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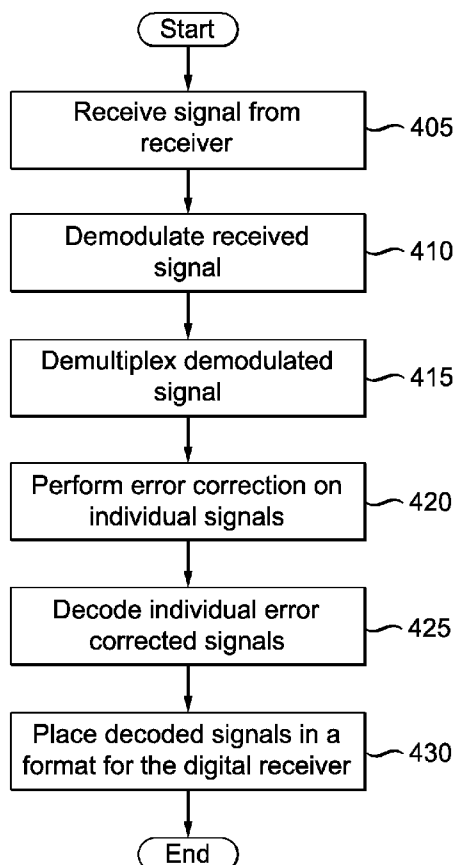


FIG. 4

(57) Abstract: A method and a transcoder to provide output of a server to a broadcast receiver having network access, including receiving an input signal from one of a plurality of receivers, demodulating the received signal, demultiplexing the demodulated signal, perform error correction on the demultiplexed signal, unscrambling the error corrected signal, formatting the unscrambled signal for a digital receiver and providing the formatted signal to the digital receiver.



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ATSC 3.0 NETWORK INTERFACE AS REMOTE DISPLAY

FIELD OF THE INVENTION

The present invention relates to ATSC 3.0 receivers and, in particular, to provide
5 a method and apparatus to provide output of a satellite or cable “server” box to an ATSC
3.0 compliant receiver.

BACKGROUND OF THE INVENTION

In multicast and broadcast applications, data are transmitted from a server to
multiple receivers over wired and/or wireless networks. A multicast system as used
10 herein is a system in which a server transmits the same data to multiple receivers
simultaneously, where the receivers form a subset of all the receivers up to and including
all of the receivers. A broadcast system is a system in which a server transmits the same
data to all of the receivers simultaneously. That is, a multicast system by definition can
include a broadcast system.

15 This section is intended to introduce the reader to various aspects of art, which
may be related to the present embodiments that are described below. This discussion is
believed to be helpful in providing the reader with background information to facilitate a
better understanding of the various aspects of the present disclosure. Accordingly, it
should be understood that these statements are to be read in this light.

20 Satellite and cable providers currently use small dedicated devices to
communicate with a master server somewhere in the premises to convert received
satellite or cable signals to standard broadcast TV signals for display (rendering). The
connection between the master server and receiver (TV) is currently done using a
dedicated hardware device to connect from a master server to a receiver (TV).

SUMMARY OF THE INVENTION

25 The next generation TV standard is currently being developed as ATSC 3.0. This
standard includes the capability to receive content over an IP connection (e.g., wired
ethernet or WiFi) in addition to over the air (broadcast). This IP interface can be used not
30 only to display content related to the broadcast programs, but could also be used as an
interface to set-top boxes such as satellite or cable set-top boxes. Currently, the cable and

satellite providers have systems for so-called "no wires" installation. These "no-wire" installations currently use small dedicated devices that fit behind the receiver (TV) and communicate with a master server somewhere in the home. Instead of using a dedicated device, the master server could convert its output to be ATSC 3.0 compliant and interface directly with an ATSC 3.0 compliant receiver (TV). Thus, the proposed method provides output from a satellite or cable "server" box to an ATSC 3.0 compliant receiver (TV). An ATSC 3.0 receiver is a broadcast receiver having network access.

A method and a transcoder to provide output of a server to a broadcast receiver having network access, including receiving an input signal from one of a plurality of receivers, demodulating the received signal, demultiplexing the demodulated signal, perform error correction on the demultiplexed signal, unscrambling the error corrected signal, formatting the unscrambled signal for a digital receiver and providing the formatted signal to the digital receiver.

While the proposed method is described in terms of an ATSC 3.0 receiver, it is not so limited and any broadcast receiver (e.g., TV) that has a WiFi interface is envisioned as a device that can benefit from the proposed method.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention is best understood from the following detailed description when read in conjunction with the accompanying drawings. The drawings include the following figures briefly described below:

Fig. 1 is an simplified overview diagram of a system including the proposed apparatus.

Fig. 2 is a block diagram is an exemplary master server that may include the present invention.

Fig. 3 is a block diagram of an exemplary embodiment of a transcoder module.

Fig. 4 is a flowchart of an exemplary embodiment of the operation of a transcoder module.

It should be understood that the drawing(s) are for purposes of illustrating the concepts of the disclosure and is not necessarily the only possible configuration for illustrating the disclosure.

5 DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present description illustrates the principles of the present disclosure. It will thus be appreciated that those skilled in the art will be able to devise various arrangements that, although not explicitly described or shown herein, embody the principles of the disclosure and are included within its scope.

10 All examples and conditional language recited herein are intended for educational purposes to aid the reader in understanding the principles of the disclosure and the concepts contributed by the inventor to furthering the art, and are to be construed as being without limitation to such specifically recited examples and conditions.

Moreover, all statements herein reciting principles, aspects, and embodiments of
15 the disclosure, as well as specific examples thereof, are intended to encompass both structural and functional equivalents thereof. Additionally, it is intended that such equivalents include both currently known equivalents as well as equivalents developed in the future, i.e., any elements developed that perform the same function, regardless of structure.

20 Thus, for example, it will be appreciated by those skilled in the art that the block diagrams presented herein represent conceptual views of illustrative circuitry embodying the principles of the disclosure. Similarly, it will be appreciated that any flow charts, flow diagrams, state transition diagrams, pseudocode, and the like represent various processes which may be substantially represented in computer readable media and so
25 executed by a computer or processor, whether or not such computer or processor is explicitly shown.

The functions of the various elements shown in the figures may be provided through the use of dedicated hardware as well as hardware capable of executing software in association with appropriate software. When provided by a processor, the functions
30 may be provided by a single dedicated processor, by a single shared processor, or by a plurality of individual processors, some of which may be shared. Moreover, explicit use

of the term “processor” or “controller” should not be construed to refer exclusively to hardware capable of executing software, and may implicitly include, without limitation, digital signal processor (DSP) hardware, read only memory (ROM) for storing software, random access memory (RAM), and nonvolatile storage.

5 Other hardware, conventional and/or custom, may also be included. Similarly, any switches shown in the figures are conceptual only. Their function may be carried out through the operation of program logic, through dedicated logic, through the interaction of program control and dedicated logic, or even manually, the particular technique being selectable by the implementer as more specifically understood from the context.

10 In the claims hereof, any element expressed as a means for performing a specified function is intended to encompass any way of performing that function including, for example, a) a combination of circuit elements that performs that function or b) software in any form, including, therefore, firmware, microcode or the like, combined with appropriate circuitry for executing that software to perform the function. The disclosure
15 as defined by such claims resides in the fact that the functionalities provided by the various recited means are combined and brought together in the manner which the claims call for. It is thus regarded that any means that can provide those functionalities are equivalent to those shown herein.

The proposed method provides an ATSC 3.0 transcoding function in a satellite or
20 cable master server. This would allow an ATSC 3.0 compliant receiver (TV) to directly receive content from the master server without the use of a dedicated hardware box at the TV. This transcoding function includes among other things, changing the encoded audio and video to an ATSC 3.0 compatible format, overlaying video at the master server (e.g., epg), conversion of transport encapsulation into ATSC 3.0 compatible format, and
25 addition of ATSC 3.0 compatible security.

Transcoding is a procedure for modifying a stream of data (content) so that the stream may be carried by a different type of network. In the proposed method the received stream is either a satellite signal or a cable signal. In either case, the signal has content for rendering on a receiver (TV) for viewing by a user. A master server receives a
30 satellite or cable signal (content) that is in a particular format. A master server is typically used by satellite or cable providers in a no-wires installation, which had a dedicated

hardware device for transcoding the received signal so that the signal can be rendered on a receiver (TV). It would be advantageous to include the transcoding function within the master server thus eliminating a unit of dedicated hardware. Further, if the transcoding function is within the master server, updates can be downloaded during off hours thus not only eliminating the need for dedicated hardware but also eliminating the need for a service technician to service the premises by removing old dedicated hardware and installing new dedicated hardware. This is a particular advantage in very rural areas with large distances between premises so much time is lost to service (maintenance).

The master server may also be fitted with an internet receiver (not shown). If the particular content selected by the user (viewer) is for some reason not available from the satellite or cable service provider then the content may be downloaded from the internet and transcoded for rendering by the ATSC 3.0 compliant receiver (TV). Thus, the ATSC 3.0 receiver (TV) is able to receive content directly from an off the air broadcast or multicast. The ATSC 3.0 receiver (TV) is also able to receive content from a master server. The master server having received the content from a satellite or cable service provider. Since an ATSC 3.0 receiver (TV) has an internet connection, the ATSC 3.0 receiver (TV) may be able to receive content from the internet directly. If for some reason the internet connection of the ATSC 3.0 compliant receiver is unable to receive content directly but the master server is able to receive content from the internet via its internet receiver then the master server can transcode the received content to an ATSC 3.0 compliant signal.

The head end transmits a number of streams of audio and video content multiplexed within a transport stream (TS). The user selects which program(s) to watch or record by selecting a channel. Today users may watch one program and record one or more other programs concurrently. The selected programs all were received by the master server in a transport stream. The transport stream creation process started with video content, each frame of which is made up of pixels (color coded) that were rasterized. Horizontal and vertical synchronization was added. The cable or satellite service provider also encoded and/or scrambled the signals. Audio signals were also processed. These signals are combined, modulated and transmitted by the head end to the master server.

Error correction coding is also applied to the individual signals before the signals are combined. Further error correction coding may also be applied to the combined signal.

Each ATSC 3.0 compliant receiver (TV) has different characteristics. The scans may be interlaced or progressive, the aspect ratios vary, picture resolutions vary, frame rate conversion may be necessary, image scaling may also be necessary. It is very unusual to have all ATSC 3.0 compliant receivers (TVs) in a premises be the same make and model so any or all of the above media reformatting may be necessary.

Transcoding includes demodulation of the received signal, error correction of the combined signal if error correction was applied to the combined signal. Demultiplexing of the combined signal to obtain (retrieve) the individual signals. Applying error correction to the individual signals and then decoding (unscrambling) the individual signals. The transcoding step results in a signal (media content) that may need to be reformatted which is performed by a digital receiver. The digital receiver essentially performs a media reformatting process. The digital receiver formats the signal for a particular ATSC 3.0 compliant receiver (TV). Since ATSC 3.0 compliant devices vary in terms of aspect ratios, image scaling, frame rate, image resolution etc., the media reformatting step may be performed in the master server before the signal is transmitted to a slave unit associated with a particular ATSC 3.0 compliant receiver (TV) or the media reformatting step may be performed by the slave unit associated with the particular ATSC 3.0 compliant receiver. It would be better performed in the master server if there is no slave unit or if the slave unit does not have sufficient processing power.

Fig. 1 is an simplified overview diagram of a system including the proposed apparatus. Fig. 1 shows a master server with a receiver and a transcoder. In fact, there may be multiple receivers and one or two transcoder modules.

Fig. 2 is a block diagram is an exemplary master server that may include the present invention. The master server includes one or more receivers such as a satellite receiver, a cable receiver and/or an internet receiver. Several components necessary for complete operation of the system are not shown in the interest of conciseness, as they are well known to those skilled in the art. If digital receiver is in a slave unit then communication may be wireless or wired line. If digital receiver is in the master server then communication is wired. Fig. 2 shows transcoder and digital receiver both in the

master server. If transcoder and digital receiver are both in the master server then they may share the controller 214, storage device 212 and control memory 220 rather than as shown on Fig. 3 with transcoder having a controller 214, control memory 220 and a storage device 212.

5 In the master server 200 shown in Fig. 2, the content is received by an input signal receiver 202. The input signal receiver 202 may be one of several known receiver circuits used for receiving signals provided over one of the several possible networks including over the air, cable, satellite, Ethernet, fiber and phone line networks. Transcoder 204 provides demodulation, demultiplexing and decoding of the signals as well as error
10 correction. Transcoder includes a controller 214, control memory 220, a storage device 212, a demodulator, a demultiplexer, an error correction module and a decoder.

Fig. 3 is a block diagram of an exemplary embodiment of a transcoder module. The received signal is received by a demodulator 305. Once the signal is demodulated, the signal is output to the demultiplexer 310. The demultiplexer extracts individual
15 signals from the demodulated signal. The individual signals are then received by an error correction module. Which uses error correction codes applied by the head end to recover any corrupted portions of the individual signals. Once the error corrected individual signals have been recovered the individual signals are decoded (unscrambled). Each of the functions of demodulation, demultiplexing, error correction and decoding is
20 performed under the control (direction) of controller 214. Instructions for operation of controller 214 are in control memory 220. Controller stores intermediate signal information in storage device 212 described in more detail below. Controller receives the decoded individual signals, formats the unscrambled signals and provides the decoded individual signals to the digital receiver.

25 Digital receiver performs the final signal selection, processing and media reformatting, and includes separation of video content from audio content for the content stream. The digital receiver handles media reformatting such as image scaling, adjustment of aspect ratios, frame rate conversion, resolution, scanning form (type) and level adjustment. These functions are performed based on the ATSC 3.0 compliant
30 receiver for the selected signal. Each ATSC 3.0 receiver may have different media

format. Scanning type (form) may be progressive or interlaced. Resolution varies from 120x176 up to 1080x 1920. Aspect ratio may be 4:3 or 16:9. SDTV requires levels 3 and 3.1. HDTV requires levels 3.2 and 4. H.264 /AVC requires High profile Level 4.2. Video processor may include modules to perform each of these functions.

5 In the event that the user is visually impaired (not blind) the display device may be a very large display screen. The visually impaired user may use a very large print format for viewing the choices (selection options) or the user interface may allow a visually impaired user to receive and make choices (selections) via an audio format.

10 The operation of the invention in the master server (or other home device) may be embedded in a controller circuit or may be implemented as a software program (either resident or cloud based) that runs using the controller circuit and memory in the master server.

15 Fig. 4 is a flowchart of an exemplary embodiment of the operation of a transcoder module. At 405 transcoder receives an input signal from any one of a plurality of receivers. The receivers received the input signal from any one of a number of service providers such as satellite service providers, cable service providers, internet service providers etc. At 410 the received signal is demodulated. At 415 the demodulated signal is demultiplexed. The received signal is a transport stream having a plurality of individual signals multiplexed together. Once individual signals have been extracted, error
20 correction is performed on the individual signals as needed at 420. The error corrected individual signals are then decode (unscrambled) at 425. At 430 the decoded individual signals are placed in a format for the digital receiver . It should be noted that the signals may also have been compressed so decompression may also be necessary.

25 It is to be understood that the present invention may be implemented in various forms of hardware, software, firmware, special purpose processors, or a combination thereof. Special purpose processors may include application specific integrated circuits (ASICs), reduced instruction set computers (RISCs) and/or field programmable gate arrays (FPGAs). Preferably, the present invention is implemented as a combination of hardware and software. Moreover, the software is preferably implemented as an
30 application program tangibly embodied on a program storage device. The application

program may be uploaded to, and executed by, a machine comprising any suitable architecture. Preferably, the machine is implemented on a computer platform having hardware such as one or more central processing units (CPU), a random access memory (RAM), and input/output (I/O) interface(s). The computer platform also includes an operating system and microinstruction code. The various processes and functions described herein may either be part of the microinstruction code or part of the application program (or a combination thereof), which is executed via the operating system. In addition, various other peripheral devices may be connected to the computer platform such as an additional data storage device and a printing device.

It should be understood that the elements shown in the figures may be implemented in various forms of hardware, software or combinations thereof. Preferably, these elements are implemented in a combination of hardware and software on one or more appropriately programmed general-purpose devices, which may include a processor, memory and input/output interfaces. Herein, the phrase "coupled" is defined to mean directly connected to or indirectly connected with through one or more intermediate components. Such intermediate components may include both hardware and software based components.

It is to be further understood that, because some of the constituent system components and method steps depicted in the accompanying figures are preferably implemented in software, the actual connections between the system components (or the process steps) may differ depending upon the manner in which the present invention is programmed. Given the teachings herein, one of ordinary skill in the related art will be able to contemplate these and similar implementations or configurations of the present invention.

CLAIMS:

1. A method for a transcoder to provide output of a server to a broadcast receiver having network access, said method comprising:

receiving an input signal from one of a plurality of receivers;
demodulating the received signal;
demultiplexing the demodulated signal;
perform error correction on said demultiplexed signal;
unscrambling the error corrected signal;
formatting the unscrambled signal for a digital receiver; and
providing said formatted signal to said digital receiver.

2. The method according to claim 1, wherein said input signal originates with a service provider.

3. The method according to claim 2, wherein said service provider is one of a satellite service provider, a cable service provider and an internet service provider.

4. The method according to claim 1, wherein said broadcast receiver having network access is an ATSC 3.0 compliant receiver.

5. A transcoder for providing output to a broadcast receiver having network access, comprising:

a demodulator receiving an input signal from one of a plurality of receivers and demodulating said received signal, said demodulator operating under direction of a controller, said demodulator in bi-directional communication with said controller;

a demultiplexer in communication with said demodulator and in bi-directional communication with said controller, said demultiplexer operating under the direction of said controller, demultiplexing said demodulated signal by said demultiplexer;

an error correction module, said error correction module in communication with said demultiplexer and in bi-directional communication with said controller, said error correction module operating under the direction of said controller, performing error correction by said error correction module;

a decoder, said decoder in communication with said error correction module and in bi-directional communication with said controller, said decoder operating under the direction of said controller, said decoder unscrambling said error corrected signal;

5 said controller formatting said unscrambled signal for a digital receiver;
and

 said controller providing said formatted signal to said digital receiver.

6. The transcoder according to claim 5, wherein said input signal originates with a service provider.

10 7. The transcoder according to claim 6, wherein said service provider is one of a satellite service provider, a cable service provider and an internet service provider.

8. The transcoder according to claim 5, wherein said broadcast receiver having network access is an ATSC 3.0 compliant receiver.

15 9. The transcoder according to claim 5, wherein said transcoder is within a master server.

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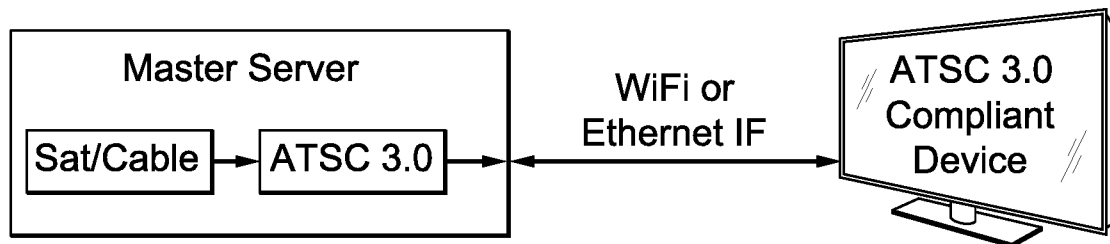


FIG. 1

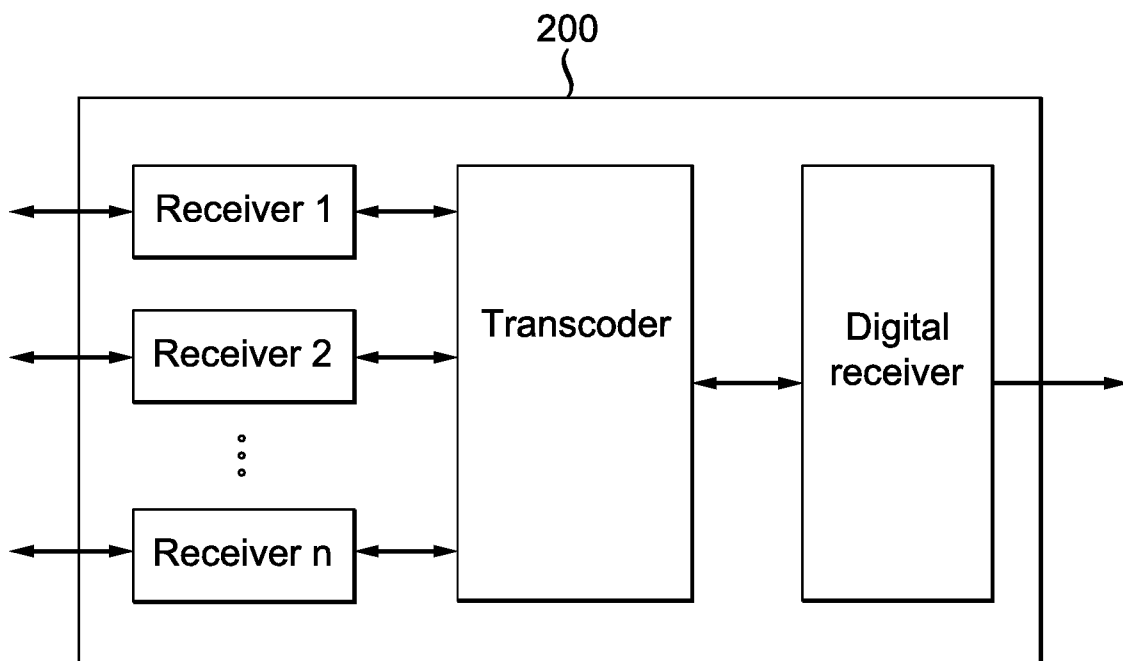


FIG. 2

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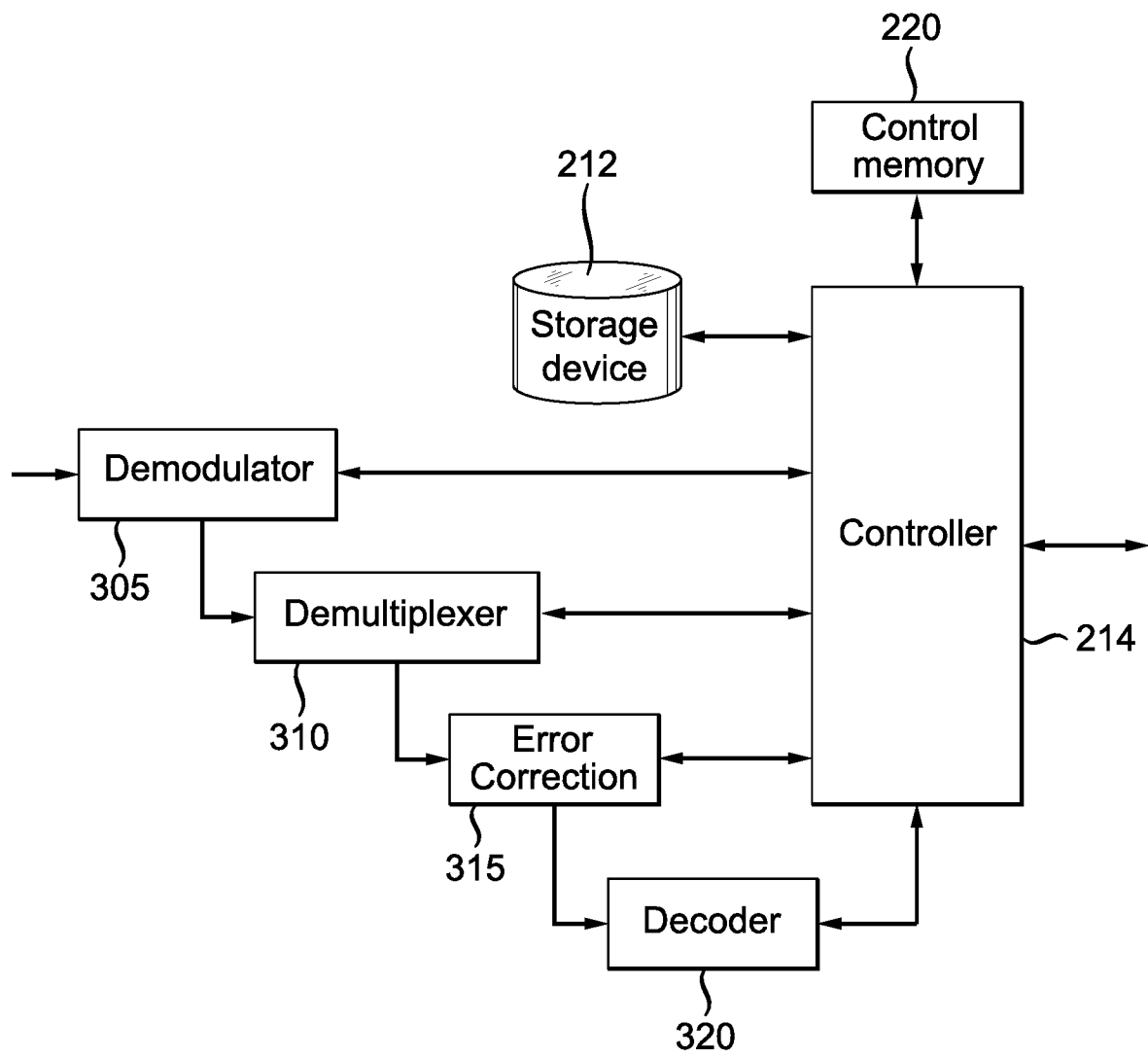
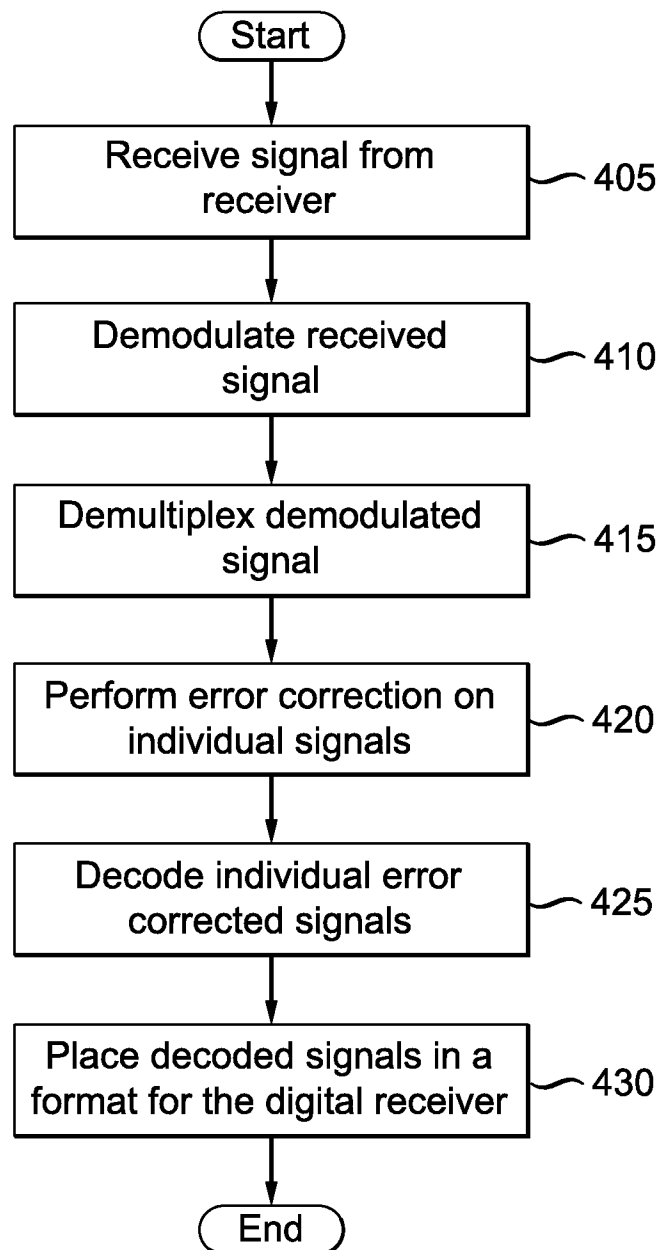


FIG. 3

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*FIG. 4*

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2016/012950

A. CLASSIFICATION OF SUBJECT MATTER

INV. H04N21/438 H04N21/436 H04N21/4402
ADD.

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 practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	Anonymous: "EyeTV Netstream 4Sat elgato.com", 9 March 2014 (2014-03-09), XP055254721, Retrieved from the Internet: URL:http://web.archive.org/web/20140309051 517/http://www.elgato.com/en/eyetv/eyetv-n etstream-4sat? [retrieved on 2016-03-02] the whole document ----- -/--	1-9



Further documents are listed in the continuation of Box C.



See patent family annex.

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"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

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"&" document member of the same patent family

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Schoeyer, Marnix

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2016/012950

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	David Denyer: "Elgato EyeTV Netstream 4Sat DVB-S2 HD TV Tuner review - Review - Macworld UK", 20 January 2014 (2014-01-20), XP055254718, Retrieved from the Internet: URL:http://www.macworld.co.uk/review/ios-mac-accessories/elgato-eyetv-netstream-4sat-review-3497900/ [retrieved on 2016-03-02] the whole document -----	1-9
X	Anonymous: "Sat-IP - Wikipedia, the free encyclopedia", 22 April 2014 (2014-04-22), XP055193000, Retrieved from the Internet: URL:http://en.wikipedia.org/w/index.php?title=Sat-IP&oldid=605272071 [retrieved on 2015-06-02] the whole document -----	1-9
A	US 2007/174875 A1 (MEDFORD BRAD A [US] ET AL) 26 July 2007 (2007-07-26) paragraph [0023] - paragraph [0026] -----	1-9

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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		US 2013239152 A1	12-09-2013
