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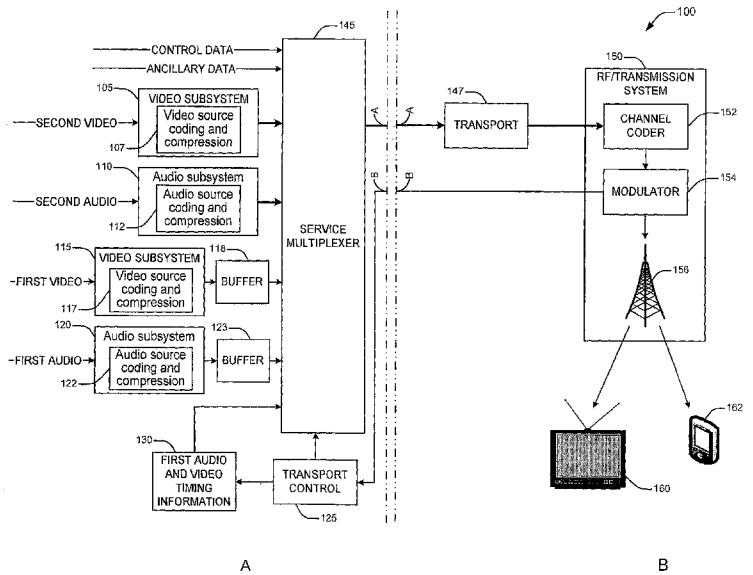
(54) Title: METHOD AND APPARATUS FOR TRANSMITTING DATA




(57) Abstract: An implementation provides a transmitter that separates sequential portions of data in a first set of data by time intervals allowing a power saving mode (1005). The transmitter transmits the sequential portions of data separated by respective time intervals having lengths configured to allow a receiver to enter and exit a power saving mode between receiving sequentially transmitted portions of data from the first set of data (1010). The transmitter separates sequential portions of data in a second set by time intervals that are not of sufficient length to allow a receiver to enter and exit a power saving mode during the time intervals (1015). The second set of data is then transmitted (1020).

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# METHOD AND APPARATUS FOR TRANSMITTING DATA

## CROSS REFERENCES

**[0001]** This application claims the benefit of U.S. Provisional Patent Application Serial No. 60/799,625, filed May 11, 2006, and titled "Protocol for Mobile Reception and Other Environments", which application is incorporated by reference herein in its entirety.

## FIELD OF THE INVENTION

**[0002]** This disclosure relates to broadcasting of digital information.

## BACKGROUND OF THE INVENTION

**[0003]** In broadcasting using the existing ATSC (Advanced Television Systems Committee) A/53 standard for digital television broadcasting, data is transmitted continuously. Receivers continuously demodulate all of the information received. In a system using a version of the ATSC A/53 protocol, the available bandwidth is over 19 Mbps, and a high data transfer rate is provided. As a result of the large data transfer rate, the power consumption requirements of the demodulator can be significant.

## SUMMARY

**[0004]** According to one general aspect, a transmitter transmits a first set of data, the transmissions of sequential portions of data constituting the first set of data being separated by respective time intervals having lengths configured to allow a receiver to enter a power saving mode and then exit the power saving mode between receiving sequentially transmitted portions of data constituting the first set of data. The transmitter transmits a second set of data, the second set of data constituting a user-selectable program, the transmissions of all portions of the second set of data being separated by respective time intervals having lengths that are not configured to allow a receiver to enter the power saving mode and then to exit the power saving mode between receiving sequentially transmitted portions constituting the second set of data.

**[0005]** According to another general aspect, a receiver exits a power saving mode for a fixed receiving period of time in order to receive a burst transmission from a first stream. The receiver receives, during the fixed

receiving period of time, the burst transmission from the first stream. The receiver receives, during the fixed receiving period of time, data from a second stream at the receiver. The receiver discards the data received from the second stream, and enters the power saving mode for a fixed power-saving period of time while waiting for another burst from the first stream.

**[0006]** According to another general aspect, a transmitter accesses a stream of data and divides the stream of data into a series of bursts. The series of bursts is then transmitted, with successive bursts in the series separated in time, over a continuous-mode transmission system.

**[0007]** According to another general aspect, a receiver receives a series of bursts of data in a stream of data. The bursts are received over a continuous-mode transmission system, with successive bursts being separated in time by separation times. The separation times have durations sufficient for the receiver to enter a power saving mode and exit the power saving mode between receiving the successive bursts.

**[0008]** The details of one or more implementations are set forth in the accompanying drawings and the description below. Other features will be apparent from the description and drawings, and from the claims.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0009]** Fig. 1 is a schematic illustration of a system according to an embodiment.

**[0010]** Fig. 2 is a schematic illustration of an embodiment of a transmitter.

**[0011]** Fig. 3 is a process flow diagram of an embodiment of a method of transmission.

**[0012]** Fig. 4 shows components of an exemplary field of data ready for transmission in an embodiment.

**[0013]** Fig. 5A shows exemplary assignment of slots and relative use of bandwidth in a method of transmission.

**[0014]** Fig. 5B shows exemplary assignment of slots and relative use of bandwidth in a method of transmission including both high definition and standard definition data.

**[0015]** Fig. 5C shows exemplary assignment of slots and relative use of bandwidth in a method of transmission including two streams of standard definition data.

**[0016]** Fig. 6 illustrates utilization of bandwidth in an embodiment.

**[0017]** Fig. 7 illustrates an implementation of control for timing of reading of burst buffers in an embodiment.

**[0018]** Fig. 8 is a block diagram of a receiver in an embodiment.

**[0019]** Fig. 9 is a process flow diagram of an embodiment of a method of receiving data.

**[0020]** Fig. 10 is a process flow diagram of an embodiment of a method of transmitting data.

**[0021]** Fig. 11 is a process flow diagram of an embodiment of a method of receiving data.

**[0022]** Fig. 12 is a process flow diagram of an embodiment of a method of transmitting data.

## DETAILED DESCRIPTION

**[0023]** One or more embodiments provide a method of receiving data and a method of transmitting data which addresses the problem of power management when the data is being transmitted according to a protocol that expects receivers to be on continuously. An example of such a protocol is the ATSC Digital Television Standard (A/53). An example of an application in which power management is desirable is that of mobile devices, which rely on internal power sources, such as batteries. As noted above, as a demodulator must examine all of the data received, the demodulator must continuously process large quantities of data. The demodulator thus has power needs that may be significant relative to the overall power consumption needs of a portable device.

**[0024]** A reduction in the data transfer rate for content specifically provided for mobile devices may reduce power consumption requirements of MPEG decoders and displays, for example. However, in the ATSC A/53 standard, because the demodulator processes all of the data, including the data provided for terrestrial television, a reduction in the data transfer rate for content specifically provided for mobile devices does not significantly reduce the power consumption requirements of the demodulator.

[0025] An implementation addresses these challenges by continuously transmitting a first set of data and intermittently transmitting a second set of data, with portions of the second set of data being separated by respective time intervals. The time intervals are sufficiently long to permit a receiver to enter a power saving mode and exit the power saving mode between receiving sequential portions of the second set of data. The first set of data is digital television programming data for terrestrial television, and the second set of data is digital television programming data for use by mobile receivers. An advantage of such an implementation is that power consumption may be reduced in mobile devices compared to power consumption required with a continuously operating demodulator.

[0026] Referring to Figure 1, a system 100 is illustrated for transmission and reception of audio and video data. At least first and second data streams are provided. A first data stream may include first audio and first video, as illustrated. A second data stream may include second audio and second video, as illustrated. The first data stream may include, by way of example, audio and video content, such as television programming, which may be digitized. The second data stream may include, by way of example, audio and video content, such as television programming, which may be digitized. In an embodiment, the first data stream may include relatively smaller amounts of data for each frame to be displayed. The first data stream may include television programming intended for transmission and display on relatively small displays, by way of example. A particular program or portion of a program in the first data stream may be deemed a first set of data. A particular program or portion of a program in the second data stream may be deemed a second set of data.

[0027] A video subsystem for the second video is shown at 105, and includes video source coding and compression 107. Video source coding and compression may include hardware and software for providing bit rate reduction. By way of example, coding and compression 107 may include hardware and software for coding data in accordance with the MPEG-2 video stream syntax. An audio subsystem for the second audio stream is shown at 110. Audio subsystem 110 may include audio source coding and compression 112. By way of example, audio source coding and compression

112 may include hardware and software for coding in accordance with the Digital Audio Compression (AC-3) Standard.

**[0028]** Video subsystem 115 receives the first video stream and may include video source coding and compression 117, which may include, by way of example, hardware and software for coding and compression in accordance with the MPEG-2 video stream syntax. Audio subsystem 120 receives the first audio stream and may include audio source coding and compression 122. Audio source coding and compression 122 may include hardware and software for coding and compression in accordance with the Digital Audio Compression (AC-3) Standard.

**[0029]** First video subsystem 115 outputs an encoded and compressed video stream to buffer 118. Buffer 118 includes a memory for storage of a portion of the encoded and compressed video stream. Depending on desired characteristics, buffer 118 may include memory for storage of from about 1, 2 or 5 seconds, or less of the encoded and compressed video stream at its playback rate, to about 60, 120 or 300 seconds of the encoded and compressed video stream at its playback rate. Similarly, first audio subsystem 120 outputs an encoded and compressed video stream to buffer 123. Buffer 123 includes a memory for storage of a portion of the encoded and compressed audio stream. Buffer 123 may include memory for storage of from about 1, 2 or 5 seconds, or less of the encoded and compressed audio stream at its playback rate, to about 60, 120, 300 or more seconds of the encoded and compressed audio stream at its playback rate. The storage capacity of both buffer 118 and buffer 123, in terms of playback rate, may be the same or substantially the same.

**[0030]** Second video subsystem 105 outputs an encoded and compressed video stream to service multiplex 145. Second audio subsystem 110 outputs an encoded and compressed audio stream to service multiplex 145. Both second video subsystem 105 and second audio subsystem 110 may output respective video and audio streams at, or substantially at, a corresponding playback rate. Buffer 118 periodically outputs to service multiplex 145 an encoded and compressed video stream, in portions, with intervals between each portion. Buffer 123 periodically outputs to service multiplex 145 an encoded and compressed audio stream, in portions, with

intervals between each portion. During each interval, no data is output by buffer 118 or buffer 123. Buffers 118 and 123 may be synchronized so as to output data during simultaneous portions, and not to output data during simultaneous intervals.

**[0031]** Service multiplex 145 also receives control data and ancillary data, as illustrated. Control data may include conditional access control data, for example. Ancillary data may include independent program services, and data associated with program audio and video services, such as closed captioning. Service multiplex also receives first audio and video timing information 130, which provides information related to timing of the output of data from buffers 118, 123.

**[0032]** Service multiplex 145 multiplexes the received data, including the encoded and compressed audio and video streams, control data, ancillary data, and first audio and video timing information. Transport 147 provides a transport mechanism. By way of example, service multiplex 145 and transport 147 may employ the MPEG-2 transport stream syntax for the packetization and multiplexing of video, audio and data signals. Transport 147 provides the packetized and multiplexed data stream, including video, audio and data signals, to RF/Transmission system 150, and particularly to channel coder 152. Channel coder 152 may add additional information usable by receivers to reconstruct the data from the received signal in the event of transmission problems or impairments. Channel coder 152 outputs the packetized and multiplexed data stream, with additional information added by channel coder 152, to modulator 154. Modulator 154 modulates the data stream. Modulator 154 may modulate using the terrestrial broadcast mode, 8-VSB (vestigial side-band), or a high data rate broadcast mode, such as 16-VSB. Modulator 154 provides the modulated data stream to wireless transmitter 156, which wirelessly transmits the modulated data stream.

**[0033]** Receivers 160, 162 are illustrated. Receiver 160 may be a fixed receiver, such as a digital television set having direct connection to an external power source, such as a source of household current. Receiver 160 may not be adapted for operation except when connected to a source of household current. Receiver 162 may be a portable device, and may be a portable handheld device. Receiver 162 may include a housing having

therein a source of power, such as one or more batteries, which may be rechargeable batteries. Receiver 162 may include a display and one or more speakers for audio output. Receiver 162 may include other functionality, and may include, by way of example, a personal digital assistant, as illustrated, a cell or satellite phone, a satellite or terrestrial radio receiver, a digital music player, a personal computer, and devices incorporating the functions of any two or more of the foregoing. Receiver 162 may include any other functionality desirable in a portable device.

**[0034]** Modulator 154 also provides modulation data to transport control 125. Transport control 125 controls the service multiplexer 145, controlling the timing of data from buffers 118 and 123, and providing synchronization to first audio and video timing information block 130, which generates timing control packets to synchronize the burst reception process in the receiver.

**[0035]** In the implementation shown in Fig. 1, the first data stream is transmitted in portions separated by intervals that are of sufficient duration for a receiver to enter a power saving mode and exit a power saving mode during the intervals. The second data stream is transmitted continuously, without intervals of sufficient duration for a receiver to enter a power saving mode and exit a power saving mode during the intervals. The first data stream may be transmitted in a burst mode. The second data stream may be transmitted in a continuous mode. Both data streams may be transmitted according to a protocol that expects a receiver to be on at all times.

**[0036]** Various implementations define an active period of time in which a receiver is not in a power saving mode, and a power-saving period of time in which a receiver is in the power saving mode. These periods of time may be fixed. These periods of time may be defined, or at least substantially determined, by the times at which a receiver enters and exits the power saving mode. During the active period of time, a receiver performs acquisition and receives data.

**[0037]** Referring now to Fig. 2, an implementation of a transmitter 200 will be discussed. The transmitter may be implemented in system 100 of Fig. 1, for example. A first channel of a second data stream 205, which may be suitably encoded and compressed as discussed above, is provided to multiplexer 145. A second channel of a second data stream 210, which may

be suitably encoded and compressed as discussed above, is also provided to multiplexer 145. Providing of first and second channels of the second data stream may be substantially continuous. The first and second channels may be first and second channels of a digital television broadcast, and may include video, audio and ancillary data. A first channel of a first data stream 220 may be provided to buffer 222. A second channel of a first data stream 224 may be provided to buffer 226. Buffer 222 and buffer 226 may each include separate buffers for a video data stream and an audio data stream. The first and second channels may be first and second channels of digital television broadcast, which may include a lower data transfer rate for a given period of programming than the second data stream.

**[0038]** Buffers 222, 226, are associated with first channel 220, and second channel 224, respectively. Buffer 222 receives first channel data 220 substantially continuously, and substantially at a playback rate associated with first channel data 220. Buffer 222 stores received first channel data, and outputs first channel data to multiplexer 145 at a rate higher than the playback rate associated with first channel data 220, with intervals separating the output of first channel data to multiplexer 145. The average rate of data output by buffer 222, including both intervals and time periods during which data is output, is the same as the rate of data received from first channel 220. Similarly, buffer 226 stores received second channel data and outputs stored second channel data to multiplexer 145 at a rate higher than the playback rate associated with second channel data 224. The average rate of data output by buffer 226, including both intervals and time periods during which data is output, is the same as the rate of data received from second channel 224. In an embodiment, there may be more than two channels, similar to channels 220, 224, and a buffer associated with each channel. Alternatively, a buffer may be associated with more than one channel.

**[0039]** Data source 230 may provide ancillary data and control data, as noted above. First data stream timing information insertion 232 provides data concerning the timing of the output of first data stream data from buffers 222, 226. The first data stream timing information insertion packet, or packets, provide the current state of the transmitter counter, and when the various burst transmissions will be sent relative to the transmitter counter. The first

data stream timing information is explained below in greater detail. Multiplexer 145 receives and multiplexes and packetizes data, including the channels of the first data stream and the channels of the second data stream, control data and ancillary data from data source 230, and first data stream timing information insertion 232, using, for example, the MPEG-2 data transport standard. The multiplexed data is provided to VSB modulator 154, which outputs a VSB modulated signal, which is then provided to a wireless transmitter (not shown). Synchronization signal information from the VSB modulator 154 may be provided to transport control 125. Transport control 125 provides timing control signals to multiplexer 145 to control the output of multiplexed data from multiplexer 145. Transport control 145 also provides timing information to first data stream timing information insertion 232.

**[0040]** Referring now to Fig. 3, a process flow in an implementation, such as the transmitter of Fig. 2, will be explained. First video and audio streams are received, as indicated by block 300. The first video and audio streams may constitute digital television channels, or other sources of data. The received first audio and video streams are buffered, as indicated by block 305. For example, buffering may be performed by buffers 222, 226 of Fig. 2. The first audio and video streams are divided into bursts, as indicated by block 310. The burst size may be defined by numbers of data fields, for example. As indicated by block 325, tags identifying the bursts as relating to burst mode transmission may be assigned to the fields that will be transmitted by burst mode transmission. The bursts may be assigned to slots in a transmission channel, as indicated by block 320. Further explanation of the assignment of bursts to slots is discussed below with reference to Fig. 5. The timing information for outputting of bursts from the buffers is obtained by the buffers, as indicated by block 325. The timing information may be determined based on a timing pulse that is also included in the transmitted data. The bursts are assigned to slots in a transmission channel, as indicated by block 320. The first audio and video stream is sent from a buffer in bursts, as indicated by block 330. The timing is in accordance with the timing information obtained at block 325, and the bursts may be assigned to slots in accordance with block 320.

[0041] The second video and audio streams are received by a multiplexer, as indicated at block 335. The multiplexer then multiplexes the timing information with the first and second streams, as indicated by block 340. As discussed in greater detail above, the stream, timing and other data, such as ancillary and control data, may be multiplexed in accordance with a standard such as the MPEG-2 transport standard. The multiplexed stream is then modulated, such as in accordance with a VSB modulation standard, as indicated by block 345. The modulated signal is then wirelessly transmitted, as indicated by block 350.

[0042] Referring now to Fig. 4, an exemplary field of data 400 ready for transmission in an embodiment is shown. The format is in accordance with the A/53 Digital Television Standard. Field 400 is divided into 313 segments. The first segment is data field sync segment 402. This segment contains data usable by a receiver to synchronize with the transmission. The remaining 312 segments are grouped in six groups, Group 1 405, through Group 6 410. Each group includes 52 segments, such as Segment 1 420 through Segment 52 422 of Group 1, and segment 261 424 through segment 312 426 of Group 6. Data fields contain data identifying them as being either associated with a first data stream, which is of interest to a demodulator in a portable device, or associated with a second data stream, which is of interest to a digital television. In one implementation, the stream identification data is included in the headers of the data packets.

[0043] It will be appreciated that data is formatted in field 400 as part of a larger process of providing forward error correction techniques and data formatting. For example, such known techniques as data randomization, Reed Solomon encoding, interleaving, trellis encoding, synchronization, and pilot insertion may be provided prior to forwarding the data to the VSB modulator.

[0044] Referring now to Fig. 5A, exemplary assignment of channels to slots in an implementation is shown. There are represented generally at 505 incoming data streams for 10 channels of programming particularly intended for transmission in a manner that permits a receiver to regularly enter and exit a power saving mode, while still receiving continuous programming for a selected channel. There is represented generally at 510 an incoming data

stream for channel capacity intended for use by digital television receivers. Block 506 generally represents the incoming data streams 505 as formatted for transmission. The channels 505 have been arranged sequentially, each representing a burst from a separate buffer associated with the channel. The vertical height of block 506 generally represents bandwidth, while the horizontal width represents time. It can be seen that the 10 channels at 505 represent a relatively small portion of the total bandwidth. The high definition data stream 510 is not allocated in slots and fills the remaining bandwidth without regard to timing, as indicated at 521.

**[0045]** Referring now to Fig. 5B, exemplary allocation of slots and division of bandwidth in an implementation including both high definition television data and standard definition television (SDTV) data is shown. Channels 505 are arranged sequentially, in the same manner as in Fig. 5A. A standard terrestrial HDTV data stream 510 occupies a major portion, which may be the majority, of the bandwidth, as indicated at 521. A standard definition television data stream 511 occupies a further portion of the bandwidth, as indicated at 522.

**[0046]** Referring now to Fig. 5C, exemplary allocation of slots and division of bandwidth in an implementation including two streams of standard definition television data is shown. Channels 505 are arranged sequentially, in the same manner, in the same manner as in Figs. 5A and 5B. A first standard definition television data stream 513 occupies a portion of the bandwidth, as indicated at 523. A second standard definition data stream 514 occupies the remaining bandwidth, as indicated at 524. Figures 5A, 5B, and 5C may illustrate bandwidth relationships between, for example, mobile programming (for example, channels 505) and standard terrestrial (for example, HDTV 521 and SDTV 522) programming.

**[0047]** Referring now to Fig. 6, the division of bandwidth between data streams for mobile receiver use, and standard terrestrial broadcast, is shown. Block 600 represents the use of bandwidth over a selected period of time. Blocks 610, 619, and intermediate blocks, each represent burst slots. Burst slot 0 may represent, for example, a burst made up of data representing a data stream for a time period equal to the entire width of block 600, even though the data is transmitted in a burst only one-tenth the overall time period.

Block 605 represents the bandwidth of continuous mode terrestrial broadcast content, such as that associated with high definition television, digital television, and other data. It will be appreciated that the numbers of slots is merely exemplary.

**[0048]** The amount of data per unit time per channel for the data transmitted in a burst mode may be less than the amount of data per unit time per channel for the data transmitted in a continuous mode. Indeed, the burst mode channels typically have a much lower data rate. For example, a burst mode channel may be in the range of 100-400 kbps, and a continuous-mode channel may be in the range of 10-12 Mbps. Accordingly, multiple burst mode channels may be accommodated in the same amount of bandwidth as a single continuous mode channel.

**[0049]** Referring now to Fig. 7, an exemplary implementation of control for timing of reading of burst buffers will be explained. A field synchronization timing pulse, which may be received from a modulator, is received at burst timing counter 710. Burst timing counter 710 outputs a value of the elapsed time in field sync periods based on the field sync timing pulse or a locally generated equivalent clock when in power saving mode. The burst timing counter is locked to the transmitter by timing information packets generated by first data stream timing information insertion block 232. In power saving mode, a timing pulse equivalent to the field sync pulse is locally generated. The clock signal is output to time read register 730. The time measured in field sync periods for reading of each burst buffer is stored in a corresponding burst time register 720, 722, 724, 726. Each burst time register provides the stored relative time to a corresponding burst comparator 740, 742, 744, 746. Burst comparators 740, 742, 744, 746 also receive the signal from the burst timing counter 710, and compare the value of the signal from the burst timing counter to the value received from the burst time register. When the signal from the burst timing counter indicates a time equal to the value received from the burst time register, the burst comparator outputs a burst buffer read signal. The field sync serves as a clock signal, and the field sync period may serve as the time base for the slots to which data is assigned, as explained above in connection with Figs. 5A-5C. Both the transmitter and receiver have counters which count in units equal to the field sync period. First data stream

timing information insertion 232 sends a packet that tells when to synchronize the burst timing counter, and the burst timing counter will determine time based on intervals equal to the interval between field syncs. The timing information packets generated by first data stream timing information insertion 232 must be periodically transmitted so that the receivers will be able to become synchronized after a power-up or an RF channel change. Field sync is an exemplary available time base for synchronizing, and alternative time bases could be employed.

**[0050]** Implementations may include information about when to wake up, or when a next burst will be sent for a given channel, by, for example, (1) using periodic timing in which, for example, every ten seconds bursts are sent, (2) including the information inside of a mobile packet, such as, for example, an MPEG control packet, or (3) including the information in a field sync segment.

**[0051]** Referring now to Fig. 8, an embodiment of a receiver 800 will be explained. Receiver 800 may be, by way of example, a portable handheld device. The modulated signal is received at antenna 805 and provided to VSB demodulator 810. VSB demodulator 810 demodulates the received signal, and may also select the signal components relevant to the receiver (for example, the video for a selected channel).

**[0052]** VSB demodulator 810 identifies the field sync pulse signal, and outputs the field sync pulse signal to the receiver burst timing counter. The output is provided to transport processor 850, which then performs data recovery functions on the signal, and outputs the audio and video signal to buffer 860. Transport processor 850 also identifies the time of next transmission of a burst of interest, and provides information to synchronize receiver burst timing counter 830 to the burst sequence at the transmitter. The time of next transmission may be, for example, provided in the received stream, provided in other control information that is received, or provided in a published guide.

**[0053]** The receiver burst timing counter 830 counts intervals equal to the interval between field syncs from the receipt of timing information from first data stream timing information insertion 232 (shown in Fig. 2), maintaining a count related to the slot sequencing in the transmitter. This counter may be

implemented as a cyclic count matching the slot sequencing of the system. Burst timing counter 830 provides a signal indicating the time elapsed following the receipt of the timing information from first data stream timing information insertion 232 to comparator 820. Burst time register 825 stores values which correspond to the time period when the burst is to be received, and provides this time to comparator 820. The values to be stored are obtained from a packet containing a mobile program guide, provided by the transmitter. Comparator 820 generates a signal when the inputs match to turn on (wake-up) VSB demodulator 810. Acquire mode multiplexer 835 provides a signal to turn on (wake up) VSB demodulator 810 when the comparator 820 inputs match or when the receiver 800 is in acquire mode (indicated by an acquire mode signal).

**[0054]** Referring now to Fig. 9, an embodiment of a process of receiving data will be explained. The process may be performed, for example, by the receiver illustrated in Fig. 8. Prior to the step indicated by block 905, the receiver may be in a power saving mode. In the power saving mode, the demodulator 810 may not be operating. In an initial step, the demodulator is activated in an acquire mode, as indicated by block 905. In the acquire mode, the demodulator is seeking to identify a data synchronization packet. In the next step, the data synchronization packet is acquired, as indicated by block 910. Once synchronization has been achieved, a signal can be received.

**[0055]** The receiver may receive and demodulate information such as program guide information, which may be displayed for a user. A user may then input a selection of a user-determined data object, which may be a stream of data representing audio and video in one television channel. The channel selection is received from the user, as indicated by block 925. The demodulator then obtains the time of the next burst transmission corresponding to the selected channel, which is loaded into the burst time register, as indicated by block 930. The receiver may then enter a power saving mode. The step of entering the power saving mode may include the step of deactivating the demodulator, as indicated by block 935. Some implementations will wait for the next burst for the selected channel before determining a "next" transmission time and entering a power-saving mode.

[0056] The receiver includes a local clock, and the time maintained by the local clock is compared to the time of the next burst or packet of interest from the burst time register, as indicated by block 940. It will be appreciated that the time stored in the burst time register may be an appropriate time in advance of the time of the next burst expected for the selected channel for the receiver to exit the power saving mode. For example, the time stored may be sufficient for one or more fields of data to be processed before the expected time of the next burst corresponding to the selected channel. One implementation exits power-saving mode several fields in advance of a burst to allow the demodulator to acquire the signal.

[0057] When the local time reaches the time from the burst time register to exit the power saving mode, then the receiver exits the power saving mode. The step of exiting the power saving mode may include activating the demodulator, as indicated by block 945. The demodulator receives the field pulse signal, as indicated by block 950. The demodulator is synchronized using the field pulse signal, as indicated by block 955. The burst, which includes data, such as television data, and the timing of the next burst, is then received, as indicated by block 965.

[0058] The data, such as video and audio data, is then forwarded to a buffer, as indicated by block 970. The process flow then returns to loading the burst time register corresponding to the selected channel, as indicated by the line leading from block 970 to block 930. The receiver then enters a power saving mode again, by deactivating the demodulator.

[0059] According to an implementation, and referring to Fig. 10, a method includes transmitting, from a transmitter, a first set of data. The transmissions of sequential portions of data constituting the first set of data are separated by respective time intervals having lengths configured to allow a receiver to enter a power saving mode and then exit the power saving mode between receiving sequentially transmitted portions of data from the first set of data, as indicated by block 1005. The transmitter transmits the sequential portions of data from the first set of data, as indicated by block 1010. A second set of data, as indicated by block 1015, has sequential portions separated by respective time intervals having lengths that are not configured to allow a receiver to enter the power saving mode and then to exit the power saving mode

between receiving sequentially transmitted portions from the second set of data. The sequential portions of the second set of data are transmitted, as indicated by block 1020. A set of data is data selectable by a user, such as, for example, by allowing the user to select from a display of the programming on the received RF channel or from a general electronic program guide.

**[0060]** Implementations may transmit all sequential portions of the first set of data with time intervals allowing the above power saving mode, and may transmit all sequential portions of the second set of data with time intervals not allowing the above power saving mode. Other implementations may transmit the data constituting the first set of data with time intervals allowing the above power saving mode, and may transmit the data constituting the second set of data with time intervals not allowing the above power saving mode. The data that constitutes a set of data is all or substantially all of the data that defines the set of data. For example, if the set of data is a television program, the data constituting the set of data is at least substantially all of the data transmitted to provide the program on a receiver.

**[0061]** In an implementation, the receiver enters the power saving mode by turning off. Other implementations enter a power saving mode by turning off (or merely entering a power saving state in) one or more components, such as, for example, a demodulator.

**[0062]** Referring to Fig. 11, in an implementation, a receiver exits a power saving mode, as indicated by block 1100. The receiver receives a burst transmission from a first stream of data, as indicated by block 1105. The receiver receives a transmission from a second data stream, as indicated by block 1110. The receiver discards the data received from the second data stream, as indicated by block 1115. The receiver then enters the power saving mode, as indicated by block 1120. The time period between exiting the power saving mode and entering the power saving mode may be referred to as an active time period.

**[0063]** In one implementation, the second data stream is a burst program that is not of interest. In another implementation, a mobile device is only interested in receiving burst programs, and the second data stream is a television (high definition or standard definition, for example) program that is not transmitted in burst mode. In another implementation, no second stream

is received during the active time period because the timing of exiting and entering the power saving mode is such that, after exiting the power saving mode and performing acquisition, only the first stream is received before entering the power saving mode.

**[0064]** Referring to Fig. 12, steps performed by a transmitter and steps performed by a receiver are shown, although these steps may be implemented separately. A transmitter accesses a stream of data, as indicated by block 1200. The stream of data is divided into a series of bursts, as indicated by block 1205. The series of bursts is transmitted with successive bursts in the series separated in time, over a continuous-mode transmission system, as indicated by block 1210. A receiver receives the transmitted bursts, as indicated by block 1215.

**[0065]** Various implementations provide backward compatibility for legacy receivers that implement the ATSC A/53 standard. In one such implementation, backward compatibility is provided by the fact that the receivers will discard any data received for a burst channel. The receivers will discard the burst data because the receivers will not recognize the channel identifier. Non-recognition occurs because identifiers for the burst channels will not be included in the channel map information provided by the broadcaster.

**[0066]** As described throughout this application, one implementation allows for low data-rate information to be burst-transmitted and burst-received on mobile devices. Such an implementation allows, for example, a user to view compressed video on a cell phone. The burst nature of the transmission and reception allows the cell phone to use power-saving modes between bursts to conserve power. Additionally, the burst data may be broadcast multiple times in a staggercast manner to allow a receiver a second (or higher) opportunity to receive the burst data.

**[0067]** Implementations have been described that allow burst data to be transmitted to receivers that implement the ATSC A/53 standard. The ATSC A/53 standard is commonly referred to as a continuous standard, and ATSC A/53-compliant receivers are commonly referred to as continuous receivers, because the data for any given channel can be transmitted continuously and would need to be received continuously. That is, there is no

burst provision built into the ATSC A/53 standard. In a similar manner, other implementations provide burst capability for different continuous standards and systems.

**[0068]** Providing a burst mode in conjunction with the ATSC A/53 standard addresses various technical problems facing broadcasters of content that broadcast using the ATSC A/53 standard. Such problems include, for example, the high-power requirements for mobile devices, and the lack of large bandwidth for additional programming. The burst mode provides a technical solution by integrating burst characteristics and timing considerations into the ATSC A/53 transmission, as well as multiplexing the burst data with the continuous data. The technical advantages include increased programming for mobile devices, lower power requirements for mobile devices, and compatibility with existing broadcasts of ATSC A/53 programming.

**[0069]** Further, various of the solutions described in this application advance the ATSC A/53 standard in non-obvious ways by, for example, requiring additional bandwidth on an already constrained physical channel (for example, constrained to 6 MHz for a broadcaster), transmitting burst data over a continuous-standard system, and requiring additional storage for bursts at transmitter and receiver. Further, receivers that take advantage of the burst nature and enter and exit a power saving mode between bursts will lose lock with any continuous-mode channels that are being received, and will also have to accommodate the relatively large acquire time that is required when exiting the burst mode.

**[0070]** The term playback rate typically refers to the bit rate at which data is played back. Thus, if a burst contains data to be played back until the next burst occurs, then the burst will generally be transmitting data a higher rate than the playback rate. The transmit rate typically refers to the average transmission rate during the time of transmission, although an instantaneous rate may also be used.

**[0071]** The various aspects, implementations, and features may be implemented in one or more of a variety of manners, even if described above without reference to a particular manner or using only one manner. For example, the various aspects, implementations, and features may be

implemented using, for example, one or more of a method, an apparatus, an apparatus or processing device for performing a method, a program or other set of instructions, an apparatus that includes a program or a set of instructions, and a computer readable medium.

**[0072]** An apparatus may include, for example, discrete or integrated hardware, firmware, and software. As an example, an apparatus may include, for example, a processor, which refers to processing devices in general, including, for example, a microprocessor, an integrated circuit, or a programmable logic device. As another example, an apparatus may include one or more computer readable media having instructions for carrying out one or more processes.

**[0073]** A computer readable medium may include, for example, a software carrier or other storage device such as, for example, a hard disk, a compact diskette, a random access memory ("RAM"), or a read-only memory ("ROM"). A computer readable medium also may include, for example, formatted electromagnetic waves encoding or transmitting instructions. Instructions may be, for example, in hardware, firmware, software, or in an electromagnetic wave. Instructions may be found in, for example, an operating system, a separate application, or a combination of the two. A processor may be characterized, therefore, as, for example, both a device configured to carry out a process and a device that includes a computer readable medium having instructions for carrying out a process.

**[0074]** A number of implementations have been described. Nevertheless, it will be understood that various modifications may be made. For example, elements of different implementations may be combined, supplemented, modified, or removed to produce other implementations. Accordingly, other implementations are within the scope of the following claims.

CLAIMS

1. A method comprising:

transmitting, from a transmitter, a first set of data, the transmissions of sequential portions of data constituting the first set of data being separated by respective time intervals having lengths configured to allow a receiver to enter and exit a power saving mode receiving sequentially transmitted portions of data constituting the first set of data; and

transmitting, from the transmitter, a second set of data, the second set of data constituting a user-selectable program, the transmissions of all portions of the second set of data being separated by respective time intervals having lengths that are not configured to allow a receiver to enter and to exit the power saving mode between receiving sequentially transmitted portions constituting the second set of data.

2. The method of claim 1, wherein the receiver enters the power saving mode by turning off.

3. The method of claim 1, wherein transmitting the second set of data comprises transmitting the second set of data according to a protocol that expects a receiver to remain on continuously while receiving the second set of data.

4. The method of claim 1, wherein transmitting the second set of data comprises transmitting the second set of data during a period of time that overlaps at least part of the transmission of the first set of data.

5. The method of claim 4, wherein said transmitting of the first set of data comprises transmission in a burst mode, and said transmitting of the second set of data comprises transmission in a continuous mode.

6. The method of claim 5, wherein said transmitting of the first and second sets of data comprise transmitting in accordance with a vestigial side-band modulation format.

7. The method of claim 4, wherein said transmitting of the first and second sets of data comprise transmitting in accordance with the ATSC A/53 Digital Television Standard.

8. The method of claim 1, wherein said transmitting of the first set of data comprises transmission in a burst mode, and said transmitting of the second set of data comprises transmission in a continuous mode.

9. The method of claim 1, wherein the second set of data comprises content of a program, with the content of the program having been encoded and interleaved.

10. The method of claim 1, wherein (1) the first set of data includes data configured to be displayed at a first playback rate, (2) the second set of data includes data configured to be displayed at a second playback rate, and (3) the first set of data is transmitted at a rate substantially higher than the first playback rate, and the second set of data is transmitted at substantially the second playback rate.

11. The method of claim 1, wherein at least one portion of the first set of data is transmitted multiple times according to a predetermined schedule.

12. A system comprising:

a buffer coupled to a source of portions of a first set of data;

a multiplexer, for multiplexing the portions of the first set of data received from the buffer with portions of a second set of data; and

a transmitter coupled to an output of said multiplexer for receiving and transmitting the multiplexed portions of said first set of data and the second set of data, the transmitter configured to transmit sequential portions of the first set of data separated by time intervals having lengths configured to allow a receiver to enter a power saving mode and exit the power saving mode between receiving sequential portions of the first set of data, wherein said transmitter is adapted for transmitting the portions of the second set of data

according to a protocol that expects a receiver to remain on while receiving the transmitted data.

13. The system of claim 12, wherein said transmitter is adapted for transmitting the second set of data during a period of time that overlaps at least part of the transmission of the first set of data.

14. The system of claim 12, wherein (1) the first set of data includes data configured to be displayed at a first playback rate, (2) the second set of data includes data configured to be displayed at a second playback rate, and (3) the transmitter is adapted to transmit the first set of data at a rate substantially higher than the first playback rate, and to transmit said second set of data at substantially the second playback rate.

15. A method comprising:

exiting a power saving mode for a fixed active period of time at a receiver in order to receive a burst transmission from a first stream;

receiving, during the fixed active period of time, the burst transmission from the first stream at the receiver;

receiving, during the fixed active period of time, data from a second stream at the receiver;

discarding the data received from the second stream; and

entering the power saving mode for a fixed power-saving period of time while waiting for another burst from the first stream.

16. The method of claim 15 wherein said exiting of the power saving mode comprises exiting at a time that is based on an expected arrival time of the burst transmission.

17. The method of claim 15, further comprising determining that the received data from the second stream does not belong to a stream of data that is of interest.

18. The method of claim 15, wherein:

the first stream is received by the receiver at a first-stream rate, and the first stream includes data configured to be displayed at a first playback rate that is substantially less than the first-stream rate, and

the second stream is received by the receiver at a second-stream rate, and the second stream includes data configured to be displayed at a second playback rate that is substantially the same as the second-stream rate.

19. The method of claim 15, wherein said receiver is a receiver of a portable playback device.

20. The method of claim 15, wherein said method provides reduced power consumption compared to operating said receiver continuously.

21. A receiver configured (1) to exit a power saving mode for a fixed receiving period of time at a receiver in order to receive a burst transmission from a first stream; (2) to receive, during the fixed receiving period of time, the burst transmission from the first stream at the receiver; (3) to receive, during the fixed receiving period of time, data from a second stream at the receiver; (4) to discard the data received from the second stream; and (5) to enter the power saving mode for a fixed power-saving period of time while waiting for another burst from the first stream.

22. The receiver of claim 21, further configured to exit the power saving mode at a time that is based on an expected arrival time of the burst transmission.

23. The receiver of claim 21, further configured to determine that the received data from the second stream does not belong to a stream of data that is of interest.

24. The receiver of claim 21, wherein:

the first stream is received by the receiver at a first-stream rate, and the first stream includes data configured to be displayed at a first playback rate that is substantially less than the first-stream rate, and

the second stream is received by the receiver at a second-stream rate, and the second stream includes data configured to be displayed at a second playback rate that is substantially the same as the second-stream rate.

25. The receiver of claim 21, wherein said receiver is a receiver of a portable playback device.

26. The receiver of claim 21, wherein said receiver operates at reduced power consumption compared to a configuration in which said receiver is operated continuously.

27. An apparatus comprising:

means for exiting a power saving mode for a fixed receiving period of time at a receiver in order to receive a burst transmission from a first stream;

means for receiving, during the fixed receiving period of time, the burst transmission from the first stream at the receiver;

means for receiving, during the fixed receiving period of time, data from a second stream at the receiver;

means for discarding the data received from the second stream; and

means for entering the power saving mode for a fixed power-saving period of time while waiting for another burst from the first stream.

28. A computer-readable medium having stored thereon a plurality of instructions for performing:

exiting a power saving mode for a fixed receiving period of time at a receiver in order to receive a burst transmission from a first stream;

receiving, during the fixed receiving period of time, the burst transmission from the first stream at the receiver;

receiving, during the fixed receiving period of time, data from a second stream at the receiver;

discarding the data received from the second stream; and

entering the power saving mode for a fixed power-saving period of time while waiting for another burst from the first stream.

29. A method comprising:

accessing a stream of data;

dividing the stream of data into a series of bursts; and

transmitting the series of bursts, with successive bursts in the series separated in time, over a continuous-mode transmission system.

30. The method of claim 29, further comprising separating the transmission of the bursts in the series by separation times of sufficient duration that a receiver can enter a power saving mode and then exit the power saving mode in between receiving the bursts.

31. The method of claim 29, further comprising separating the transmission of the bursts in the series by separation times of sufficient duration that a receiver can turn off and then on in between receiving the bursts.

32. The method of claim 29, further comprising determining the separation in time.

33. The method of claim 29, wherein each burst in the series includes an indication of an expected transmission time of the next burst in the series.

34. The method of claim 29, wherein the separation in time is of sufficient duration to permit the receiver, after receiving a burst in the series, then entering the power saving mode and then exiting the power saving mode, to reacquire a signal upon which the bursts are received and to receive the next burst in the series on the reacquired signal.

35. The method of claim 29, wherein the continuous-mode transmission system uses vestigial side-band transmission.

36. The method of claim 29, wherein the continuous-mode transmission system transmits in compliance with an ATSC A/53 digital broadcasting standard.

37. A system comprising:

a processor adapted to receive a first stream of data and to divide the first stream of data into a series of bursts; and

a transmitter adapted to simultaneously transmit a second stream of data in a continuous mode and to transmit the series of bursts in a burst mode, the transmission of successive bursts being separated in time.

38. The system of claim 37, wherein the transmitter is adapted to separate the transmission of the bursts in the series by separation times of sufficient duration that a receiver can enter a power saving mode and then exit the power saving mode in between receiving the bursts.

39. The system of claim 37, wherein the transmitter is adapted to separate the transmission of the bursts in the series by separation times of sufficient duration that a receiver can turn off and then on in between receiving the bursts.

40. The system of claim 37, further comprising a processor adapted to determine the separation time.

41. The system of claim 37, wherein the transmitter is adapted to include in one or more bursts in the series an indication of an expected transmission time of the next burst in the series.

42. A method comprising receiving at a receiver a series of bursts of data in a stream of data, the bursts being received over a continuous-mode transmission system, with successive bursts being separated in time by

separation times having a duration sufficient for the receiver to enter a power saving mode and exit the power saving mode between receiving the successive bursts.

43. The method of claim 42, further comprising:

entering the power saving mode after receiving a particular burst in the series; and

exiting the power saving mode prior to receiving an additional of the bursts in the series, the exiting occurring sufficiently in advance of receiving the additional burst to allow the receiver to acquire a signal on which the bursts are received and then to receive the additional burst.

44. The method of claim 43 further comprising:

receiving with the particular burst an indication of an expected reception time for the additional burst; and

determining, based on the received indication of the expected reception time for the additional burst, a time to exit the power saving mode prior to receiving the additional burst,

wherein exiting the power saving mode comprises powering up the receiver at the determined time.

45. The method of claim 43, further comprising reacquiring a signal which carries the stream of data, wherein the additional burst is received on the reacquired signal.

46. A receiver adapted to receive a series of bursts of data in a stream of data, the bursts being received over a continuous-mode transmission system, with successive bursts being separated in time by separation times having a duration sufficient for the receiver to enter a power saving mode and exit the power saving mode between receiving the successive bursts.

47. The receiver of claim 46, wherein said receiver is adapted (1) to enter the power saving mode after receiving a first of the bursts in the series, and (2) to exit the power saving mode prior to receiving a second of the bursts in

the series, the exiting occurring sufficiently in advance of receiving the second burst to allow the receiver to acquire a signal on which the bursts are received and then to receive the second burst.

48. The receiver of claim 47, wherein:

the receiver is adapted to receive with the first burst an indication of an expected reception time for the second burst,

the receiver further comprises a processor for determining, based on the received indication of the expected reception time for the second burst, a time to exit the power saving mode prior to receiving the second burst, and

the receiver is adapted to exit the power saving mode at the determined time.

49. An apparatus comprising:

means for receiving a series of bursts of data in a stream of data, the bursts being received over a continuous-mode transmission system, and with successive bursts being separated in time by separation times; and

means for entering a power saving mode and exiting the power saving mode, the separation times having a duration sufficient for said apparatus to enter the power saving mode and exit the power saving mode between receiving the successive bursts.

50. A computer-readable medium having stored thereon instructions for receiving at a receiver a series of bursts of data in a stream of data, the bursts being received over a continuous-mode transmission system, successive bursts being separated in time by separation times having a duration sufficient for the receiver to enter a power saving mode and exit the power saving mode between successive bursts.

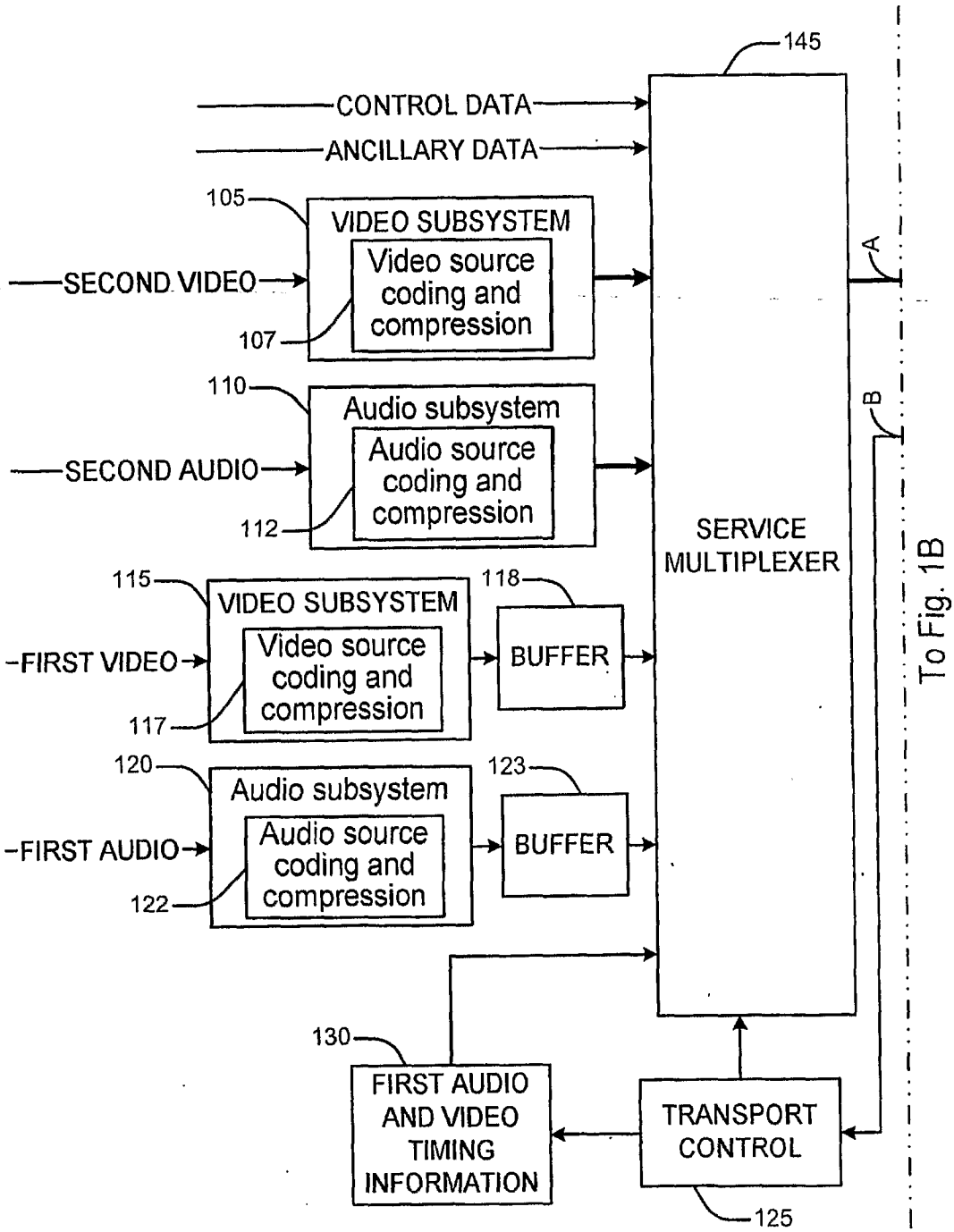
145
CONTROL DATA
ANCILLARY DATA
105
VIDEO SUBSYSTEM
SECOND VIDEO
Video source coding and compression
107
110
Audio subsystem
SECOND AUDIO
Audio source coding and compression
112
115
VIDEO SUBSYSTEM
118
FIRST VIDEO
Video source coding and compression
BUFFER
117
120
Audio subsystem
123
FIRST AUDIO
Audio source coding and compression
BUFFER
122
SERVICE MULTIPLEXER
A
B
To Fig. 1B
130
FIRST AUDIO AND VIDEO TIMING INFORMATION
TRANSPORT CONTROL
125

Fig. 1A

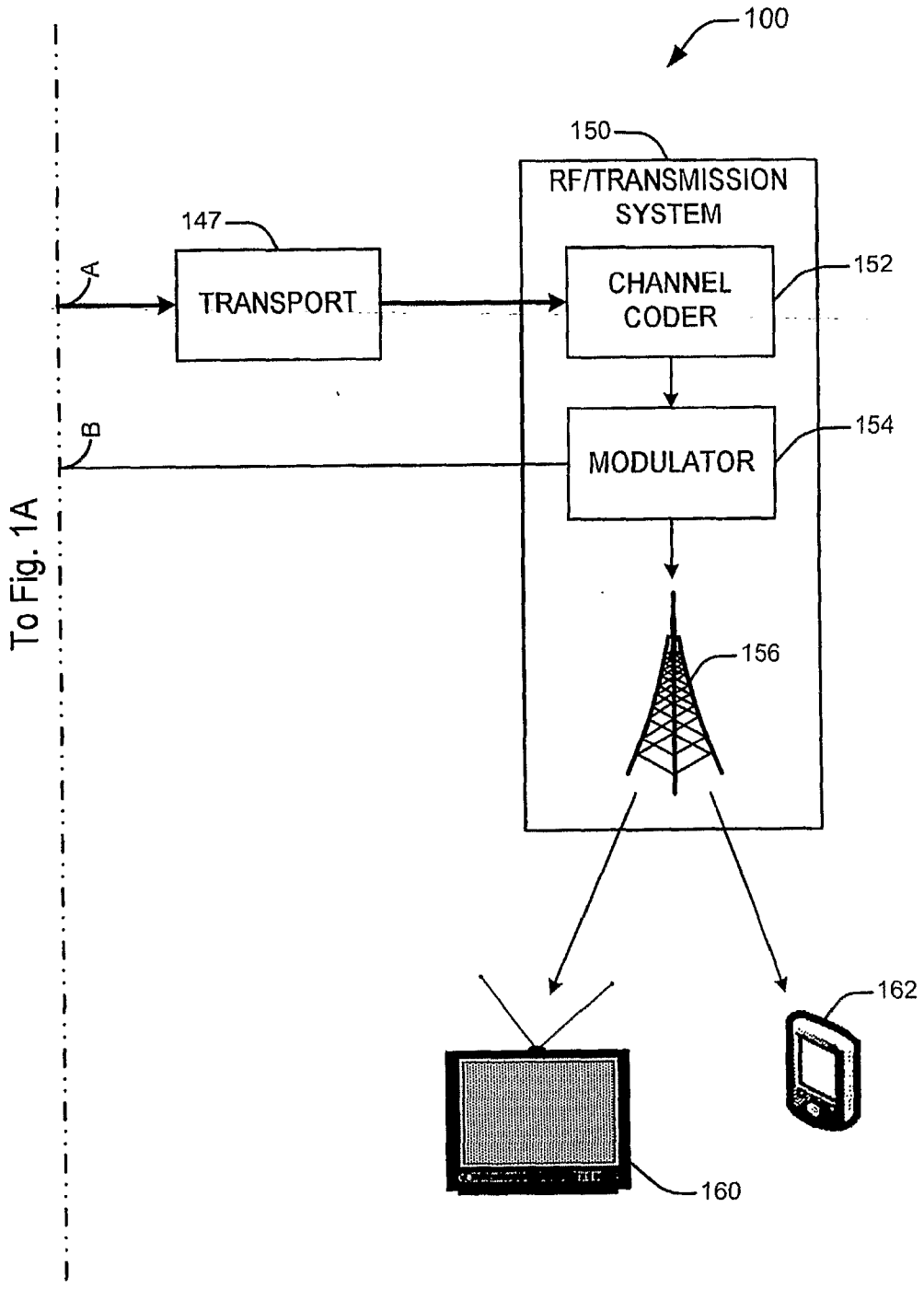
100
150
RF/TRANSMISSION SYSTEM
147
TRANSPORT
A
B
CHANNEL CODER
152
MODULATOR
154
156
To Fig. 1A
162
160

Fig. 1B

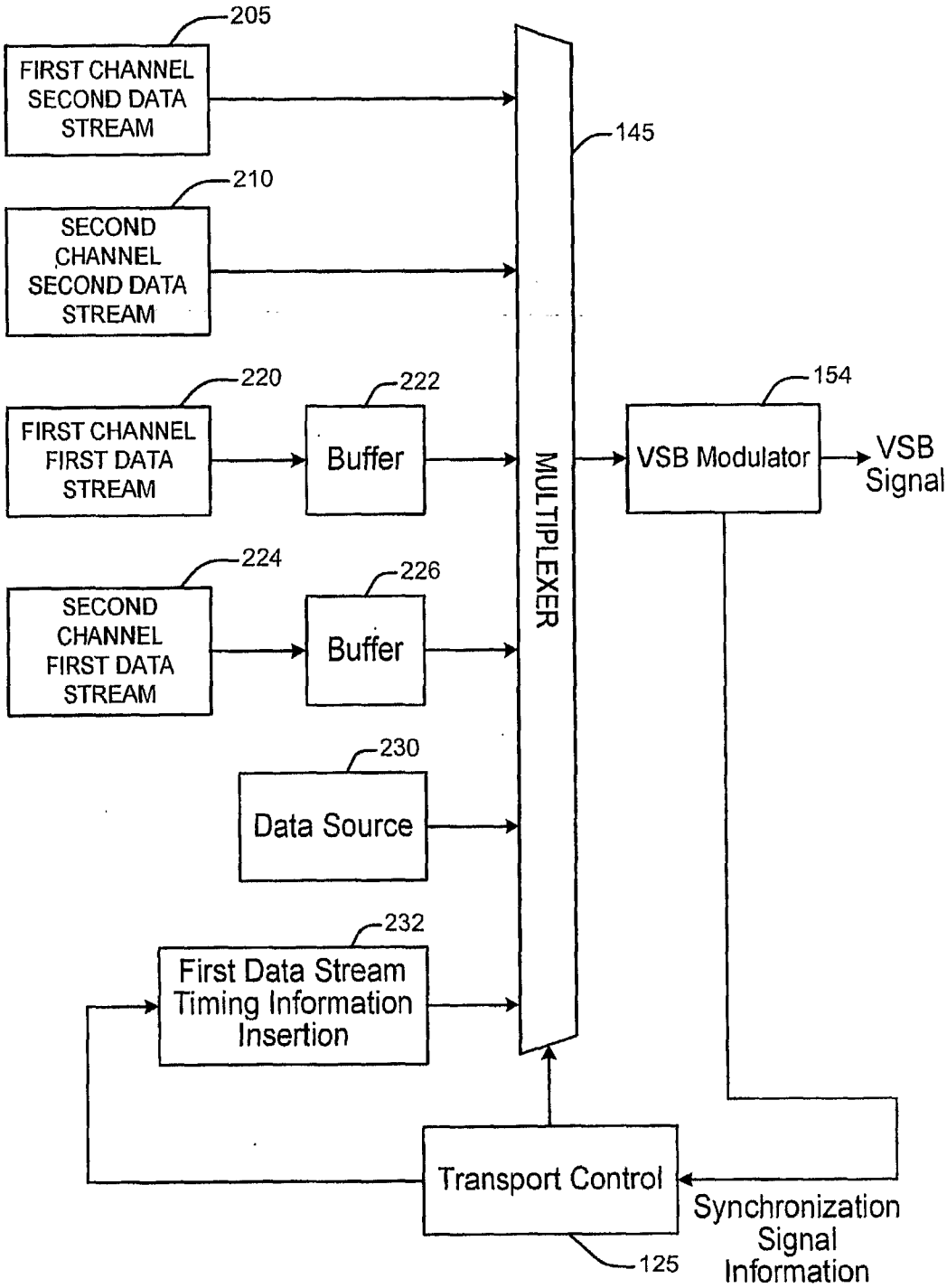
205
FIRST CHANNEL SECOND DATA STREAM
210
SECOND CHANNEL SECOND DATA STREAM
220
FIRST CHANNEL FIRST DATA STREAM
222
Buffer
224
SECOND CHANNEL FIRST DATA STREAM
226
Buffer
230
Data Source
232
First Data Stream Timing Information Insertion
145
MULTIPLEXER
154
VSB Modulator
VSB Signal
Transport Control
125
Synchronization Signal Information

Fig. 2

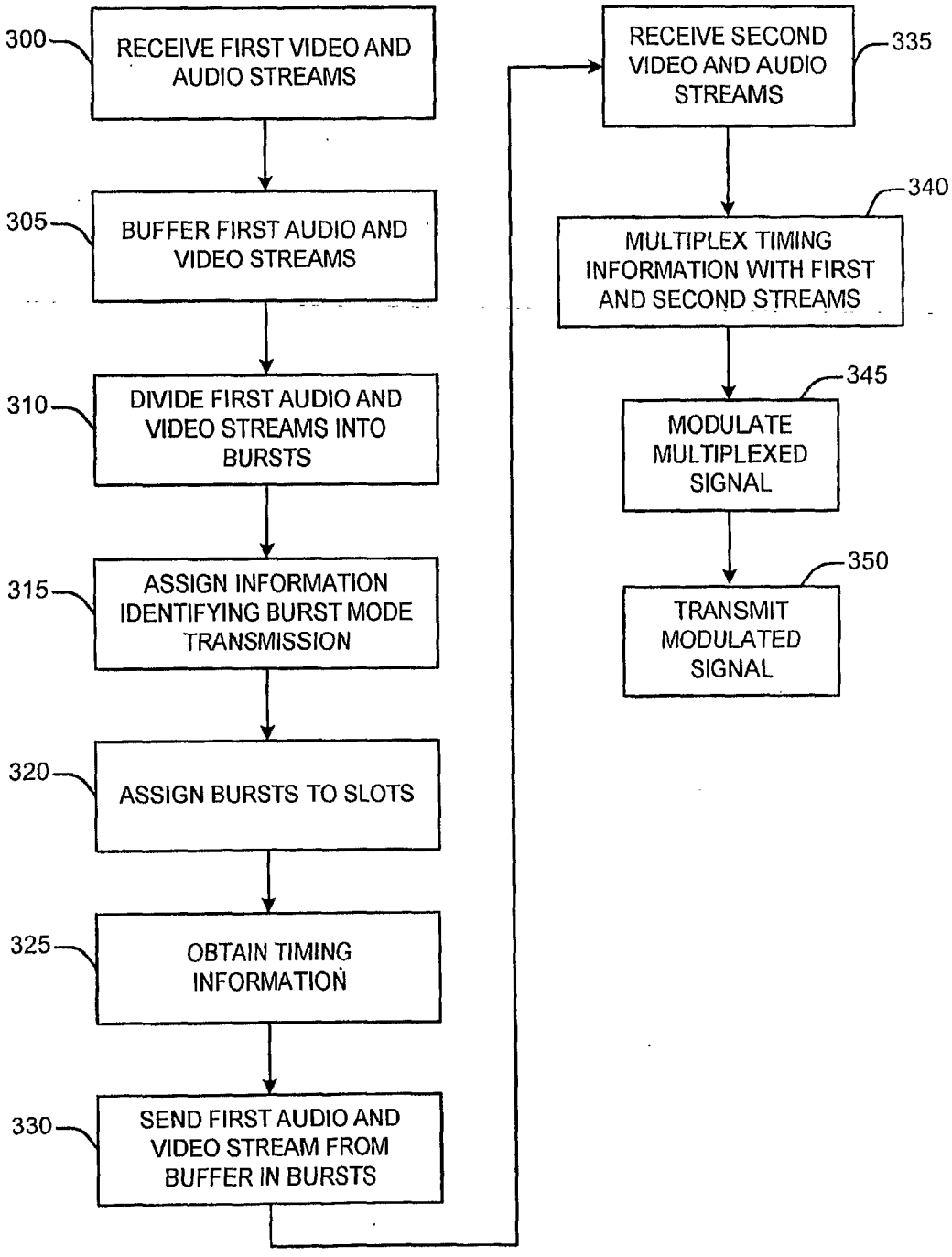
300
RECEIVE FIRST VIDEO AND AUDIO STREAMS
305
BUFFER FIRST AUDIO AND VIDEO STREAMS
310
DIVIDE FIRST AUDIO AND VIDEO STREAMS INTO BURSTS
315
ASSIGN INFORMATION IDENTIFYING BURST MODE TRANSMISSION
320
ASSIGN BURSTS TO SLOTS
325
OBTAIN TIMING INFORMATION
330
SEND FIRST AUDIO AND VIDEO STREAM FROM BUFFER IN BURSTS
335
RECEIVE SECOND VIDEO AND AUDIO STREAMS
340
MULTIPLEX TIMING INFORMATION WITH FIRST AND SECOND STREAMS
345
MODULATE MULTIPLEXED SIGNAL
350
TRANSMIT MODULATED SIGNAL

Fig. 3

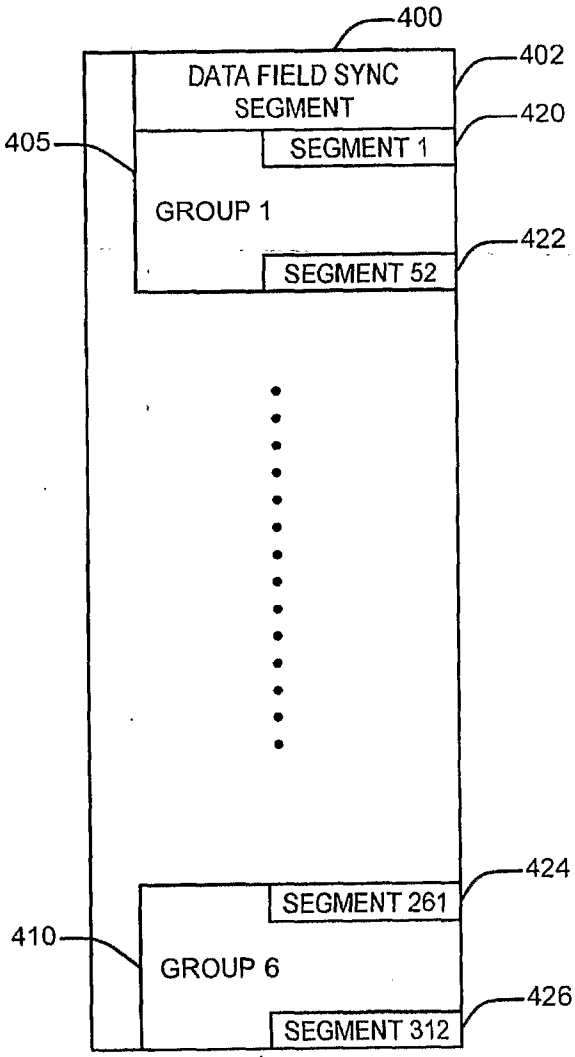
400
DATA FIELD SYNC SEGMENT
402
420
SEGMENT 1
405
GROUP 1
422
SEGMENT 52
424
SEGMENT 261
410
GROUP 6
426
SEGMENT 312

Fig. 4

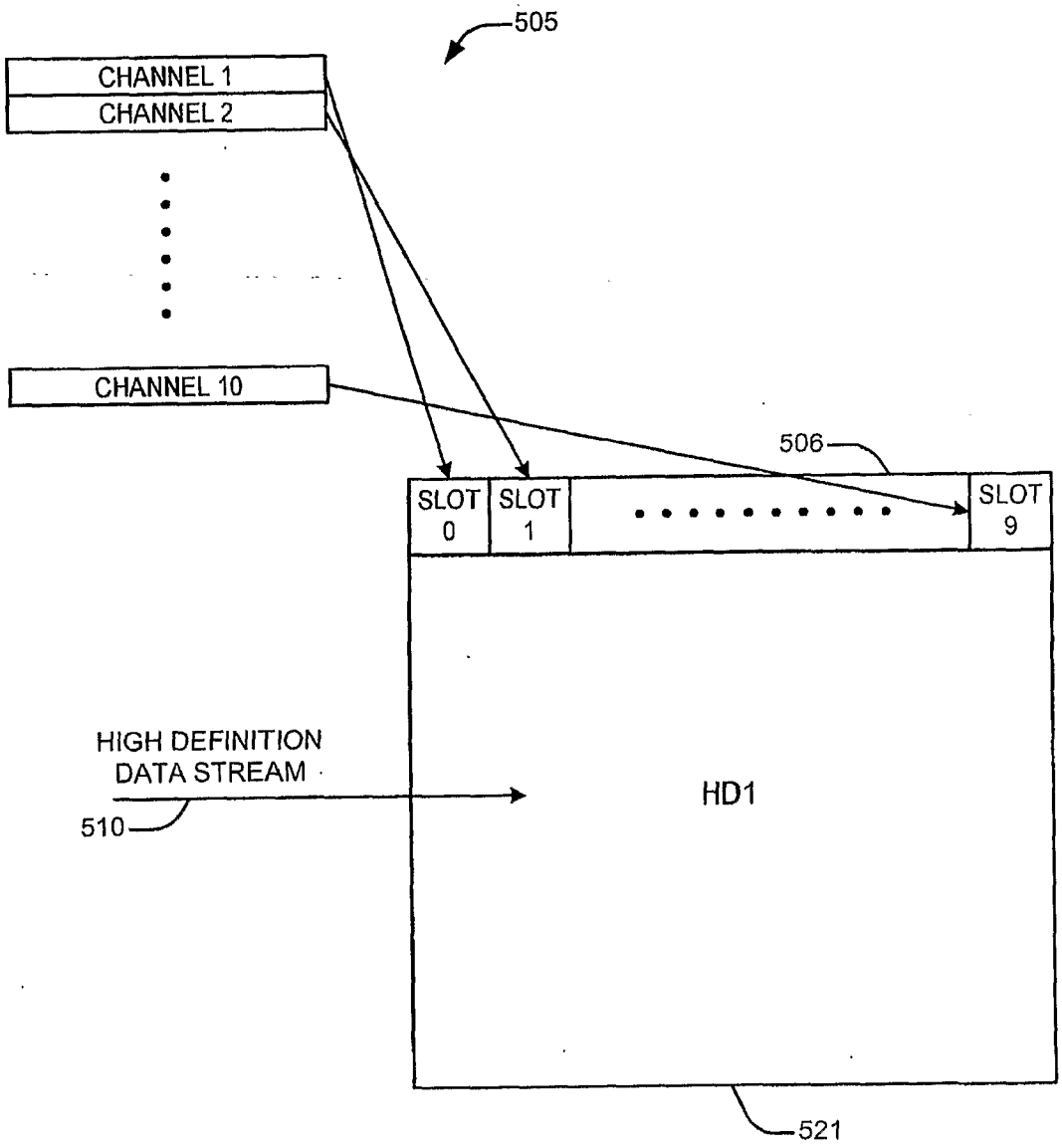
505
CHANNEL 1
CHANNEL 2
CHANNEL 10
506
SLOT 0
SLOT 1
SLOT 9
HIGH DEFINITION DATA STREAM
510
HD1
521

Fig. 5A

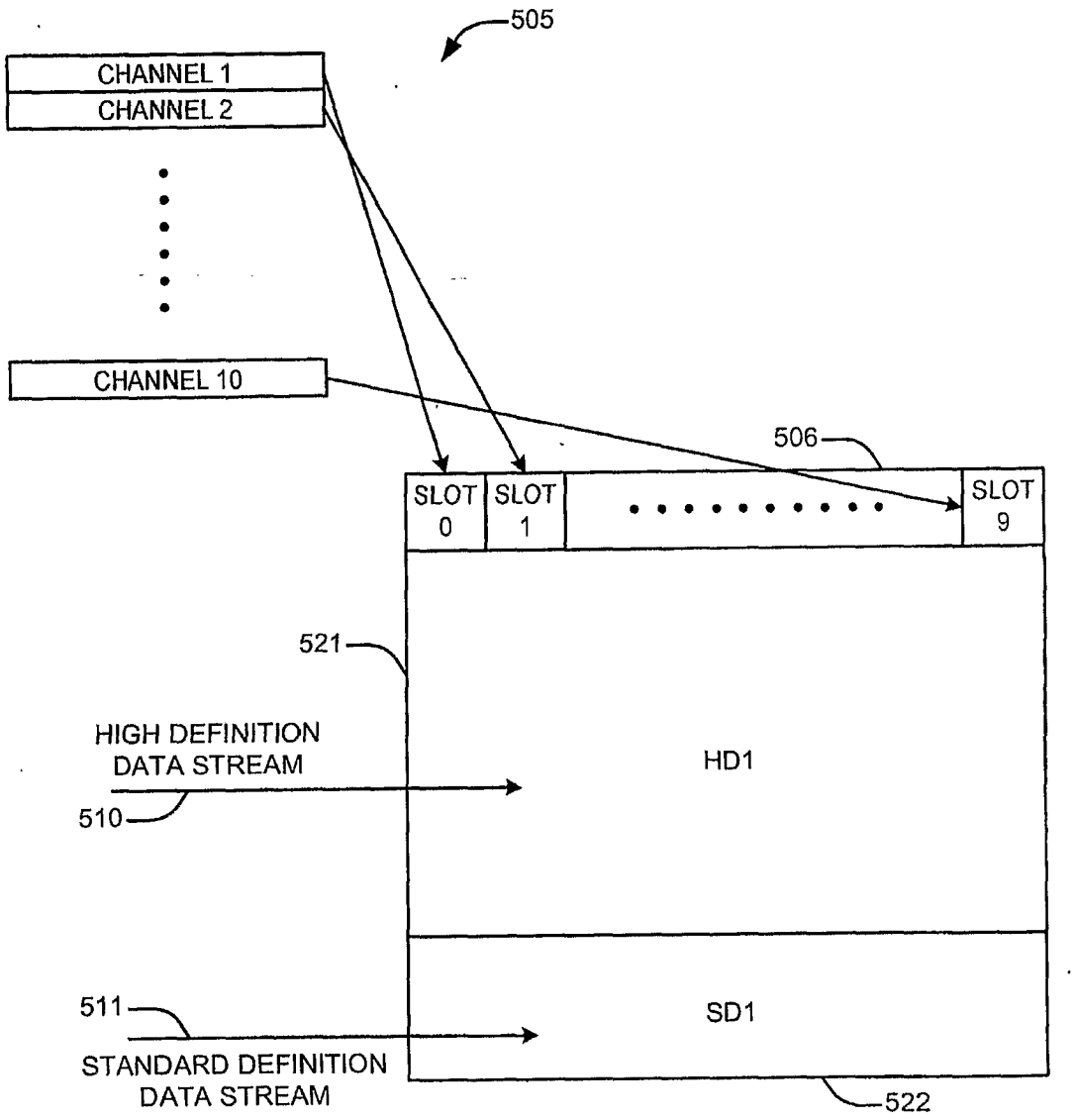
505
CHANNEL 1
CHANNEL 2
CHANNEL 10
506
SLOT 0
SLOT 1
SLOT 9
521
HIGH DEFINITION DATA STREAM
510
HD1
511
SD1
STANDARD DEFINITION DATA STREAM
522

Fig. 5B

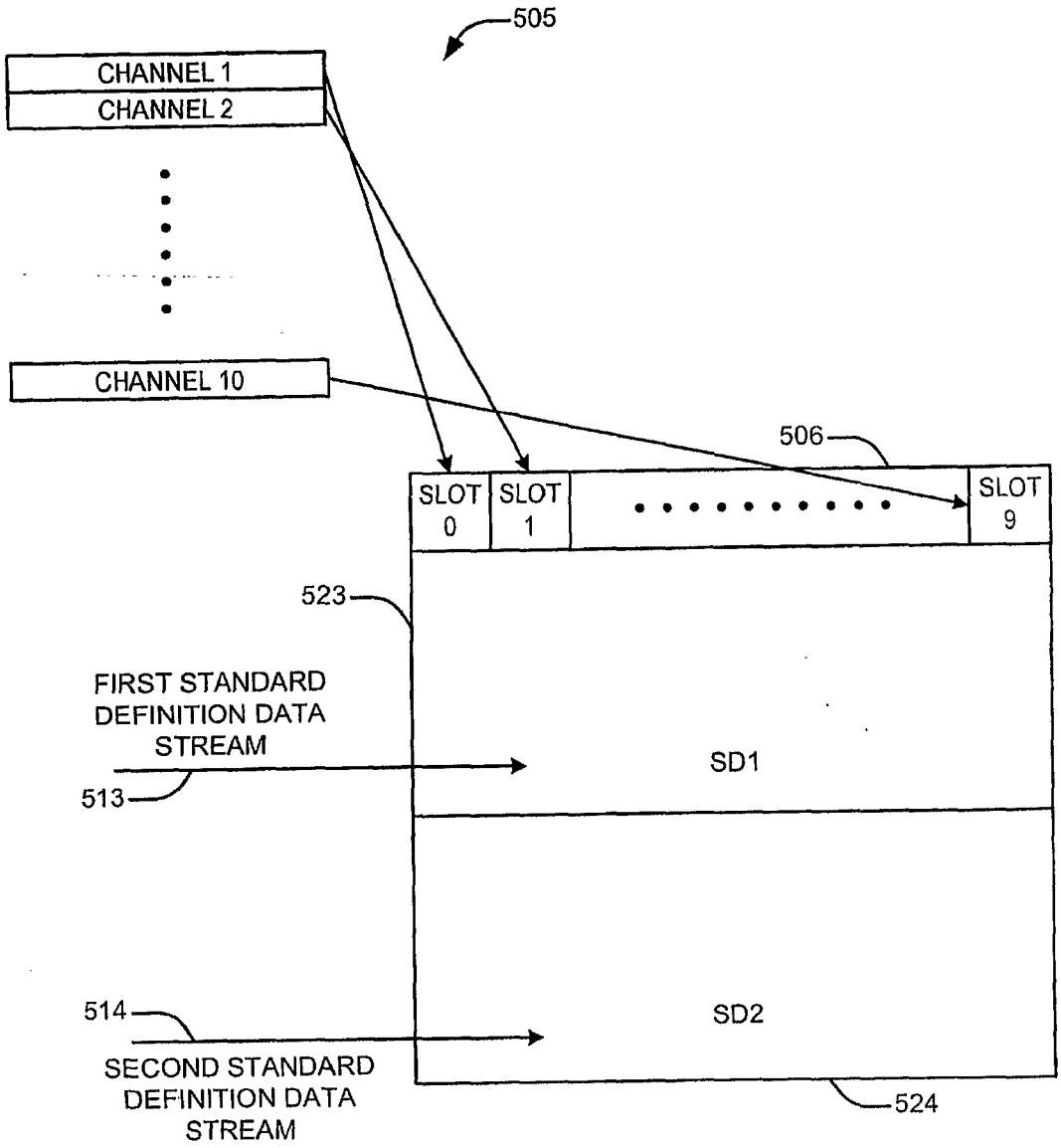
505
CHANNEL 1
CHANNEL 2
CHANNEL 10
506
SLOT 0
SLOT 1
SLOT 9
523
FIRST STANDARD DEFINITION DATA STREAM
513
SD1
514
SD2
SECOND STANDARD DEFINITION DATA STREAM
524

Fig. 5C

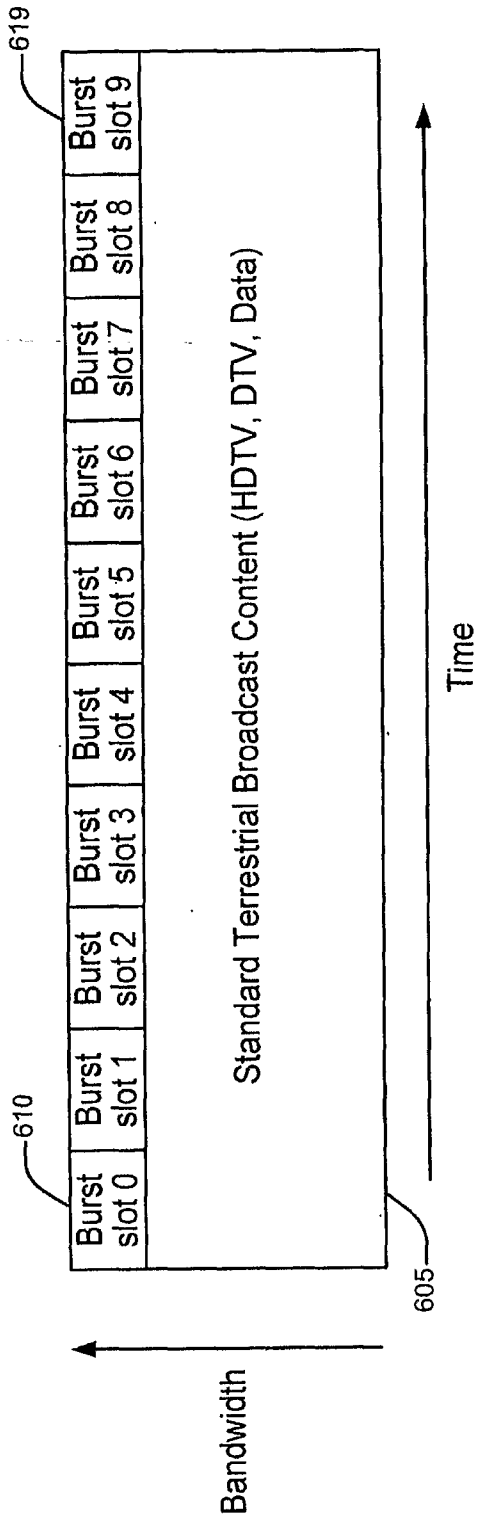
619
Burst slot 0
Burst slot 1
Burst slot 2
Burst slot 3
Burst slot 4
Burst slot 5
Burst slot 6
Burst slot 7
Burst slot 8
Burst slot 9
Standard Terrestrial Broadcast Content (HDTV, DTV, Data)
610
605
Time
Bandwidth
600

FIG. 6

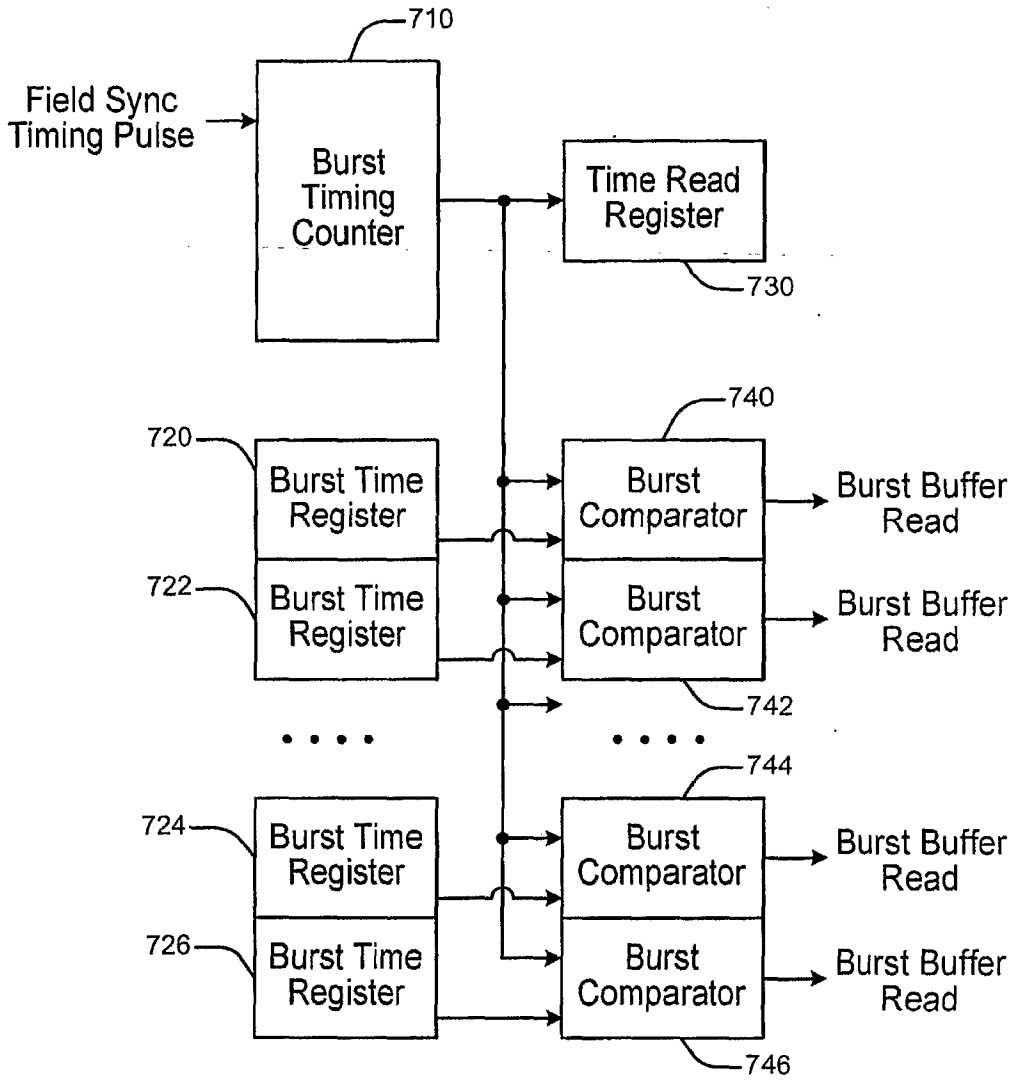
710
Field Sync Timing Pulse
Burst Timing Counter
Time Read Register
730
740
720
Burst Time Register
Burst Comparator
Burst Buffer Read
722
Burst Time Register
Burst Comparator
Burst Buffer Read
742
744
724
Burst Time Register
Burst Comparator
Burst Buffer Read
726
Burst Time Register
Burst Comparator
Burst Buffer Read
746

Fig. 7

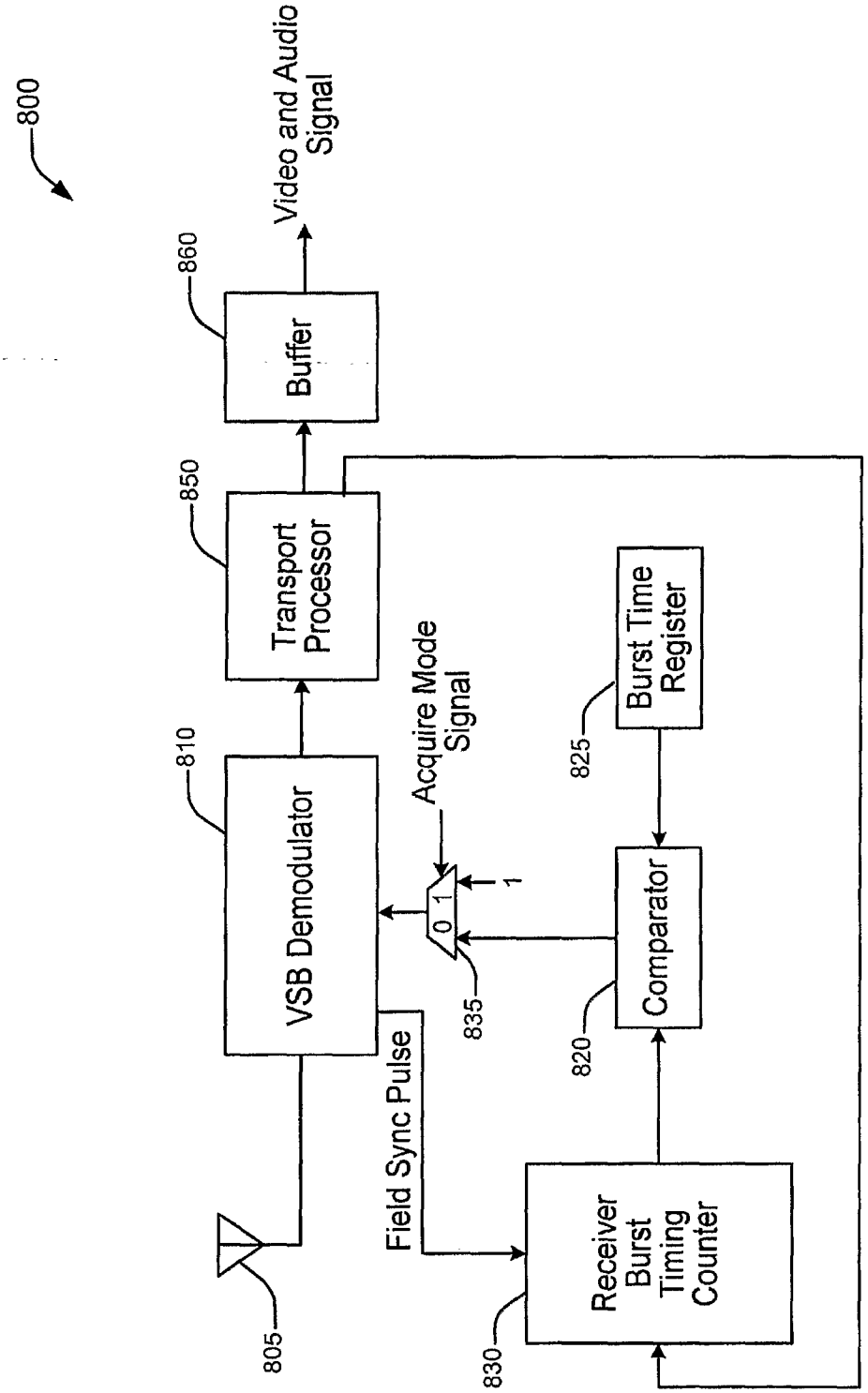
800
Video and Audio Signal
860
Buffer
850
Transport Processor
810
VSB Demodulator
Acquire Mode Signal
825
Burst Time Register
0
1
1
835
820
Comparator
Field Sync Pulse
805
830
Receiver Burst Timing Counter

FIG. 8

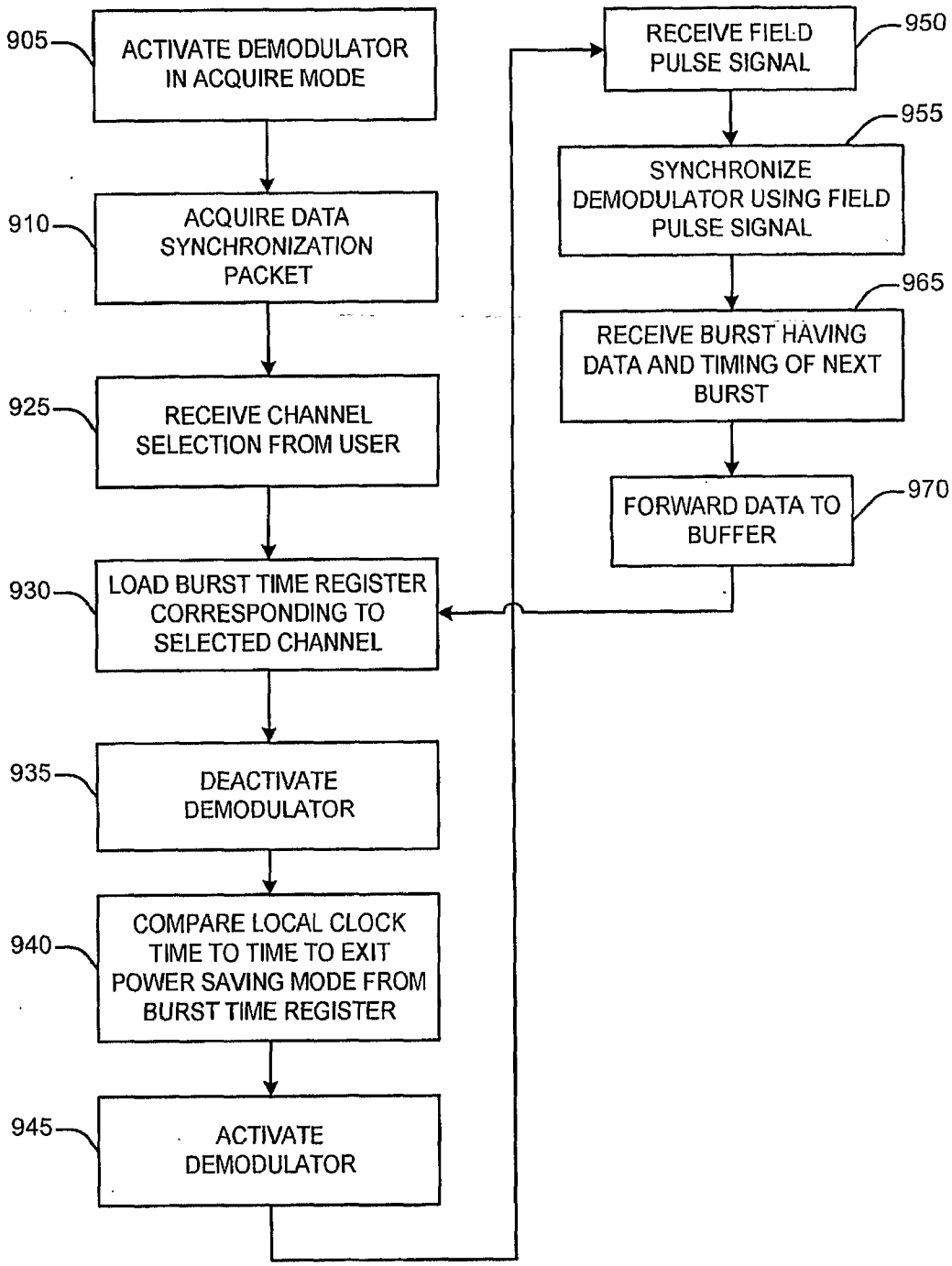
905
ACTIVATE DEMODULATOR IN ACQUIRE MODE
910
ACQUIRE DATA SYNCHRONIZATION PACKET
925
RECEIVE CHANNEL SELECTION FROM USER
930
LOAD BURST TIME REGISTER CORRESPONDING TO SELECTED CHANNEL
935
DEACTIVATE DEMODULATOR
940
COMPARE LOCAL CLOCK TIME TO TIME TO EXIT POWER SAVING MODE FROM BURST TIME REGISTER
945
ACTIVATE DEMODULATOR
950
RECEIVE FIELD PULSE SIGNAL
955
SYNCHRONIZE DEMODULATOR USING FIELD PULSE SIGNAL
965
RECEIVE BURST HAVING DATA AND TIMING OF NEXT BURST
970
FORWARD DATA TO BUFFER

Fig. 9

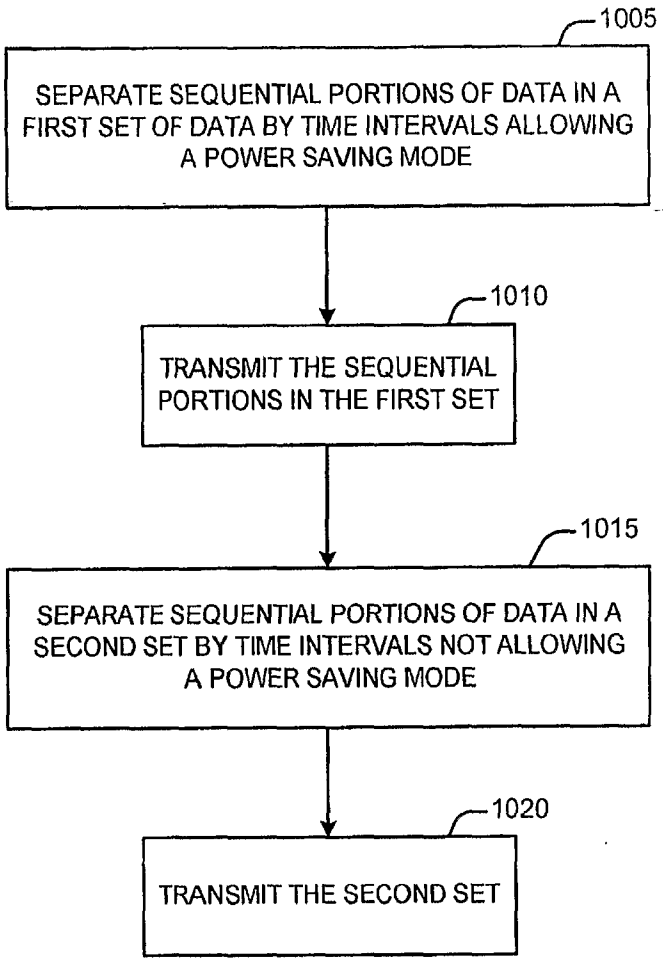
1005
SEPARATE SEQUENTIAL PORTIONS OF DATA IN A FIRST SET OF DATA BY TIME INTERVALS ALLOWING A POWER SAVING MODE
1010
TRANSMIT THE SEQUENTIAL PORTIONS IN THE FIRST SET
1015
SEPARATE SEQUENTIAL PORTIONS OF DATA IN A SECOND SET BY TIME INTERVALS NOT ALLOWING A POWER SAVING MODE
1020
TRANSMIT THE SECOND SET

Fig. 10

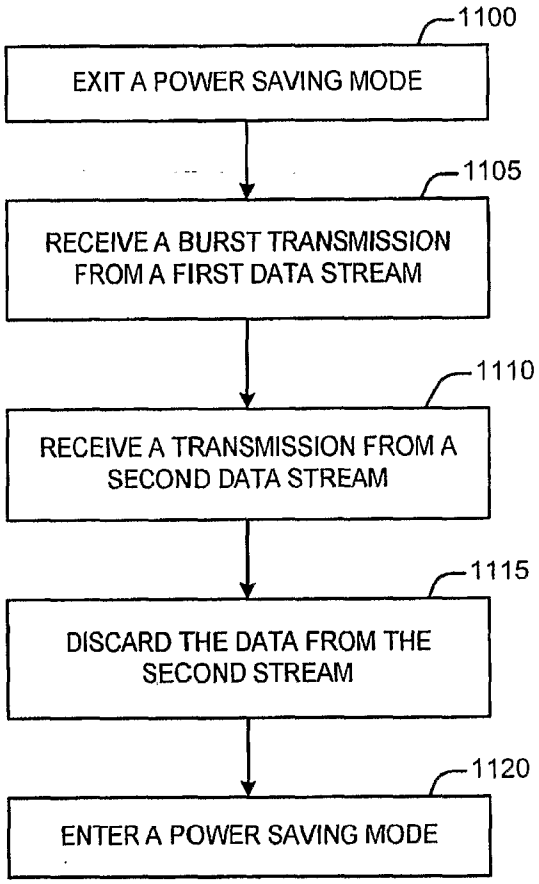
1100
EXIT A POWER SAVING MODE
1105
RECEIVE A BURST TRANSMISSION FROM A FIRST DATA STREAM
1110
RECEIVE A TRANSMISSION FROM A SECOND DATA STREAM
1115
DISCARD THE DATA FROM THE SECOND STREAM
1120
ENTER A POWER SAVING MODE

Fig. 11

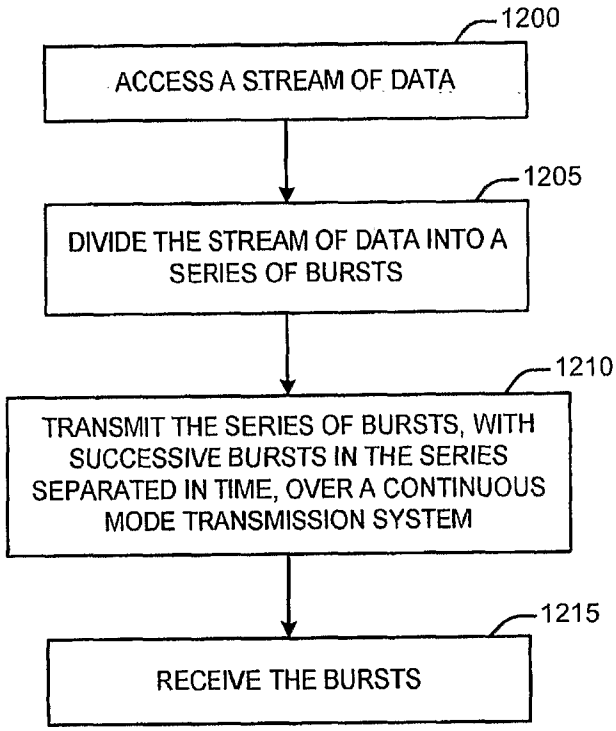
1200
ACCESS A STREAM OF DATA
1205
DIVIDE THE STREAM OF DATA INTO A SERIES OF BURSTS
1210
TRANSMIT THE SERIES OF BURSTS, WITH SUCCESSIVE BURSTS IN THE SERIES SEPARATED IN TIME, OVER A CONTINUOUS MODE TRANSMISSION SYSTEM
1215
RECEIVE THE BURSTS

Fig. 12

# INTERNATIONAL SEARCH REPORT

International application No
PCT/US2006/048320

A. CLASSIFICATION OF SUBJECT MATTER
INV. H04N7/24

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, 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 | "Digital Video Broadcasting (DVB); DVB-H Implementation Guidelines" EUROPEAN TELECOMMUNICATIONS STANDARDS INSTITUTE, ETSI TR 102 377 V1.1.1, February 2005 (2005-02), pages 1-81, XP014027140 sections 4.1 - 4.5, 5.2.1, 5.3 ----- | 1-50 |
| X | KORNFELD M ET AL: "DVB-H: DIGITALER RUNDFUNK FUER SMARTPHONE, PDA & CO" FKT FERNSEH UND KINOTECHNIK, FACHVERLAG SCHIELE & SCHON GMBH., BERLIN, DE, vol. 59, no. 1/2, 2005, pages 35-42, XP001208041 ISSN: 1430-9947 3.1, 3.2 figures 1,2,6 ----- -/-- | 1-50 |

[X] Further documents are listed in the continuation of Box C. [ ] See patent family annex.

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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

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"&" document member of the same patent family

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 2 August 2007 | 17/08/2007 |

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

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# INTERNATIONAL SEARCH REPORT

International application No
PCT/US2006/048320

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| A | CHARLES POYNTON: "Digital Video and HDTV, Algorithms and Interfaces" 2003, MORGAN KAUFMANN PUBLISHERS , XP002445214 ISBN: 1-55860-792-7 page 587 - page 592 | 6,7,35, 36 |
| A | BORKO FURHT: "Interactive television systems" PROCEEDINGS OF THE 1996 ACM SYMPOSIUM ON APPLIED COMPUTING, [Online] 1996, pages 7-11, XP002445223 Philadelphia, United States Retrieved from the Internet: URL:http://portal.acm.org> [retrieved on 2007-08-01] page 10, line 3 - line 11 | 11 |
| P,X | JAEKEL T: "TIME SLICES - WESENTLICHES MERKMAL VON DVB-H" FKT FERNSEH UND KINOTECHNIK, FACHVERLAG SCHIELE & SCHON GMBH., BERLIN, DE, vol. 60, no. 3, 2006, pages 135-138, XP001500707 ISSN: 1430-9947 the whole document | 1-50 |

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