

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
24 December 2003 (24.12.2003)

PCT

(10) International Publication Number  
**WO 03/107656 A1**

(51) International Patent Classification<sup>7</sup>: **H04N 5/00**

(21) International Application Number: PCT/GB03/02282

(22) International Filing Date: 27 May 2003 (27.05.2003)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:  
0213432.8 12 June 2002 (12.06.2002) GB

(71) Applicant (for all designated States except US): **PACE MICRO TECHNOLOGY Plc** [GB/GB]; Victoria Road, Saltaire, Shipley B18 3LF (GB).

(72) Inventor; and

(75) Inventor/Applicant (for US only): **SHEEN, Timothy** [GB/GB]; Victoria Road, Saltaire, Shipley BF18 3LF (GB).

(74) Agent: **BAILEY WALSH & Co.**; 5 York Place, Leeds LS1 2SD (GB).

(81) Designated States (national): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

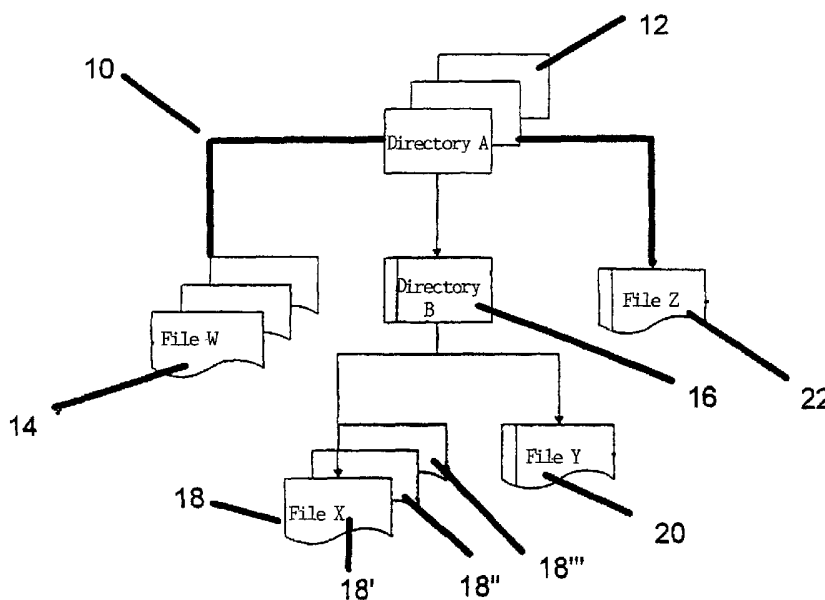
(84) Designated States (regional): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

**Published:**

- with international search report
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments

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.

(54) Title: BROADCAST DATA RECEIVER AND METHOD OF STORING DATA THEREFOR



(57) Abstract: The invention relates to a method, system and apparatus, for the reception, processing and storage of data received by a broadcast data receiver, saved data allowing the subsequent generation of video and audio for television programs and also including data for interactive facilities typically relating to said programs. Upon the user selection to record a program by storing data in a memory means, the related interactive data is also stored. The interactive data is typically broadcast in a carousel format, (repeating data loops) and when stored the data for one loop is stored in a file and only any data change in subsequent lops is stored in further files, thereby using reduced storage space in the memory means.



WO 03/107656 A1

## Broadcast Data Receiver and Method of Storing Data Therefor

This invention relates to a broadcast data receiver (BDR) and a method of storing data received by and for processing by the same.

Television Systems increasingly include as an integral part thereof, either by being included in the same housing or by being connected thereto, a BDR, also known as a Set Top Box. The BDR is provided to receive digital data which is broadcast from a remote location or locations by one or more television or other service broadcasters. The data can be carried to the BDR's at the various locations via cable, satellite and/or terrestrial transmission systems. The received data is received in an encoded form and processed and decoded by the BDR using known decoding integrated circuits and in conformation with International data processing Standards, such as MPEG-2, to provide video, audio and/or auxiliary data for viewing on a display screen or for listening via speakers.

In an increasingly common embodiment the BDR is provided with a memory means such as a hard disk drive which allows the selective storage of data received by the BDR onto the memory means so as to allow the data to be selected for processing and viewing by the viewer at a time after the receipt of the data by the BDR. When storing the received data, the BDR selects the relevant data from the incoming received transport stream which includes data for a whole range of television programmes and services. The data which is selected for storage is in response to the viewer programme selection such that the data required to generate the selected programme is identified and selected. The selected data is conventionally

stored in substantially the same format as it is broadcast to and received by the BDR.

The digital television audio/video services are often accompanied by interactive applications. The interactive content can be in the form of supplementary information which is selectively viewable alongside a regular television programme. Alternatively, the interactive application can be the sole content of the service, and the application may be unrelated to a particular television programme. In either case, it is desirable to store the supplementary information data relating to the interactive application so that the same is subsequently available as it would be if the selected programme from the memory was being watched "live". The data for such interactive services is often broadcast in a carousel format (i.e., a Digital Storage Media - Command Control (DSM-CC) object carousel in the UK Digital Terrestrial television (DTT) context). A carousel format is when data is broadcast as a repeating loop of the same data encapsulated in a data transport stream which is broadcast and received by the BDR. If the transport stream is recorded in the normal manner, a plurality of copies of the same loop of data or substantially similar data would be recorded on the hard disk drive of the BDR. As such, an increased amount of disk space is required by the BDR for storing this data. This is undesirable, expensive and may result in a reduction in the performance of the BDR and/or a reduction in performance of the interactive application with a corresponding television programme.

In addition, conventionally, when data is required by an interactive application, the BDR must wait until the required portion of the carousel is broadcast and then retrieve the interactive data therefrom. As such, the user may be required to wait for pages of text and/or images from the interactive service

to load. This is inconvenient for the user and may dissuade the user from using the interactive service.

It is therefore an aim of the present invention to provide a broadcast data receiver and method of storing data therefor, which overcomes the abovementioned problems.

According to a first aspect of the present invention there is provided a method of processing data received by a BDR, said method including receiving data from a broadcaster at a remote location, decoding and processing the data to provide video, audio and/or auxiliary data, said broadcast data relating to one or more television programmes and/or interactive service information, at least part of said interactive service information broadcast as a repeating loop of data encapsulated in a data transport stream (carousel format), said BDR having a memory means for the selective storage therein of broadcast data, representing a viewer selection and characterised in that upon a viewer selection, the data relating to a loop of the selected interactive service information is retrieved, as the data storage is performed and stored in a files system in the memory of said BDR.

Thus while conventionally the complete data transport stream (PID) for the selected programme would be stored in a single file on the memory means, the present invention provides the means to filter the data transport stream, based on one or more pre-defined criteria, into constituent files. For example, the pre-defined criteria can include one or more different versions of the interactive data over time.

Preferably the files system includes modules containing data blocks, the data blocks contain packets of data and the packets of data represent the incoming transport streams to the BDR.

The packets of data in the incoming data transport streams are stored, processed and allocated into files for storing in memory. This is in contrast to the conventional method where the BDR records and processes the data in the form of transport streams and stores the transport streams.

Preferably the interactive service information data relates to the one or more selected television programmes which are stored. Further preferably both the interactive service information and the one or more television programmes are broadcast in a carousel format.

Preferably the memory is in the form of a hard disk drive (HDD) provided in or connected to the BDR.

If there is no change in each loop of the interactive data preferably said repeated loops of data are not stored in the memory and thus the memory means storage space is not used up with the repeated storage of duplicate data.

If the interactive data changes with time (i.e., the interactive application accompanying a video service or television programme changes in synchronicity with the video service or television programme) the different versions of the interactive data are saved as separate files within the file system.

Preferably each new file version of the interactive service data recorded is provided with a time stamp based on the system clock (STC) of the BDR. Thus, when the recorded data is being played back on the BDR and a time stamp is reached, the appropriate file with a corresponding time stamp is identified from the file system and used for playback until the next time stamp is identified. This is different to conventional recording methods where interactive data is recorded and stored as a

transport stream and, as such, when a user wishes to look at a particular point in an interactive application, they have to wait for the transport stream to playback until a time stamp corresponding to the relevant point is identified. In the present invention, any desired point of an interactive service will be located in a file having a time stamp associated therewith. The BDR can therefore quickly identify the desired point in the service by playing back the file version having the relevant time stamp. Thus the viewer is not required to wait for a prolonged period of time to access a desired point in an interactive application.

Preferably the file system is provided with an index system to allow easy retrieval of files therefrom.

According to a second aspect of the present invention there is provided a television system, said television system including a display screen and a broadcast data receiver, said BDR receiving data from a broadcaster at a remote location and decoding and processing the data to provide video, audio and/or auxiliary data, said broadcast data relating to one or more television programmes and interactive service information, at least part of said interactive service information broadcast in a carousel format, said BDR having memory means for the storage of broadcast data following a viewer selection and characterised in that the data relating to said interactive services is retrieved from the carousel format as the data storage occurs and a first version stored in a file in the memory of said BDR, and for as long as repeated loops of the data remain the same no further interactive data is stored in memory.

Typically analysis of each data loop is performed and, if a change is detected, the data which has changed is saved in a new file.

According to a further aspect of the present invention there is provided a method of storing data in a broadcast data receiver, said BDR receiving data from a broadcaster at a remote location and decoding and processing the data to provide video, audio and/or auxiliary data, said broadcast data relating to one or more television programmes and interactive service information, at least part of said interactive service information data broadcast in a carousel format, said BDR having memory means for the storage of broadcast data following a viewer selection and characterised in that said method includes the steps of retrieving data relating to said selected interactive services from the carousel format and storing said retrieved data as part of a file system in the memory of said BDR, and when subsequent loops of the same data in the carousel format are received, the said data is not stored in the memory means.

The advantage of the present invention is that by storing the interactive data as a file system rather than as a single file containing transport stream, a significant amount of disk space is saved. In addition, the interactive data can be accessed at any time without a user having to wait for the relevant section of the carousel to be available, as is the case with conventional systems.

An embodiment of the present invention will now be described with reference to the following description and figures, wherein:

Figures 1a and 1b illustrate the arrangement of a conventional file system;

Figure 2 illustrates a time versioned file system according to the present invention.

Conventionally, data recorded on a memory means such as a Hard Disk Drive (HDD) of a BDR or set top box is typically recorded in the data transport streams format with each stream having a single storage file. When the data transport streams are broadcast in a carousel format, a large amount of memory is required in the BDR to store what is repeated data. In accordance with the present invention, the data transport stream is processed and saved as a plurality of files within a file system of the HDD, thereby reducing disk space and allowing easy retrieval of a particular file version on demand.

Although the majority of data in the carousel will typically be static i.e the same data, simply repeated, for many revolutions of the carousel format, some data elements will periodically change. In order to make allowance for such temporal data, files within the file system are provided with a "delivery time" in addition to a path/name. The delivery time or time stamp given to a particular file version is based on the system clock (STC) of the BDR. Files can then be retrieved from the file system based on the time at which the file with the changed data was input into the file system.

For example, in an interactive quiz show, part of the interactive application may be a current question. As the show progresses the interactive file for the quiz show is updated to contain the new question. Thus if the programme and interactive data is being stored in the memory means, the interactive data relating to the question is the same loop of data until the question changes whereupon a new loop or carousel of data is broadcast. When the version of the question file changes in the original broadcast, a new file version is stored in the memory means with a time stamp. When the recorded interactive service is played back from the HDD, the BDR is required to have all versions of the stored interactive data available to the user so that the

relevant version (question in this example) can be retrieved and displayed depending on the time in the programme which is retrieved for display from the HDD. When the system clock of the BDR reaches the relevant time stamp, the file version of the interactive data with a corresponding time stamp is played back to the user.

An example showing the disk space saved in using the present invention is now provided.

In this example, a programme selected to be recorded for subsequent viewing by storing the data in the HDD has an interactive data component that is broadcast in a carousel format with a data loop repeat rate of 30 seconds i.e the same data loop is repeated every 30 seconds and a bandwidth of 1Mbit/sec, then using conventional memory means of storage, the carousel data will occupy approximately 3.75 Mbytes of memory space in the BDR. The data contained in the carousel will be less than this due to the encapsulation overhead (data discarded from the transport stream when the transport stream is processed). Recording the transport stream for this service component alongside a program that lasts, for example, for one hour, requires 450 Mbytes of disk space ( $3.75 \times 2 = 7.5$  Mbytes/minute and  $7.5 \times 60\text{mins} = 450$  Mbytes in 1 hour).

If we now assume the carousel is static, i.e the data in each loop is always the same, the required space for the data in the file system of the invention would be less than 3.75 Mbytes (due to the removal of the transport stream and carousel encapsulation overhead). A reduction in required disk space of 99.16% is therefore achieved, as for as long as the data in the carousel format remains unchanged, only one data loop needs to be kept, the remaining unchanged data loops are simply discarded and

not stored. Thus, the reduction is  $(450-3.75/450) \times 100 = 99.16 \%$ ).

If the carousel format becomes non-static, i.e, some of the data in the loop changes over time. the expected increase in storage required may be predicted as follows:

If the time varying data is updated once every minute i.e every second data loop of the carousel, and the time varying data accounts for 5% of the loop data, with all other parameters the same, the required space for the data in the proposed file system is  $3.75 + 59 \text{ loops} \times (3.75 \times 0.05) = 14.82\text{MB}$  which still represents a 96.7 % saving of disk space compared to the disk space required for saving the whole data transport stream.

Referring to the figures, figure 1a shows the arrangement of a conventional memory means 2 wherein a single folder 4 contains two files 6, 8. Figure 1b shows a further conventional arrangement 3 wherein the entire transport data stream of the carousel format is saved as a single file 5 in a single directory 7.

Figure 2 illustrates the memory allocation system 10 of the present invention. Directory 12 comprises three carousel format data files. Each file, file W, file Z and Directory B, represents a particular data storage event, i.e a particular programme. Each file includes data for an interactive service rotating to a programme provided in a carousel format. The carousel format typically provides version numbers that change as new versions of the carousel loops become available, thereby allowing the BDR to apply a time stamp to the newly acquired versions. Retrieval of a required version for playback of the interactive data to the viewer from the memory means depends on the time stamp allocated to each version. The first part of directory 12 contains a file 14. The file 14 has three versions and the

retrieval of a particular version depends on the time stamp allocated to each version in comparison with the playback time of the associate programme data. The second part of directory 12 contains a subdirectory 16. The sub-directory 16 contains two files 18, 20. File 20 represents a data carousel in which the data has remained static and is therefore saved as a single file. The loop data of file 18 has changed over time, thereby producing three different versions 18', 18'', 18'''. The third part of directory 12 contains a single static (unchanged data) loop file 22.

Thus if, for example, the programme data associated with file 18 is selected by the viewer for watching, by accessing the data from the memory means, the storage system identifies the data file 18 as containing relevant interactive data. The decision whether to access and process the version 18', 18'' or 18''' is made depending on the time stamp on each version in comparison with the time stamp of the programme data, i.e the part of the programme being watched. A match of the time stamps dictates which of the versions 18', 18'', 18''' is accessed and generated for viewing.

Thus the structure of the filing system of the present invention can be built up in the above described manner and can cope with both changing versions of loop data within the same data storage file and a file system with a changing structure.

The interactive data can relate to, for example, questions to which the viewer can enter an answer via the BDR, data which allows the user selection of a particular service version, such as different audio versions, data which allows the user to enter a vote, or the like.

## Claims

1. A method for processing data received by a broadcast data receiver (BDR), said method including receiving data from a broadcaster at a remote location, decoding and processing the data to provide video, audio, and/or auxiliary data, said broadcast data relating to one or more television programmes and/or interactive service information, at least part of said interactive service information broadcast as a repeating loop of data encapsulated in a data transport stream (carousel format), said BDR having a memory means for the selective storage therein of broadcast data, representing a viewer selection and characterised in that upon a viewer selection, the data relating to a loop of the selected interactive service information is retrieved as the data storage is performed and stored in a files system in the memory of said BDR.
2. A method according to claim 1 characterised in that the transport stream of received data is filtered based on one or more predefined criteria into constituent files.
3. A method according to claim 2 characterised in that the predefined criteria include one or more different versions of the programme interactive data received over time.
4. A method according to claim 1 characterised in that the file system includes modules containing data blocks, the data blocks containing packets of data and the packets of data make up the incoming data transport streams to the BDR.
5. A method according to claim 4 characterised in that the packets of data in the incoming transport streams are selected, processed and constructed into files for storing in memory.

6. A method according to claim 1 characterised in that the interactive service information relates to the viewer selected television programme or programmes.
7. A method according to claim 6 characterised in that the interactive service information and the one or more television programmes are broadcast in a carousel format.
8. A method according to claim 1 characterised in that the receiver includes a memory in the form of a hard disk drive.
9. A method according to claim 1 characterised in that data in the interactive data loops may change with time and the different data which is detected is stored as a further file version within the file system.
10. A method according to claim 9, characterised in that if no data change occurs in each subsequent loop of recorded data no further data is stored.
11. A method according to claim 9 characterised in that each new file version of the interactive service data recorded is provided with a time stamp based on the system clock of the BDR and indicating the time of storage with respect to the time during the storage of the data for the programme.
12. A method according to claim 11 characterised in that when the recorded data is being played back on the BDR and a time stamp is reached, the appropriate file version of interactive data with the corresponding time stamp is identified from the file system and used to generate the interactive data until the next time stamp is identified.

13. A method according to claim 1 wherein the file system is provided with an index of files therein.

14. A television system, said television system including a display screen and a broadcast data receiver, said BDR receiving data from a broadcaster at a remote location and decoding and processing the data to provide video, audio and/or auxiliary data, said broadcast data relating to one or more television programmes and interactive service information, at least part of said interactive service information broadcast in a carousel format, said BDR having memory means for the storage of broadcast data following a viewer selecting and characterised in that the data relating to said interactive services is retrieved from the carousel format as the data storage occurs and a first version stored in a file in the memory of said BDR and for as long as repeated loops of the data remain the same no further interactive data is stored in memory.

15. A system according to claim 14 characterised in that analysis of each data loop is performed and, if a data change is detected, the data which has changed is saved in a new file with a time stamp allocated to the same.

16. A broadcast data receiver, said BDR receiving data from a broadcaster at a remote location and decoding and processing the data to provide video, audio and/or auxiliary data, said broadcast data relating to one or more television programmes and interactive service information, at least part of said interactive service information data broadcast in a carousel format, said BDR having memory means for the storage of broadcast data following a viewer selection and characterised in that said method includes the steps of retrieving data relating to said selected interactive services from the carousel format and storing said received data as part of a file system in the memory

of said BDR, and when subsequent loops of the same data in the carousel format are received, the said data is not stored in the memory means.

Figure 1a

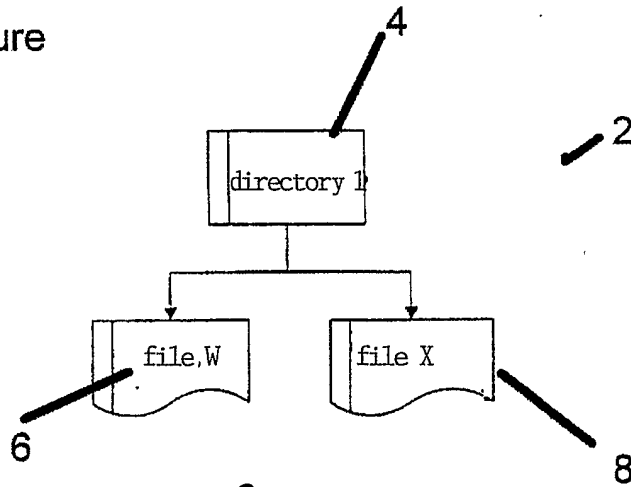


Figure 1b

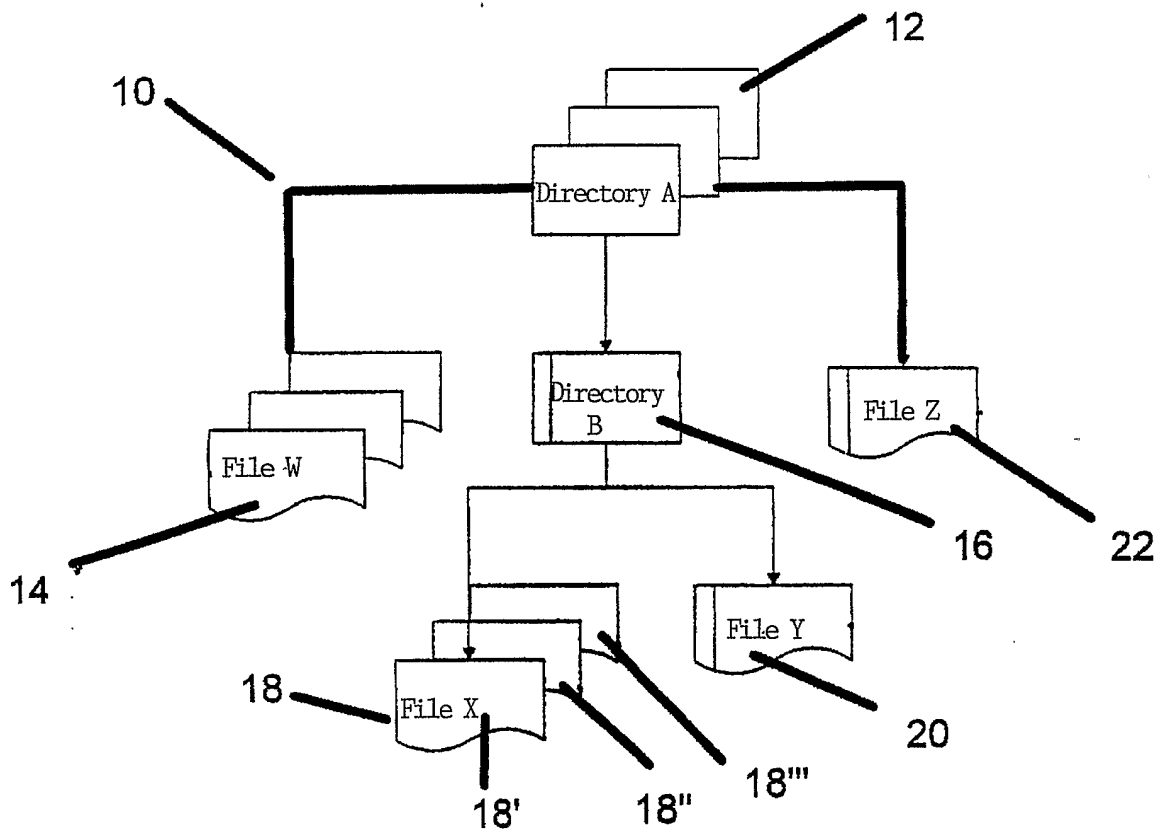
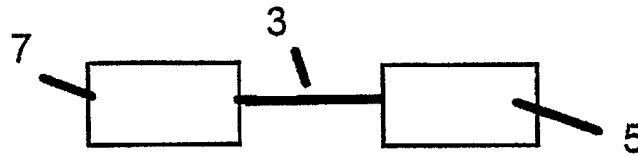


Figure 2

# INTERNATIONAL SEARCH REPORT

PCT/GB 03/02282

**A. CLASSIFICATION OF SUBJECT MATTER**  
IPC 7 H04N5/00

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)  
IPC 7 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, WPI Data, PAJ

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 01 33852 A (OPENTV CORP) 10 May 2001 (2001-05-10) page 4, line 19 - line 35 page 5, line 5 - page 6, line 2 page 6, line 14 - line 21 page 6, line 32 - line 33 page 7, line 12 - line 16 page 7, line 24 - line 30 page 8, line 3 - line 12 figure 5	1-16
A	EP 1 107 600 A (SONY SERVICE CT EUROP N V) 13 June 2001 (2001-06-13) abstract	1,14,16

Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

\* Special categories of cited documents :

- \*A' document defining the general state of the art which is not considered to be of particular relevance
- \*E' earlier document but published on or after the international filing date
- \*L' document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- \*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

24 October 2003

31/10/2003

Name and mailing address of the ISA  
 European Patent Office, P.B. 5818 Patentlaan 2  
 NL - 2280 HV Rijswijk  
 Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
 Fax: (+31-70) 340-3016

Authorized officer  
  
 Sindic, G

## INTERNATIONAL SEARCH REPORT

PCT/GB 03/02282

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
WO 0133852	A	10-05-2001	AU	1252701 A	14-05-2001
			BR	0015152 A	16-07-2002
			CA	2388789 A1	10-05-2001
			CN	1382344 T	27-11-2002
			EP	1224806 A1	24-07-2002
			JP	2003513559 T	08-04-2003
			WO	0133852 A1	10-05-2001
<hr/>					
EP 1107600	A	13-06-2001	GB	2357922 A	04-07-2001
			EP	1107600 A1	13-06-2001
			JP	2001245272 A	07-09-2001
			US	2003191815 A1	09-10-2003
<hr/>					