection, a 16-bit (2 bytes) cyclic redundancy checksum (CRC) is proposed. Such a CRC will detect 99.99% of the errors. In the first station 10, a CRC block 13 calculates a CRC per Y-segment. It is possible to do the same per U-segment and per V-segment, but in a preferred embodiment the checksum calculation for U and V is combined to limit the overhead on CRC bits. Such a CRC will be able to detect 99% of the errors, but, since an erroneous U or V segment will be less visible then an erroneous Y segment, this is an acceptable solution. Thus, in this embodiment, there are two bytes per Y-segment used for

CRC and two bytes per combination of U and V segments used for CRC, in other words a total of 4 bytes CRC per YUV segment.

For more information on the compression, reference is made to the presentation "Lossless and Fine-Granularity Scalable Near-Lossless Color Image Compression" by R.J. van der Vleuten and S. Egner at the 25th Symposium on Information Theory in the Benelux, 2-4 June 2004, Kerkrade, the Netherlands, of which the proceedings are availably as ISBN: 90-71048-20-9, the contents of this presentation being incorporated herein by reference.

The compression is performed to such degree that the resulting data rate is less than or equal to the capacity of the link 20. It is now possible, in principle, to generate a straight train of data for transmission over the link 20. However, it is very well possible that the equipment of the link 20 is not capable of handling such unorganized data train. In order to overcome this problem, the present invention proposes to pack the data train into a standard video format of a size that can be handled by the link 20. This video format will be indicated as target format, and the resulting video signal will be indicated as target signal TS.

To this end, the first station 10 further comprises a formatter block 14, receiving the compressed source signal CSS from the compression block 12, possibly provided with CRC. The formatter block 14 has information regarding the link 20, more specifically information regarding the data rate capacity of the link 20, and the formatter block 14 is designed to select a target standard video format having a data rate less that the data rate capacity of the link 20. In a possible embodiment, this selection is predefined in the first station 10. In another possible embodiment, the formatter block 14 is provided with a memory (not shown) containing a table of possible video formats, and the formatter block 14 is designed to select a suitable format from this memory. If there are more standard video formats possible, the formatter block 14 will select from the potentially possible formats the one having the largest number of pixels per frame.

For instance, assume that the link 20 is capable of transmitting the following formats:

720 x 480
768 x 576
1024 x 768
1280 x 720p

In such case, although the link 20 is capable of transmitting the formats 1024 x 768 and lower, the formatter block 14 will select format 1280 x 720p as target format. With a source format of 1920 x 1080, the required compression factor would then be at least 2.25. In such exemplary situation, the compression block 12 could perform the compression as follows:

Y: 128 bytes compressed to 84 bytes.

U: 128 bytes compressed to 43 bytes.

V: 128 bytes compressed to 43 bytes.

This leads to an overall compression of (128 + 128 + 128) / (84 + 43 + 43) = 2.26.

Figure 2 illustrates the resulting YUV segments after addition of CRC bytes; it is noted that the addition of CRC bytes reduces the number of video content bytes.

In the following, two possible embodiments for the multiplexing process performed by the formatting block 14 are described.

In a first embodiment, with reference to figure 3, the multiplexing is performed on a segment basis. The segments are multiplexed over the three available channels (R,G,B). The R-channel contains YUV segment 1, 4, 7 etc. The G-channel contains YUV segment 2, 5, 8 etc. The B-channel contains YUV segment 3, 6, 9 etc. The disadvantage of this segment multiplexing is that segments need to be buffered at encoder as well as decoder side. The CRC is considered part of the segment.

In a second embodiment, with reference to figure 4, the multiplexing is performed on a pixel basis. A first V-segment V1 is written as pixel data in the B-channel. A first U-segment U1 is written as pixel data in the G-channel. A first Y-segment Y1 is written as pixel data in the R-channel. Second, third and fourth Y-segments Y2, Y3, Y4 are written as pixel data in the R, G, B channels, respectively. And so on. Thus, one channel (here: the R channel) will contain only Y-segments, one channel (here: the G channel) will contain alternatively U and Y segments, and one channel (here: the B channel) will contain alternatively V and Y segments.

Pixel based multiplexing will limit the use of buffers, but adds additional control logic. Both first station 10 and second station 30 need to know the way of multiplexing. If the number of Y pixels is not a multiple of the number of U or V pixels, pixel multiplexing may be difficult. The CRC is considered part of the segment.

The first station 10 further comprises a transmission format modelling block 15; in the case of an HDMI link, this would be a block for outputting an HDMI signal. Apart from the video information received from the formatter 14, the transmission format modelling block 15 also receives the audio data received at the input of the first station 10. Further, the first station 10 may also generate a CEC message for transmission over the CEC channel of the HDMI link, as will be explained later.

The first station 10 further comprises a link transmission block 16, which receives the HDMI signal from the transmission format modeling block 15 and converts this signal to a signal suitable for actual transmission over the link 20. Depending on the physical realization of the link 20, the transmission block 16 generates electrical pulses or an optical signal or a wireless signal. Control will be a bidirectional communication. In case of wireless transmission, for high-speed forward link, the technologies that could be used are UWB or 60 GHz communications. For low speed bi-directional control data, another wireless technology can be used.

In the second station 30, the receiving section 31 receives the HDMI signals in the physical form determined by the physical realization of the link 20, and retrieves the HDMI signal, which contains the video data, audio data and CEC control data.

The second station 30 further comprises an HDMI receiver 34, which receives the HDMI signal from the receiving section 31, and which outputs the CEC control data, the audio data, and the video data.

The second station 30 further comprises a de-formatter block 35, which receives the video data from the HDMI receiver 34, and which performs the inverse operation of the formatter block 14 on the (standard) video signal as received, such as to provide the compressed Y, U, V data together with possible CRC data. If, on transmission, an error correcting code like FEC has been used, errors may be corrected in this block. If an error detecting code like CRC has been used, errors cannot be corrected here. The error detection information (CRC data) is then sent to the error concealment block 37 further in the chain.

The second station 30 further comprises a de-compressor block 36, which receives the compressed Y, U, V data from the de-formatter block 35, and which performs the inverse operation of the compression block 12, such as to provide uncompressed Y, U, V data.

If an error detection code has been used, errors cannot be corrected. Since a bit error could lead to an error of Nb consecutive bytes on the screen, preferably some way of error concealment is performed. To this end, the second station 30 further comprises an error concealment block 37, receiving the uncompressed Y, U, V data from the de-compressor block 36, and receiving the CRC data (if any) from the de-formatter block 35. The error concealment block 37 may perform any of the following (or other) methods if an error is detected in a segment:

* The erroneous segment is replaced by the segment directly above on the

previous line.

* The erroneous segment is replaced by the average of the segment directly above on the previous line and the segment directly below on the next line.

The second station 30 further comprises a backconversion block 38 for converting the YUV signals received from the error concealment block 37 to RGB signals. The backconversion block 38 provides its RGB output signals to the display device 33, which also receives the audio data and the possible CEC data from the HDMI receiver 34.
It is noted that, in practice, the circuit blocks 31, 34, 35, 36, 37, 38 will be accommodated within a housing of the display device 33 (monitor or the like).

It is further noted that the RGB signals may be sent to the display device 33 directly, if the display device is a type accepting RGB signals, or may first be packed in a standard video signal, if the display device is a type expecting to receive digital video signals.

In principle, the first station 10 and the second station 30 of the system 1 form a matching set. This means that the second station "knows" what kind of compression is performed by the first station, and it means that the first station in turn "knows" this. However, in practice it may happen that the user connects a different display device (monitor) to the first station 10. If the video transmitted by the first station 10 is compressed while the display device does not know this, the user can not view "recognizable" video. Also, it is possible that the first station 10 receives source signals of different sizes. In case it receives a source signal of size 1280 x 720, it does not need to perform any compression, whereas in case it receives a source signal of size 2560 x 1440 it needs to perform compression with a higher compression factor. In other words, the compression factor actually applied may not always be the same.

In such cases, the first station 10 needs to communicate with the second station 30, which communication can take place over the CEC channel. This communication is initiated by the first station 10, for instance on power-up, or at the occasion of the HDMI cable being connected, or each time a video transmission is started, by the first station 10 sending a CEC message. This CEC message may, for instance, contain the compression factor.

The first station 10 may for instance receive any of the four following types of answer from the second station 30:

1) the second station 30 is not the standard station belonging to the first station 10, and it has not installed any CEC facility; in that case, the second station 30 does not respond at all.

2) the second station 30 is not the standard station belonging to the first station 10, but it has installed CEC facility; in that case, the second station 30 may respond by sending a <feature abort> message, indicating that it does not support the compression feature.

3) the first station 10 communicates the compression factor, and the second station 30, whether or not it is the standard station belonging to the first station 10, has installed CEC facility and it understands the message from the first station 10; in that case, the second station 30 will send an acknowledgement message that it recognizes the compression factor.

4) the second station 30 is the standard station belonging to the first station 10, and the first station 10 performs a predefined standard compression; in that case, the second station 30 will send an acknowledgement message.

In the situations 3) and 4), processing may take place as described earlier. However, in the situations 1) and 2), it is preferred that the first station 10 does not proceed as described, because it is highly likely that the second station 30 will not or not correctly decompress the video signal received over the link 20, so that the display of the video signal will not result in viewable images. Nevertheless, the first station 10 has to take some fallback action in order to reduce the data rate, and according to the invention the first station 10 will do so in a manner which will at least result in viewable images without decompression.

In a first possible fallback method, the first station 10 will scale the video to a resolution that can be handled by the second station 30 as well as by the link 20.

In a second possible fallback method, the first station 10 will discard some of the pixels of the frames in order to generate a target video signal with the suitable target size. In the present example, where the source video signal has a size of 1920 x 1080 pixels while the target video signal has a size of 1280 x 720 pixels, the first station 10 may discard or ignore the first 180 lines of each frame and the last 180 lines of each frame, so that it will transmit only data from lines 181 to 900. Further, of each line, the first station 10 may discard or ignore the first 320 pixels and the last 320 pixels, so that it will transmit only the data corresponding to pixels 321 to 1600. Thus, a video signal will result having a size of 1280 x 720 pixels, indeed, which on display without decompression will result in a viewable image of 1280 pixels wide and 720 pixels high, corresponding to a central portion of the original image. The price of this fallback method is that from the original image upper and lower horizontal bands of 180 lines height have been lost and left and right vertical bands of

320 pixels wide have been lost along the edges of the original picture, but at least the user can view video.

Summarizing, the present invention provides a video transmission system 1 which comprises a transmitting station 10, a receiving station 30, and a data link 20 coupling these two stations. The transmitting station receives a source video signal SS for frames having size X1,Y1, X1 and Y1 indicating the number of pixels in the horizontal and vertical dimension of the frames, each pixel being associated with nb bits of digital data. The pixel data are compressed such that the number of bits of the compressed data per frame is equal to $X*Y*nb < X1*Y1*nb$, wherein X and Y correspond to horizontal and vertical dimension of the frames of a target standard video format. The compressed data are formatted into an uncompressed target video signal corresponding to said target standard video format. The uncompressed target video signal is transmitted over the data link 20, which preferably is an HDMI link.

In this invention, the following innovative ideas are incorporated:

* use a 16-bit CRC for Y and a 8-bit CRC for U and V; more in general, use a CRC for Y which is twice as large as the CRC for U and V.
* format the compressed video in a standard HDMI video format;
* use error detection and concealment;
* crop the image when the display is not compatible with the the first station 10;
* use a vendor-specific CEC message to detect the presence of the decoder at the receiver side.

It is to be particularly noted that the signal transferred over the link 20 is in all aspects a standard video signal of size X,Y, which can be received and processed by any standard video processing apparatus, up to and including a display device. Particularly, this standard video signal contains pixel data coding for X*Y pixels, which upon display will result in pixel color and pixel brightness of an image having size X pixels wide and Y pixels height. This is a difference with respect to prior art, where a compressed video signal does not have the format of a standard video signal and thus can not be displayed without a decompression process. However, in the standard video signal according to the present invention, the data in pixel x,y do not correspond to one actual pixel in the image intended for display. The image intended for display has size X1 pixels wide and Y1 pixels height, wherein X1>X or Y1>Y, or both, thus containing X1*Y1 pixels. The data coding for these X1*Y1 pixels is compressed so that the number of bits is reduced, and the compressed data is redistributed over the X*Y pixels of the standard video signal used for transmission. Thus, this standard video signal can be considered as constituting a transport vehicle of size X*Y, containing compressed data of an original signal of size X1*Y1. Thus, the pixel data are compressed but the video signal as such is an uncompressed video signal.

While the invention has been illustrated and described in detail in the drawings and foregoing description, it should be clear to a person skilled in the art that such illustration and description are to be considered illustrative or exemplary and not restrictive. The invention is not limited to the disclosed embodiments; rather, several variations and modifications are possible within the protective scope of the invention as defined in the appending claims.

For instance, instead of using the CEC protocol, the first station 10 may also use a parameter in the monitor's EDID information.

Other variations to the disclosed embodiments can be understood and effected by those skilled in the art in practicing the claimed invention, from a study of the drawings, the disclosure, and the appended claims. In the claims, the word "comprising" does not exclude other elements or steps, and the indefinite article "a" or "an" does not exclude a plurality. A single processor or other unit may fulfill the functions of several items recited in the claims. The mere fact that certain measures are recited in mutually different dependent claims does not indicate that a combination of these measures cannot be used to advantage. A computer program may be stored/distributed on a suitable medium, such as an optical storage medium or a solid-state medium supplied together with or as part of other hardware, but may also be distributed in other forms, such as via the Internet or other wired or wireless telecommunication systems. Any reference signs in the claims should not be construed as limiting the scope.

In the above, the present invention has been explained with reference to block diagrams, which illustrate functional blocks of the device according to the present invention. It is to be understood that one or more of these functional blocks may be implemented in hardware, where the function of such functional block is performed by individual hardware components, but it is also possible that one or more of these functional blocks are implemented in software, so that the function of such functional block is performed by one or more program lines of a computer program or a programmable device such as a microprocessor, microcontroller, digital signal processor, etc.

CLAIMS:

1. Method for transmitting video data, the method comprising the steps of:

- receiving an original video signal for frames having size X1,Y1, X1 indicating the number of pixels in the horizontal dimension of the frames and Y1 indicating the number of pixels in the vertical dimension of the frames, each pixel being associated with nb bits of digital data, so that the number of bits per frame is equal to X1*Y1*nb;
- from this original video signal, extracting the pixel data;
- compressing the pixel data such that the number of bits of the compressed data per frame is equal to X*Y*nb < X1*Y1*nb, wherein X and Y are chosen such as to correspond to horizontal and vertical dimension, respectively, of the frames of a target standard video format;
- from the compressed data, calculating target pixel data of X*Y pixels per frame, and using these target pixel data to generate an uncompressed target video signal corresponding to said target standard video format;
- transmitting the uncompressed target video signal.

2. Method according to claim 1, wherein said target standard video format is selected from the group comprising 720x480, 768x576, 1024x768, 1280x720, 1920x1080, 2560x1440.

3. Method according to claim 1, wherein the uncompressed target video signal is transmitted over an HDMI link.

4. Method according to claim 1, wherein the step of compressing the pixel data comprises segment based multiplexing or pixel based multiplexing.

5. Method according to claim 1, further comprising the steps of:

- before transmission of the video data, transmitting a control message to a receiver;
- receiving a return message back from the receiver;

- in response to the received return message, deciding to proceed with compressing video data and transmit the compressed video data.

6. Method according to claim 5, wherein, if no timely return message from the receiver is received back, or if the return message indicates that the receiver will not be capable of decompressing the compressed video data, it is decided, instead of compressing the pixel data of all original pixels, to select the pixel data of X*Y of the original pixels, and to use these pixel data to generate the uncompressed target video signal.

7. Method for receiving video data which has been transmitted using the transmission method according to claim 1, the receiving method comprising the steps of:

- receiving a video signal for frames having size X,Y, X indicating the number of pixels in the horizontal dimension of the frames and Y indicating the number of pixels in the vertical dimension of the frames, each pixel being associated with nb bits of digital data, so that the number of bits per frame is equal to X*Y*nb;
- from this received video signal, extracting the pixel data;
- decompressing the pixel data such that the number of bits of the decompressed data per frame is equal to X1*Y1*nb > X*Y*nb, wherein X1 and Y1 correspond to horizontal and vertical dimension, respectively, of the frames of an original standard video format;
- from the decompressed data, calculating original pixel data of X1*Y1 pixels per frame, and using these original pixel data to generate an uncompressed original video signal corresponding to said original standard video format.

8. Standard video data signal, for frames having size X,Y, X indicating the number of pixels in the horizontal dimension of the frames and Y indicating the number of pixels in the vertical dimension of the frames, each pixel being associated with nb bits of digital data, so that the number of bits per frame is equal to X*Y*nb;
wherein the pixel data are compressed data corresponding to original pixel data of an original standard video format in which the frames have size X1,Y1, wherein X1>X and/or Y1>Y.

9. Transmitting station (10) for a video transmission system (1), comprising:

- an input for receiving a source video signal (SS) for frames having size X1,Y1, X1 indicating the number of pixels in the horizontal dimension of the frames and Y1 indicating the number of pixels in the vertical dimension of the frames, each pixel being associated with nb bits of digital data, so that the number of bits per frame is equal to X1*Y1*nb;

- a compression block (12) for compressing the pixel data such that the number of bits of the compressed data per frame is equal to X*Y*nb < X1*Y1*nb, wherein X and Y are chosen such as to correspond to horizontal and vertical dimension, respectively, of the frames of a target standard video format;
- a formatting block for formatting the compressed data into an uncompressed target video signal corresponding to said target standard video format;
- transmission means (15, 16) for transmitting the uncompressed target video signal over a data link (20).

10. Transmitting station according to claim 9, wherein the transmission means (15, 16) comprise a transmission format modeling block (15) for translating the uncompressed target video signal to a signal format corresponding to the data link (20).

11. Transmitting station according to claim 10, wherein the transmission means (15, 16) further receive an audio signal contained in the source video signal, and combine this audio signal in the target video signal to be transmitted.

12. Transmitting station according to claim 10, further comprising means for generating a control signal (CEC), wherein the transmission means (15, 16) further receive the control signal and combine this control signal in the target video signal to be transmitted.

13. Transmitting station according to claim 9, further comprising a conversion block (11) arranged before the compression block (12), for converting received RGB signals of the input signal (SS) to YUV signals.

14. Transmitting station according to claim 9, wherein the signal format is HDMI.

15. Transmitting station according to claim 9, adapted for performing the method of any of claims 1-6.

16. Receiving station (30) for a video transmission system (1), comprising:
- a receiving section (31) for receiving a video signal for frames having size

X,Y, X indicating the number of pixels in the horizontal dimension of the frames and Y indicating the number of pixels in the vertical dimension of the frames, each pixel being associated with nb bits of digital data, so that the number of bits per frame is equal to X*Y*nb;

- a deformatter (35) for retrieving the pixel data from the video signal;
- a decompressor (36) for decompressing the pixel data such that the number of bits of the decompressed data per frame is equal to X1*Y1*nb > X*Y*nb, wherein X1 and Y1 correspond to horizontal and vertical dimension, respectively, of the frames of an original standard video format;

17. Receiving station according to claim 16, further comprising backconversion means (38), for converting the decompressed YUV data back into RGB data.

18. Receiving station according to claim 16, further comprising a display device (33) for receiving the uncompressed original video signal.

19. Receiving station according to claim 16, further comprising error concealment means (37) arranged between the decompressor (36) and the conversion means (38), and receiving an error correction signal (CRC) from the deformatter (35);
wherein the error concealment means (37) are adapted, in response to receiving an error correction signal (CRC) indicating a possibly defective segment of pixel data, to replace to possibly defective segment by a replacement segment of data.

20. Receiving station according to claim 19, wherein the replacement segment contains the pixel data of the segment directly above the possibly defective segment.

21. Receiving station according to claim 19, wherein the error concealment means (37) are adapted to calculate the pixel data of the replacement segment as the average of the pixel data of the segment directly above the possibly defective segment and the pixel data of the segment directly below the possibly defective segment.

22. Video transmission system (1), comprising a transmitting station (10), a receiving station (30), and a data link (20) coupling these two stations, wherein the transmitting station (10) is implemented in accordance with any of the previous claims 9-15.

23. Video transmission system according to claim 22, wherein the receiving station (30) is implemented in accordance with any of the previous claims 16-21.

24. Video transmission system according to claim 22, wherein the data link (20) is an HDMI link.

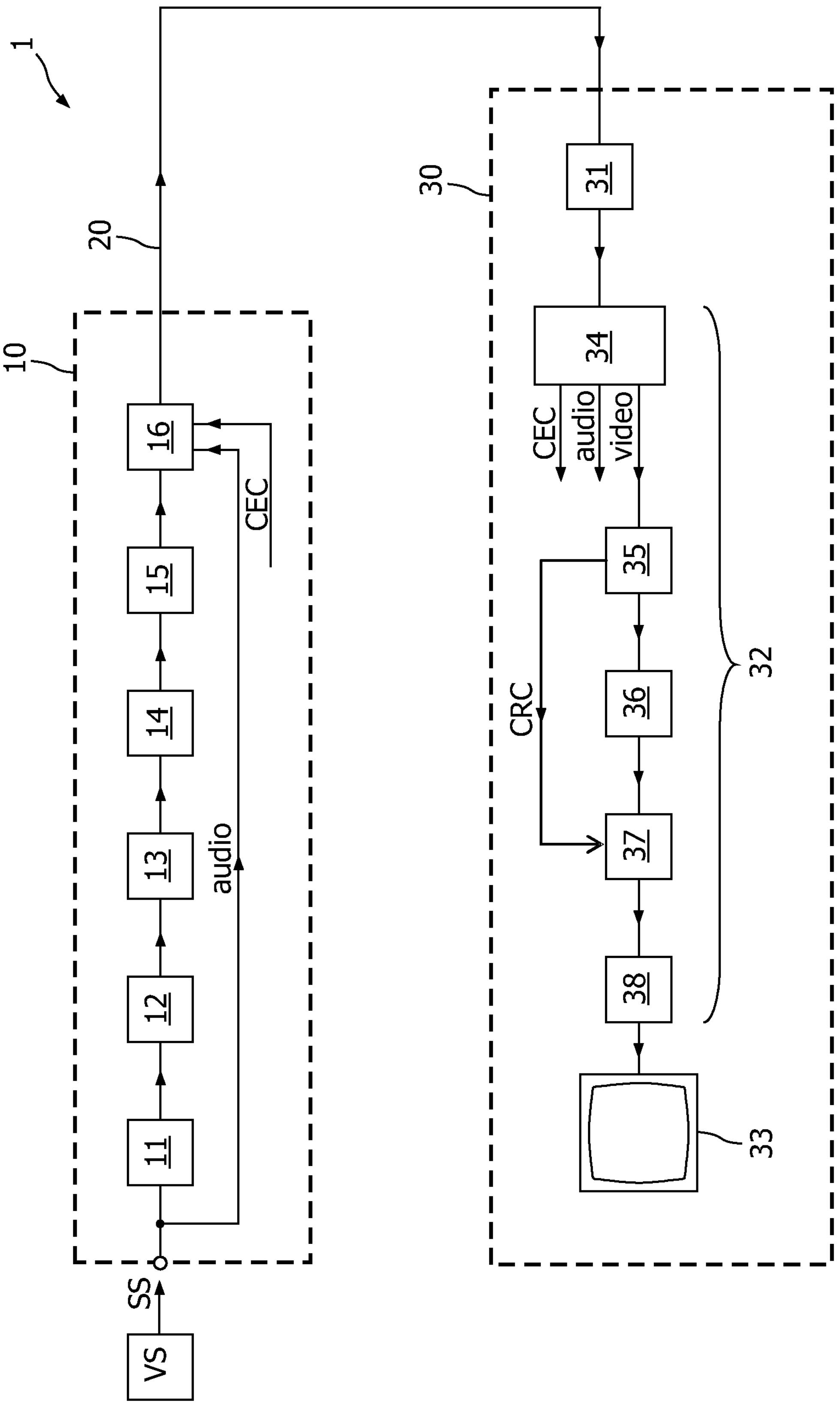

1
10
20
30
VS
SS
11
12
13
14
15
16
audio
CEC
31
34
CEC
audio
video
35
36
37
38
CRC
32
33

FIG. 1

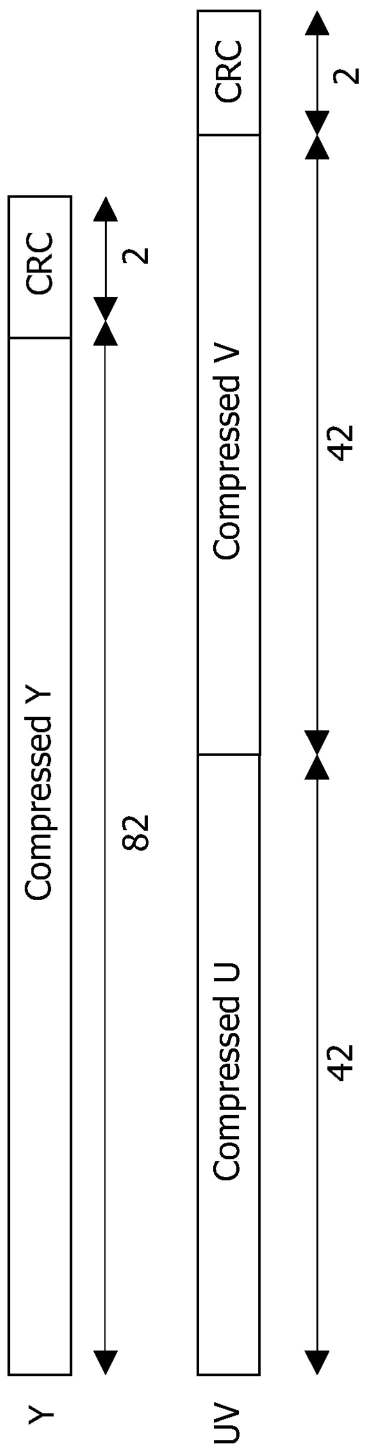

CRC
2
Compressed Y
82
Y
CRC
2
Compressed V
42
Compressed U
42
UV

FIG. 2

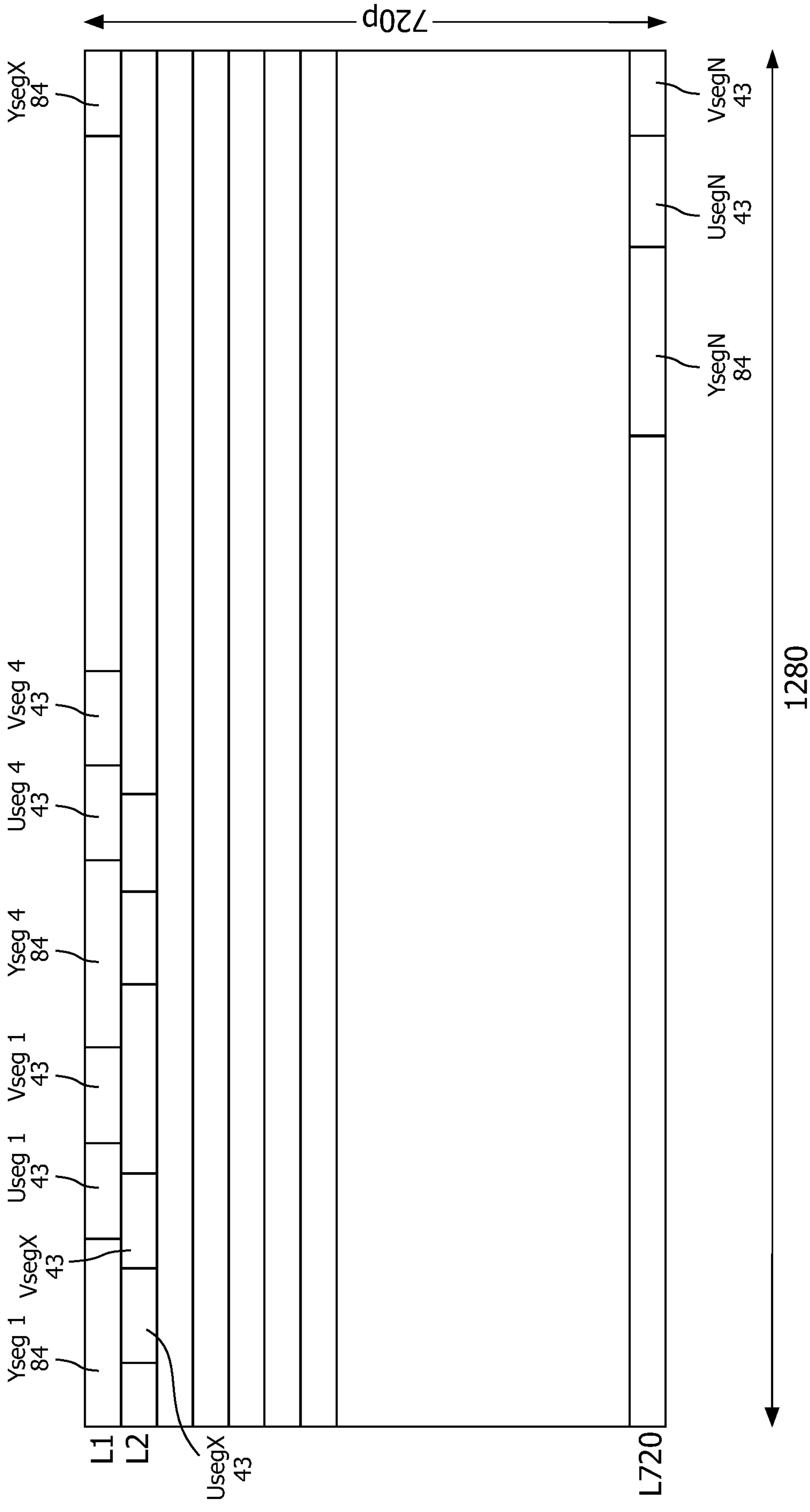

720p
YsegX 84
Vseg 4 43
Useg 4 43
Yseg 4 84
Vseg 1 43
Useg 1 43
VsegX 43
Yseg 1 84
L1
L2
UsegX 43
L720
VsegN 43
UsegN 43
YsegN 84
1280

FIG. 3

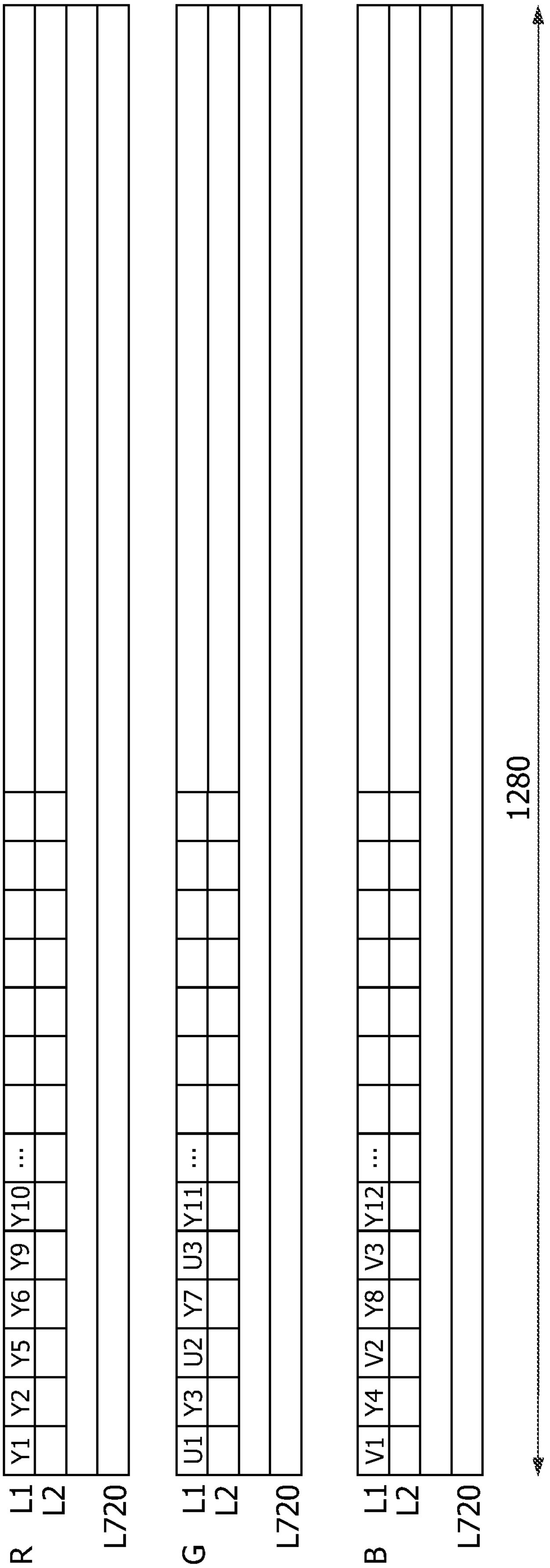

R
L1
L2
L720
Y1
Y2
Y5
Y6
Y9
Y10
...
G
L1
L2
L720
U1
Y3
U2
Y7
U3
Y11
...
B
L1
L2
L720
V1
Y4
V2
Y8
V3
Y12
...
1280

FIG. 4

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2007/050945

A. CLASSIFICATION OF SUBJECT MATTER
INV. H04N7/24 H04N7/26

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H04N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 353 059 A (LAWLOR ROBERT J D [IE] ET AL) 4 October 1994 (1994-10-04) abstract column 1, line 7 - column 2, line 52	1-24
A	VAN DER VLEUTEN R J: "Lossless and Fine-Granularity Scalable Near-Lossless Color Image Compression" SYMPOSIUM ON INFORMATION THEORY IN THE BENELUX, XX, XX, 2 June 2004 (2004-06-02), pages 209-216, XP008081930 cited in the application the whole document	1-24
A	US 2004/008767 A1 (UEDA HIROAKI [JP] ET AL) 15 January 2004 (2004-01-15) abstract	1-24

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
3 August 2007	13/08/2007

Name and mailing address of the ISA/	Authorized officer
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INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2007/050945

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 537 157 A (WASHINO KINYA [US] ET AL) 16 July 1996 (1996-07-16) the whole document -----	1-24

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/IB2007/050945

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			JP	3859227	B2	20-12-2006
			JP	8509337	T	01-10-1996
			US	5450140	A	12-09-1995
			WO	9424813	A1	27-10-1994