



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
01.11.2017 Bulletin 2017/44

(51) Int Cl.:
H04H 20/42 (2008.01) **H04H 20/16 (2008.01)**
H04H 60/25 (2008.01) **H04H 60/41 (2008.01)**

(21) Application number: **17166857.7**

(22) Date of filing: **18.04.2017**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
MA MD

(71) Applicant: **Alpine Electronics, Inc.**
Tokyo (JP)
(72) Inventor: **Ono, Ken**
Fukushima, 970-1192 (JP)
(74) Representative: **Schmitt-Nilson Schraud Waibel Wohlfrom**
Patentanwälte Partnerschaft mbB
Destouchesstraße 68
80796 München (DE)

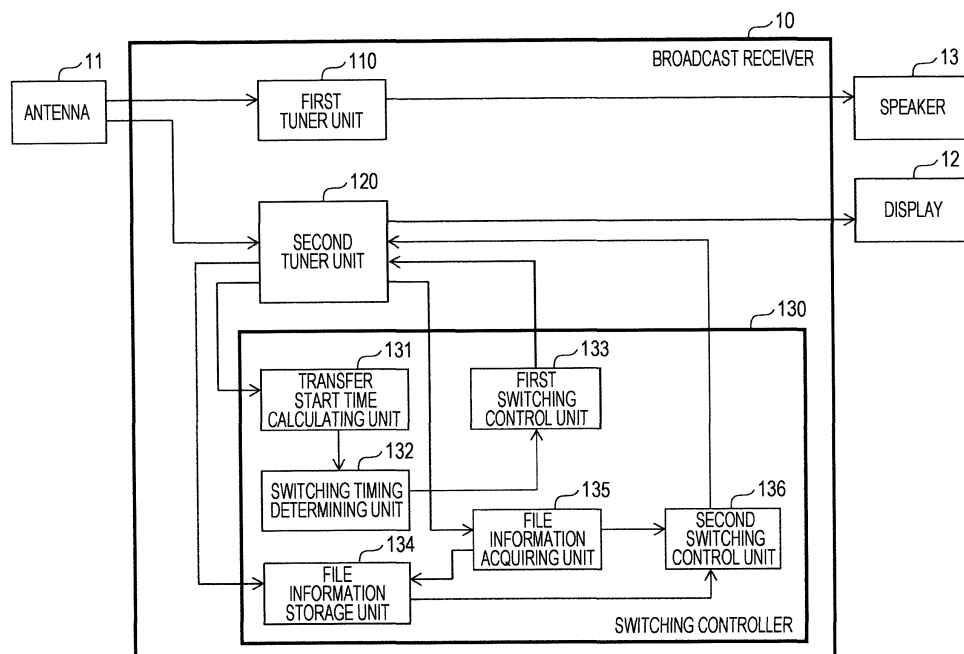
(30) Priority: **28.04.2016 JP 2016090734**

(54) **BROADCAST RECEIVER AND RECEPTION SWITCHING CONTROL METHOD**

(57) A broadcast receiver includes a transfer start time calculating unit (131) that calculates a time at which to start the transmission of each file to be received in first reception processing, a switching timing determining unit (132) that determines a switching time at which a switchover from second reception processing to the first reception processing is to be made by a second tuner unit (120, 120'), according to the calculated time at which to start

the transmission of each file, and a switching control unit (133, 133') that controls the second tuner unit (120, 120') so that it makes a switchover from the second reception processing to the first reception processing according to the determined switching time. When the second tuner unit (120, 120') makes a switchover from the second reception processing to the first reception processing, a file can be received from its beginning.

FIG. 1



Description

[0001] The present invention relates to a broadcast receiver and a reception switching control method, and more particularly the present invention is preferably used in a broadcast receiver and a reception switching control method in which both data broadcast reception processing and other reception processing are executed with a single tuner.

[0002] Digital Audio Broadcast (DAB) is used as one of the broadcasting standards. In DAB broadcasting, it has been a conventional practice to use a sub-tuner separately from a main tuner, which receives a main broadcast, to receive a data broadcast in background while the main tuner is receiving a main broadcast. In data broadcasting, an electronic program guide (EPG), traffic information in Transport Protocol Experts Group (TPEG) broadcast, and other digital data are broadcasted as files. The sub-tuner receives a plurality of files sequentially.

[0003] In DAB broadcasting, scan processing is also executed in the sub-tuner; in scan processing, a service list (receivable frequency list), which lists channels that can be received, is created. When the user selects a desired broadcast service from this type of service list, the user can select a broadcasting station from which to receive a desired program through the main tuner and can view and listen to the program.

[0004] To execute both data broadcast reception processing and scan processing with a single sub-tuner as described above, it is necessary to alternately execute the two pieces of processing. Conventionally, the two pieces of processing have been divided by a predetermined time slot according to, for example, a predetermined priority order, and have been alternately executed.

[0005] In the technology disclosed in Japanese Unexamined Patent Application Publication No. 2005-159868, a multiplex broadcast receiver has a main tuner that receives program broadcasts and a sub-tuner that receives road traffic information transmitted at intervals of a predetermined time. While the sub-tuner is not receiving road traffic information, the state of the reception of an alternative frequency for a program broadcast that the main tuner is receiving is checked. If the reception state is superior, the main tuner is made to follow the alternate frequency in the superior reception state.

[0006] In the technology disclosed in JP 2004-343745 A, a wireless broadcast receiver has a main tuner and a background tuner. The background tuner can be used to stably receive traffic message channel (TMC) data in a certain wireless broadcast program, without impairing a diversity function (by which, for example, alternative frequency bands for a wireless broadcast program selected by the main tuner are scanned). In the wireless broadcast receiver described in Japanese Unexamined Patent Application Publication No. 2004-343745, a first data block in a second broadcast channel signal is received by the background tuner, and a time at which to transmit a second data block in the second broadcast channel signal

is estimated. When the reception of the first data block is completed, the background tuner is tuned to a third reception frequency, and the background tuner is tuned to a second reception frequency at the estimated time at which to transmit the second data block.

[0007] In the conventional method by which, in a receiver in which both data broadcast reception processing and scan processing are alternately executed with a single tuner, the two pieces of processing are divided by a predetermined time slot and are alternately executed, a processing time assigned to scan processing is a predetermined time. However, a data broadcast is transferred sequentially one file at a time.

[0008] Therefore, when scan processing for the predetermined time is terminated and a switchover to data broadcast reception is made, if the transmission of a file has been already started, the file starts from its intermediate point and is thereby incomplete. Even if the file is received, the received file is invalid. The file needs to be received again from scratch when the file is transmitted the next time or later.

[0009] This situation can occur for all files to be received, which has been problematic in that much time is taken until the reception of all target files is completed. Incomplete files remains stored in a memory. Another problem is that if the number of incomplete files is gradually increased, the remaining available space in the memory is reduced.

[0010] Fig. 6 illustrates an example of a switching operation executed by a conventional broadcast receiver between data broadcast reception processing and scan processing. In Fig. 6, processing (data broadcast reception processing and scan processing) executed by the background tuner in the broadcast receiver is illustrated in time series. As illustrated in Fig. 6, the background tuner alternately executes data broadcast reception processing and scan processing.

[0011] In data transmitted in data broadcasting in the example in Fig. 6, directory information (header information) and six files numbered 1 to 6 that follow the director information constitute one carousel. In data broadcasting, a carousel of this type is repeatedly transmitted, so the background tuner repeatedly receives the carousel.

[0012] In the example in Fig. 6, the background tuner first receives directory information and then starts the reception of the file 1 in a data broadcast (time t1). When the reception of the file 1 is terminated, the background tuner makes a switchover to scan processing (time t2). The background tuner then executes scan processing for a predetermined time. While the background tuner is executing scan processing, in data broadcasting, the files 2 and 3 are transmitted sequentially after the file 1. While executing scan processing, however, the background tuner does not receive the files 2 and 3.

[0013] After the elapse of the predetermined time from the start of scan processing, the background tuner makes a switchover to data broadcast reception processing (time t3). Since the transmission of the file 3 has been

already started at that time, the background tuner receives the file 3 from an intermediate point in the file 3. Therefore, the file 3 received by the background tuner is invalid. When terminating the reception of the file 3 (time t4), the background tuner receives the file 4, which is transmitted next, from its beginning. Therefore, the file 4 received by the background tuner is valid.

[0014] When terminating the reception of the file 4, the background tuner makes a switchover to scan processing (time t5). The background tuner executes scan processing for the predetermined time. While the background tuner is executing scan processing, in data broadcasting, the files 5 and 6 are transmitted sequentially after the file 4. While executing scan processing, however, the background tuner does not receive the files 5 and 6.

[0015] After the elapse of the predetermined time from the start of scan processing, the background tuner makes a switchover to data broadcast reception processing (time t6). Since the transmission of the file 6 has been already started at that time, the background tuner receives the file 6 from an intermediate point in the file 6. Therefore, the file 6 received by the background tuner is invalid. When terminating the reception of the file 6 (time t7), the background tuner receives directory information and the file 1, which are transmitted next, from their beginnings.

[0016] Although the file 1 has been already received, the background tuner receives the file 1 without alteration. When terminating the reception of the file 1, the background tuner makes a switchover to scan processing (time t8). After that, the background tuner repeatedly executes similar processing.

[0017] Valid files received in the operation described above are only the files 1 and 4. Although the files 3 and 6 have been received, they are incomplete, so they need to be received again in their next or later transmission. The file 1 has been received twice, but the files 2 and 5 have not been received even once. Therefore, the files 2 and 5 need to be received again in their next or later transmission. As described above, in the conventional switching operation between data broadcast reception processing and scan processing, file reception processing in data broadcasting is inefficient, and a long time is taken to complete the reception of all files.

[0018] The present invention addresses this problem with the object of suppressing, when both data broadcast reception processing and other processing are alternately executed with a single tuner, invalid files in a data broadcast from being received so that the data broadcast is efficiently received.

[0019] The invention relates to a broadcast receiver and a method according to the appended claims.

[0020] In an aspect of the present invention, a broadcast receiver has a first tuner unit that receives program data in a digital broadcast and also includes a second tuner unit that alternately executes first reception processing in which a data broadcast file is received and second reception processing different from the first re-

ception processing. In the broadcast receiver, a time at which to start the transmission of a file to be received in the first reception processing is calculated, a switching time at which a switchover from the second processing to the first reception processing is to be made by the second tuner unit is determined from the calculated time at which to start the transmission of the file, and the second tuner unit is controlled so that it makes a switchover from the second reception processing to the first reception processing according to the determined switching time.

[0021] In a broadcast receiver which is structured as described above, it is possible to control a time at which to make a switchover from the second reception processing to the first reception processing according to a time at which to start the transmission of a data broadcast file, so that the file can be received from its beginning. Therefore, when both data broadcast reception processing and other processing are alternately executed with a single tuner, it is possible to suppress invalid files in a data broadcast from being received so that the data broadcast is efficiently received.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022]

Fig. 1 is a block diagram illustrating an example of the functional structure of a broadcast receiver in a first embodiment of the present invention;

Fig. 2 is a flowchart illustrating an example of processing executed by the broadcast receiver in the first embodiment of the present invention;

Fig. 3 illustrates an example of a switching operation executed by the broadcast receiver in the first embodiment of the present invention between data broadcast reception processing and scan processing;

Fig. 4 is a block diagram illustrating an example of the functional structure of a broadcast receiver in a second embodiment of the present invention;

Figs. 5A and 5B illustrate examples of a switching operation executed by the broadcast receiver in the second embodiment of the present invention between first data broadcast reception processing and second data broadcast reception processing; and

Fig. 6 illustrates an example of a switching operation executed by a conventional broadcast receiver between data broadcast reception processing and scan processing.

[0023] A first embodiment of the present invention will be described with reference to Figs. 1 to 3.

[0024] Example of the functional structure of a broadcast receiver 10

[0025] Fig. 1 is a block diagram illustrating an example of the functional structure of the broadcast receiver 10 in the first embodiment of the present invention. The broad-

cast receiver 10 in Fig. 1 is an apparatus that can receive a DAB broadcast. Separately from a main tuner (first tuner unit 110), which receives a main broadcast, the broadcast receiver 10 has a sub-tuner (second tuner unit 120). While the main tuner is receiving a main broadcast, the sub-tuner receives a data broadcast (such as, for example, an EPG, a TPEG broadcast, or Broadcasting Web Site (BWS)) in background.

[0026] As illustrated in Fig. 1, the broadcast receiver 10 has the first tuner unit 110, the second tuner unit 120, and a switching controller 130. The switching controller 130 has a transfer start time calculating unit 131, a switching timing determining unit 132, a first switching control unit 133, a file information storage unit 134, a file information acquiring unit 135, and a second switching control unit 136. The first tuner unit 110 is connected to an antenna 11 and a speaker 13. The second tuner unit 120 is connected to the antenna 11 and a display 12.

[0027] The functional blocks 131 to 136 described above can be structured by any one of hardware, a digital signal processor (DSP), and software. If, for example, these functional blocks 131 to 136 are structured by software, they include a central processing unit (CPU), a random-access memory (RAM), a read-only memory (ROM), and other components in a computer in practice. When programs stored in the RAM, the ROM, a hard disk, a semiconductor memory, or another storage medium are operated, these functional blocks 131 to 136 are implemented.

[0028] The first tuner unit 110 (main tuner) receives program data in a digital broadcast through the antenna 11. The program data received by the first tuner unit 110 is subject to decoding and other processes and is converted to a format in which the program data can be output, after which the program data is output from the speaker 13, making the program data audible to the user.

[0029] The second tuner unit 120 (background tuner) alternately executes first reception processing in which a data broadcast file is received through the antenna 11 and second reception processing different from the first reception processing. In this embodiment, the first reception processing executed by the second tuner unit 120 is data broadcast reception processing. Information in a data broadcast received in data broadcast reception processing forms a carousel composed of directory information and a plurality of files (see Fig. 3). Each file is composed of a plurality of segments; file identification information and other information are stored in the segment at the beginning of the file. The directory information includes the number of segments constituting each file, a segment size, and other information. In this embodiment, the reception of files implies not only the reception of files but also the reception of directory information.

[0030] The second reception processing executed by the second tuner unit 120 is scan processing to create a service list in a digital broadcast. The second tuner unit 120 alternately executes data broadcast reception processing and scan processing. A switchover from scan

processing to data broadcast reception processing is controlled by the first switching control unit 133, which will be described later, so that the switchover is made immediately before the transmission of the next file to be received starts. In principle, a switchover from data broadcast reception processing to scan processing is made at a point in time at which a file is received in a complete state. If, however, the next file to be received after a switchover from scan processing to data broadcast reception processing has been already received, a switchover from data broadcast reception processing to scan processing is controlled by the second switching control unit 136, which will be described later. Data in a data broadcast received by the second tuner unit 120 and the service list created by the second tuner unit 120 are output on the display 12, making the data and service list visible to the user.

[0031] The transfer start time calculating unit 131 calculates a time at which to start the transmission of a file to be received in data broadcast reception processing. Specifically, according to a file reception termination time at which the second tuner unit 120 has made a switchover from data broadcast reception processing to scan processing, the file size of a file to be transmitted while scan processing (second reception processing) is in progress (the file will be referred to below as the yet-to-receive file), and the transmission rate of the yet-to-receive file, the transfer start time calculating unit 131 calculates a time at which to start the transmission of the next file to be received, the next file being transmitted after the yet-to-receive file. The file size of the yet-to-receive file can be calculated from, for example, the number of segments in the yet-to-receive file and the segment size, which are included in the directory information. The transmission rate of the yet-to-receive file can be acquired from service information that can be acquired when tuning is executed in the second tuner unit 120. This transmission rate is a transmission rate related to data broadcast reception. Its value is common to all files.

[0032] The switching timing determining unit 132 determines a switching time at which a switchover from scan processing to data broadcast reception processing is to be made by the second tuner unit 120, according to the time, calculated by the transfer start time calculating unit 131, at which to start the transmission of the next file to be received. Particularly, in this embodiment, the switching timing determining unit 132 determines a time that is a predetermined time before the time, calculated by the transfer start time calculating unit 131, at which to start the transmission of the next file to be received, as the switching time at which a switchover from scan processing to data broadcast reception processing is to be made.

[0033] The first switching control unit 133 controls the second tuner unit 120 so that it makes a switchover from scan processing to data broadcast reception processing, according to the switching time determined by the switching timing determining unit 132.

[0034] The file information storage unit 134 stores identification information about a file that has been received in data broadcast reception processing. When, for example, the transmission of a file to be received in data broadcast reception processing is started, the file information acquiring unit 135 acquires identification information about the file from the segment at the beginning of the file. When the reception of the file has been terminated in the data broadcast reception processing, the file information storage unit 134 stores the identification information, acquired by the file information acquiring unit 135, about the file.

[0035] After the reception of one file has been terminated, the file information acquiring unit 135 acquires identification information about the next file from it when the transmission of the file starts. The file information acquiring unit 135 acquires identification information about the file from, for example, the segment at the beginning of the file.

[0036] After the second tuner unit 120 has made a switchover from scan processing to data broadcast reception processing, when the transmission of the next file starts, the identification information, acquired by the file information acquiring unit 135, about the next file may be already stored in the file information storage unit 134. In this case, the second switching control unit 136 controls the second tuner unit 120 so that it makes a switchover from data broadcast reception processing to scan processing.

Example of processing executed by the broadcast receiver 10

[0037] Fig. 2 is a flowchart illustrating an example of processing executed by the broadcast receiver 10 in the first embodiment of the present invention. Processing in Fig. 2 is started when, for example, the power supply of the broadcast receiver 10 is turned on, and continues to be executed until the power supply of the broadcast receiver 10 is turned off.

[0038] First, the second tuner unit 120 receives a file (receives directory information at first) in data broadcast reception processing (step S202). The second tuner unit 120 then decides whether the reception of the file in data broadcast reception processing has been terminated (step S204). If the second tuner unit 120 decides that the reception of the file has not been terminated (the result in step S204 is No), the second tuner unit 120 executes processing in step S204 again.

[0039] If the second tuner unit 120 decides that the reception of the file has been terminated (the result in step S204 is Yes), the second tuner unit 120 decides whether the received file is directory information (step S206). If the second tuner unit 120 decides that the received file is directory information (the result in step S206 is Yes), the second tuner unit 120 executes processing in steps S202 and S204 again. If the second tuner unit 120 decides that the received file is not directory infor-

mation (the result in step S206 is No), the second tuner unit 120 makes processing proceed to step S208.

[0040] In step S208, the file information storage unit 134 stores identification information about the received file. Then, the second tuner unit 120 starts scan processing (step S210). The transfer start time calculating unit 131 calculates a time at which to start the transmission of the next file to be received, the next file being transmitted after a yet-to-receive file that is transmitted during scan processing (step S212). Furthermore, the switching timing determining unit 132 determines a time that is a predetermined time before the time, calculated in step S212, at which to start the transmission of the next file to be received, as the switching time at which a switchover from scan processing to data broadcast reception processing is to be made (step S214).

[0041] After that, the first switching control unit 133 decides whether the switching time determined in step S214 has arrived (step S216). If the first switching control unit 133 decides that the switching time has not yet arrived (the result in step S216 is No), the first switching control unit 133 executes processing in step S216 again. If the first switching control unit 133 decides that the switching time has arrived (the result in step S216 is Yes), the second tuner unit 120 makes a switchover from scan processing to data broadcast reception processing under control of the first switching control unit 133 (step S218). Since the transmission of the next file to be received has not yet been started at this point in time, the second tuner unit 120 partially receives the remaining part of the yet-to-receive file.

[0042] Then, the second tuner unit 120 decides whether the transmission of the next file to be received has been started (step S220). If the second tuner unit 120 decides that the transmission of the next file to be received has not yet been started (the result in step S220 is No), the second tuner unit 120 executes processing in step S220 again.

[0043] If the second tuner unit 120 decides that the transmission of the next file to be received has been started (the result in step S220 is Yes), the file information acquiring unit 135 acquires identification information about the file to be received from the file (step S222). Then, the second switching control unit 136 decides whether the identification information, acquired in step S222, about the file to be received is stored in the file information storage unit 134 (step S224).

[0044] If the second switching control unit 136 decides that the identification information about the file to be received is not stored in the file information storage unit 134 (the result in step S224 is No), processing returns to step S202, where the second tuner unit 120 receives the file without alteration (step S202). The second tuner unit 120 then executes processing in step S204 and later again.

[0045] If the second switching control unit 136 decides that the identification information about the file to be received is stored in the file information storage unit 134

(the result in step S224 is Yes), the second tuner unit 120 makes a switchover from data broadcast reception processing to scan processing under control of the second switching control unit 136 (step S226). The second tuner unit 120 then executes processing in step S210 and later again.

Example of a switching operation executed by the broadcast receiver 10

[0046] Fig. 3 illustrates an example of a switching operation executed by the broadcast receiver 10 in the first embodiment of the present invention between data broadcast reception processing and scan processing. In Fig. 3, processing (data broadcast reception processing and scan processing) executed by the second tuner unit 120 in the broadcast receiver 10 is illustrated in time series. As illustrated in Fig. 3, the second tuner unit 120 alternately executes data broadcast reception processing and scan processing.

[0047] In data transmitted in data broadcasting in the example in Fig. 3, directory information (header information) and six files numbered 1 to 6 that follow the director information constitute one carousel. In data broadcasting, a carousel of this type is repeatedly transmitted, so the second tuner unit 120 repeatedly receives the carousel.

[0048] In the example in Fig. 3, the second tuner unit 120 first receives directory information and then starts the reception of the file 1 in a data broadcast (time t1). When the reception of the file 1 is terminated, the second tuner unit 120 makes a switchover from data broadcast reception processing to scan processing (time t2).

[0049] At that time, the file information storage unit 134 stores identification information about the file 1, which has been received. According to a time at which the reception of the file 1 was terminated (that is, the time is time t2), the file size of a yet-to-receive file to be transmitted during scan processing (that is, the yet-to-receive file is the file 2), and the transmission rate of the file 2, the transfer start time calculating unit 131 calculates a time at which to start the transmission of the next file to be received, the next file being transmitted after the yet-to-receive file (that is, the next file is the file 3). The file size of the file 2 can be calculated from the number of segments in the file 2 and the segment size, which are included in the directory information. The transmission rate of the file 2 can be acquired from service information that can be acquired when tuning is executed in the second tuner unit 120. The value of the transmission rate is common to the files 1 to 6.

[0050] Furthermore, the switching timing determining unit 132 determines a time (time t3) that is a predetermined time before the time, calculated by the transfer start time calculating unit 131, at which to start the transmission of the file 3, as the switching time at which a switchover from scan processing to data broadcast reception processing is to be made.

[0051] When the determined switching time comes, the second tuner unit 120 makes a switchover from scan processing to data broadcast reception processing under control of the first switching control unit 133 (time t3). Although, at that time, the file 2, which is a yet-to-receive file, is being transmitted, the transmission of the file 2 is terminated soon, after which the transmission of the file 3 is started in succession. When the transmission of the file 3 is started, the file information acquiring unit 135 acquires identification information about the file 3 from the segment at the beginning of the file 3. In this example, identification information about the acquired file 3 is not stored in the file information storage unit 134, so the second tuner unit 120 receives the file 3, starting from its beginning. Therefore, the file 3 received by the second tuner unit 120 becomes valid.

[0052] When the reception of the file 3 is terminated, the second tuner unit 120 makes a switchover from data broadcast reception processing to scan processing (time t4).

[0053] At that time, the file information storage unit 134 stores identification information about the file 3, which has been received. According to a time at which the reception of the file 3 was terminated (that is, the time is time t4), the file size of a yet-to-receive file to be transmitted during scan processing (that is, the yet-to-receive file is the file 4), and the transmission rate of the file 4, the transfer start time calculating unit 131 calculates a time at which to start the transmission of the next file to be received, the next file being transmitted after the yet-to-receive file (that is, the next file is the file 5).

[0054] Furthermore, the switching timing determining unit 132 determines a time (time t5) that is a predetermined time before the time, calculated by the transfer start time calculating unit 131, at which to start the transmission of the file 5, as the switching time at which a switchover from scan processing to data broadcast reception processing is to be made.

[0055] When the determined switching time comes, the second tuner unit 120 makes a switchover from scan processing to data broadcast reception processing under control of the first switching control unit 133 (time t5). Although, at that time, the file 4, which is a yet-to-receive file, is being transmitted, the transmission of the file 4 is terminated soon, after which the transmission of the file 5 is started in succession. When the transmission of the file 5 is started, the file information acquiring unit 135 acquires identification information about the file 5 from the segment at the beginning of the file 5. In this example, identification information about the acquired file 5 is not stored in the file information storage unit 134, so the second tuner unit 120 receives the file 5, starting from its beginning. Therefore, the file 5 received by the second tuner unit 120 becomes valid.

[0056] When the reception of the file 5 is terminated, the second tuner unit 120 makes a switchover from data broadcast reception processing to scan processing (time t6).

[0057] At that time, the file information storage unit 134 stores identification information about the file 5, which has been received. According to a time at which the reception of the file 5 was terminated (that is, the time is time t6), the file size of a yet-to-receive file to be transmitted during scan processing (that is, the yet-to-receive file is the file 6), and the transmission rate of the file 6, the transfer start time calculating unit 131 calculates a time at which to start the transmission of the next file to be received, the next file being transmitted after the yet-to-receive file (that is, the next file is directory information).

[0058] Furthermore, the switching timing determining unit 132 determines a time (time t7) that is a predetermined time before the time, calculated by the transfer start time calculating unit 131, at which to start the transmission of the directory information, as the switching time at which a switchover from scan processing to data broadcast reception processing is to be made.

[0059] When the determined switching time comes, the second tuner unit 120 makes a switchover from scan processing to data broadcast reception processing under control of the first switching control unit 133 (time t7). Although, at that time, the file 6, which is a yet-to-receive file, is being transmitted, the transmission of the file 6 is terminated soon, after which the transmission of the directory information is started in succession. Thus, the second tuner unit 120 can receive the directory information, starting from its beginning.

[0060] When the second tuner unit 120 terminates the reception of the directory information, the file information acquiring unit 135 acquires identification information about the file 1 to be transmitted in succession, starting from the segment at the beginning of the file 1. Since the file 1 has been already received, its identification information is already stored in the file information storage unit 134. Therefore, the second tuner unit 120 does not receive the file 1 this time, but makes a switchover from data broadcast reception processing to scan processing under control of the second switching control unit 136 (time t8).

[0061] At that time, according to a time at which the reception of the directory information was terminated (that is, the time is time t8), the file size of a yet-to-receive file to be transmitted during scan processing (that is, the yet-to-receive file is the file 1), and the transmission rate of the file 1, the transfer start time calculating unit 131 calculates a time at which to start the transmission of the next file to be received, the next file being transmitted after the yet-to-receive file (that is, the next file is the file 2). Furthermore, the switching timing determining unit 132 determines a time (time t9) that is a predetermined time before the time, calculated by the transfer start time calculating unit 131, at which to start the transmission of the file 2, as the switching time at which a switchover from scan processing to data broadcast reception processing is to be made.

[0062] When the determined switching time comes,

the second tuner unit 120 makes a switchover from scan processing to data broadcast reception processing under control of the first switching control unit 133 (time t9). Although, at that time, the file 1, which is a yet-to-receive file, is being transmitted, the transmission of the file 1 is terminated soon, after which the transmission of the file 2 is started in succession. When the transmission of the file 2 is started, the file information acquiring unit 135 acquires identification information about the file 2 from it. In this example, identification information about the acquired file 2 is not stored in the file information storage unit 134, so the second tuner unit 120 receives the file 2, starting from its beginning. Therefore, the file 2 received by the second tuner unit 120 becomes valid. Subsequently, the second tuner unit 120 repeatedly executes similar processing.

[0063] In the operation described above, the valid received files are the files 1, 2, 3, and 5. It is clear that when data broadcast reception processing is just executed two more times by repeating the operation in Fig. 3 in succession, the remaining files 4 and 6 eligible for reception can be received immediately in a valid state.

[0064] As described above, with the broadcast receiver 10 in this embodiment, a time at which to transmit a file in a data broadcast is calculated, and a time at which to make a switchover from scan processing to data broadcast reception processing is controlled immediately before the calculated time. This enables each file to be received, starting from its beginning. With the broadcast receiver 10 in this embodiment, therefore, when both data broadcast reception processing and other processing are alternately executed with a single tuner, it is possible to suppress the reception of invalid files in a data broadcast and to efficiently receive the data broadcast.

[0065] With the broadcast receiver 10 in this embodiment, identification information about received files are stored, so whether a file to be transmitted has been already received is decided. If the file has been already received, while the file is being transmitted, scan processing can be executed instead of data broadcast reception processing. With the broadcast receiver 10 in this embodiment, therefore, it is possible to eliminate the wasteful reception of received files and to efficiently execute both data broadcast reception processing and scan processing.

Second embodiment

[0066] A second embodiment of the present invention will be described next with reference to Figs. 4 and 5. In the first embodiment, scan processing has been executed as the second reception processing, but this is not a limitation. For example, as will be described in the second embodiment, data broadcast reception processing different from data broadcast reception processing executed as the first reception processing may be executed as the second reception processing.

Example of the functional structure of a broadcast receiver 10'

[0067] Fig. 4 is a block diagram illustrating an example of the functional structure of the broadcast receiver 10' in the second embodiment of the present invention. The broadcast receiver 10' in Fig. 4 differs from the broadcast receiver 10 (see Fig. 1) in the first embodiment in that the broadcast receiver 10' has a second tuner unit 120' instead of the second tuner unit 120 and that the switching controller 130 has a first switching control unit 133' instead of the first switching control unit 133.

[0068] In the second embodiment, the first reception processing executed by the second tuner unit 120' is data broadcast reception processing in which files of first data type are received (the data broadcast reception processing will be referred to below as the first data broadcast reception processing). The second reception processing executed by the second tuner unit 120' is data broadcast reception processing in which files of second data type, different from the first data type, are received (the data broadcast reception processing will be referred to below as the second data broadcast reception processing).

[0069] The first data broadcast reception processing and second data broadcast reception processing may be any combination if different data types are used between the first data broadcast reception processing and the second data broadcast reception processing. For example, data broadcast reception processing in which EPG files are received may be applied as the first data broadcast reception processing, and data broadcast reception processing in which TPEG files are received may be applied as the second data broadcast reception processing.

[0070] The second tuner unit 120' alternately executes the first data broadcast reception processing and second data broadcast reception processing. In principle, the second tuner unit 120' is controlled by the first switching control unit 133' so that files of first data type are preferentially received. If, however, the reception of all files of first data type has been completed, the second tuner unit 120' is controlled by the first switching control unit 133' so that files of second data type are preferentially received. This is because, if only files of first data type are preferentially received, the number of invalid files of second data type is increased. This would make it impossible to complete the reception of all files of second data type.

[0071] Specifically, the first switching control unit 133' controls the second tuner unit 120' so that files of first data type are preferentially received until the reception of all files of first data type is completed, as will be described in (1) and (2) below.

(1) While the first data broadcast reception processing is in progress, the first switching control unit 133' controls the second tuner unit 120' so that it makes a switchover from the first data broadcast reception processing to the second data broadcast reception processing at a time at which the reception of a file

of first data type is terminated. Therefore, files of first data type can be received up to the last one so that any of the files of first data type, which should be preferentially acquired, is not invalidated.

(2) While the second data broadcast reception processing is in progress, the first switching control unit 133' controls the second tuner unit 120' so that it makes a switchover from the second data broadcast reception processing to the first data broadcast reception processing at the switching time determined by the switching timing determining unit 132. Therefore, each file of first data type can be received, starting from its beginning, so that any of the files of first data type, which should be preferentially acquired, is not invalidated. In this case, the reception of a file of second data type may be suspended before the file is completely received, and the file of second data type may be invalidated. In spite of this, priority is given to the reception of each file of first data type from its beginning.

After the reception of all files of first data type has been completed, the first switching control unit 133' controls the second tuner unit 120' so that files of second data type are preferentially received as described in (3) and (4) below.

(3) While the second data broadcast reception processing is in progress, the first switching control unit 133' controls the second tuner unit 120' so that it makes a switchover from the second data broadcast reception processing to the first data broadcast reception processing at a time at which the reception of a file of second data type is terminated. Therefore, files of second data type can be received up to the last one so that any of the files of second data type, which should be preferentially acquired, is not invalidated.

(4) While the first data broadcast reception processing is in progress, the first switching control unit 133' controls the second tuner unit 120' so that it makes a switchover from the first data broadcast reception processing to the second data broadcast reception processing at the switching time determined by the switching timing determining unit 132. Therefore, each file of second data type can be received, starting from its beginning, so that any of the files of second data type, which should be preferentially acquired, is not invalidated. In this case, the reception of a file of first data type may be suspended before the file is completely received, and the file may be invalidated. In spite of this, priority is given to the reception of each file of second data type from its beginning.

[0072] After the reception of all files of second data type has been completed, the first switching control unit 133' further controls the second tuner unit 120' so that files of first data type are preferentially received as described in (1) and (2) above. Thus, even if files of first

data type and files of second data type need to be acquired again because, for example, data in a data broadcast has been changed, the files of first data type can be preferentially received again.

Examples of a switching operation executed by the broadcast receiver 10'

[0073] Figs. 5A and 5B illustrate examples of a switching operation executed by the broadcast receiver 10' in the second embodiment of the present invention between the first data broadcast reception processing and the second data broadcast reception processing. In Figs. 5A and 5B, processing (first data broadcast reception processing and second data broadcast reception processing) executed by the second tuner unit 120' in the broadcast receiver 10' is illustrated in time series. As illustrated in Figs. 5A and 5B, the second tuner unit 120' alternately executes the first data broadcast reception processing and second data broadcast reception processing.

[0074] In data of first data type transmitted in data broadcasting in the example in Figs. 5A and 5B, directory information (header information) at the beginning of the data and six files numbered A1 to A6 constitute one carousel. In the first data broadcast reception processing, the second tuner unit 120' receives data of first data type structured in this way.

[0075] Similarly, in data of second data type transmitted in data broadcasting in the example in Figs. 5A and 5B, directory information (header information) at the beginning of the data and six files numbered B1 to B6 constitute one carousel. In the second data broadcast reception processing, the second tuner unit 120' receives data of second data type structured in this way.

[0076] Fig. 5A illustrates processing executed by the second tuner unit 120' before the second tuner unit 120' completes the reception of all of the files A1 to A6 of first data type. In Fig. 5A, priority is given to the reception of the files A1 to A6 of first data type (that is, the first data broadcast reception processing is executed). Therefore, in a case in which the second tuner unit 120' is executing the first data broadcast reception processing, the second tuner unit 120' makes a switchover from the first data broadcast reception processing to the second data broadcast reception processing at a time at which the reception of a file of first data type is terminated. In the first data broadcast reception processing in this case, therefore, all files of first data type can be completely received. In a case in which the second tuner unit 120' is executing the second data broadcast reception processing, however, the second tuner unit 120' makes a switchover from the second data broadcast reception processing to the first data broadcast reception processing at a switching time immediately before the transmission of the next file to be received (the next file is of first data type) starts. In the second data broadcast reception processing in this case, therefore, a file of second data type may not be completely received.

[0077] In Fig. 5A, for example, if the second tuner unit 120' is executing processing to receive the files A1, A3, and A5 in the first data broadcast reception processing, the second tuner unit 120' makes a switchover from the first data broadcast reception processing to the second data broadcast reception processing at times t2, t4, and t6 at which the reception of the files A1, A3, and A5 is terminated. If the second tuner unit 120' is executing processing to receive the files B2 and B4 in the second data broadcast reception processing, the second tuner unit 120' makes a switchover from the second data broadcast reception processing to the first data broadcast reception processing at switching times (times t3 and t5) immediately before the transmission of the files A3 and A5 starts.

[0078] Fig. 5B illustrates processing executed by the second tuner unit 120' after the second tuner unit 120' completes the reception of all of the files A1 to A6 of first data type. In Fig. 5B, priority is given to the reception of the files B1 to B6 of second data type (that is, the second data broadcast reception processing is executed). Therefore, in a case in which the second tuner unit 120' is executing the second data broadcast reception processing, the second tuner unit 120' makes a switchover from the second data broadcast reception processing to the first data broadcast reception processing at a time at which the reception of a file of second data type is terminated. In the second data broadcast reception processing in this case, therefore, all files of second data type can be completely received. In a case in which the second tuner unit 120' is executing the first data broadcast reception processing, however, the second tuner unit 120' makes a switchover from the first data broadcast reception processing to the second data broadcast reception processing at a switching time immediately before the transmission of the next file to be received (the next file is of second data type) starts. In the first data broadcast reception processing in this case, therefore, a file of first data type may not be completely received.

[0079] In Fig. 5B, for example, if the second tuner unit 120' is executing processing to receive the files B1, B3, and B5 in the second data broadcast reception processing, the second tuner unit 120' makes a switchover from the second data broadcast reception processing to the first data broadcast reception processing at times t2, t4, and t6 at which the reception of the files B1, B3, and B5 is terminated. If the second tuner unit 120' is executing processing to receive the files A2 and A4 in the first data broadcast reception processing, the second tuner unit 120' makes a switchover from the first data broadcast reception processing to the second data broadcast reception processing at switching times (times t3 and t5) immediately before the transmission of the files B3 and B5 starts.

[0080] As described above, the second tuner unit 120' operates so as to preferentially receive the files A1 to A6 of first data type, starting from the first one and continuing to the last one, over the files B1 to B6 of second data

type until the second tuner unit 120' receives all of the files A1 to A6 of first data type. After having received all of the files A1 to A6 of first data type, the second tuner unit 120' operates to preferentially receive the files B1 to B6 of second data type, starting from the first one and continuing to the last one, over the files A1 to A6 of first data type. Therefore, the second tuner unit 120' can efficiently complete the reception of all of the files A1 to A6 of first data type and the files B1 to B6 of second data type.

[0081] If the second tuner unit 120' has completed the reception of all of the files B1 to B6 of second data type in the operation illustrated in Fig. 5B, the second tuner unit 120' operates so as to preferentially receive the files A1 to A6 of first data type again, starting from the first one and continuing to the last one, over the files B1 to B6 of second data type, as illustrated in Fig. 5A. Thus, even if all of the files A1 to A6 of first data type and all of the files B1 to B6 of second data type need to be acquired again because, for example, data in a data broadcast has been changed, the files A1 to A6 of first data type can be preferentially received first again, starting from the first one and continuing to the last one, over the files B1 to B6 of second data type, as in Fig. 5A.

[0082] Although, in the examples in Figs. 5A and 5B, the files A1 to A6 of first data type are preferentially received first over the files B1 to B6 of second data type, this is not a limitation. That is, the files B1 to B6 of second data type may be preferentially received first over the files A1 to A6 of first data type. Alternatively, the user may determine that either of the files A1 to A6 of first data type and the files B1 to B6 of second data type is to be preferentially received first.

[0083] Although, in the above embodiments, a switchover to the second processing is made each time one file is received in the first reception processing, this is not a limitation; a switchover to the second processing may be made each time a plurality of files are received in the first reception processing.

[0084] Although, in the above embodiments, the number of yet-to-receive files, which have not been received, during the second reception processing, is 1, this is not a limitation; the number of yet-to-receive files may be 2 or more. To complete the reception of all files in a shorter time, however, the number of yet-to-receive files is preferably reduced as much as possible.

[0085] In the above embodiments, a time, calculated by the transfer start time calculating unit 131, at which to start the transmission of a file to be received is the same as a time at which the transmission of a yet-to-receive file that has been transmitted before the file to be received is transmitted is terminated. In the above embodiments, therefore, a time at which the transmission of a yet-to-receive file is terminated may be calculated, instead of calculating a time at which to start the transmission of a file to be received.

[0086] Although, in the above embodiments, when a switchover is made from the first reception processing to the second reception processing, a time at which to start

the transmission of the next file to be received is calculated, the present invention is not limited to this. When, for example, directory information is received, times at which to start transmission of all files to be received may be calculated in advance.

[0087] Although, in the above embodiment, a time that is a predetermined time before a time at which to start the transmission of the next file to be received is determined as the switching time at which a switchover from the second reception processing to the first reception processing is to be made, this is not a limitation. If it is possible to receive the next file to be received from its beginning, a time itself at which to start the transmission of the next file to be received may be determined as the switching time.

[0088] The above embodiments have been just described as examples to embody the present invention. It should not be interpreted that these embodiments limit the technical range of the present invention. That is, the present invention can be practiced in various other forms without departing from the scope of the claims.

Claims

1. A broadcast receiver that is configured to receive a digital broadcast, the receiver comprising:

a first tuner unit (110) that is configured to receive program data in the digital broadcast;
 a second tuner unit (120, 120') that is configured to alternately execute first reception processing to receive a file in a data broadcast and second reception processing different from the first reception processing;
 a transfer start time calculating unit (131) that is configured to calculate a time at which to start transmission of a file to be received in the first reception processing;
 a switching timing determining unit (132) that is configured to determine a switching time at which a switchover from the second reception processing to the first reception processing is to be made by the second tuner unit (120, 120'), according to the time, calculated by the transfer start time calculating unit (131), at which to start transmission of a file; and
 a switching control unit (133, 133') that is configured to control the second tuner unit (120, 120') so that the second tuner unit (120, 120') makes a switchover from the second reception processing to the first reception processing, according to the switching time determined by the switching timing determining unit (132).

2. The broadcast receiver according to Claim 1, wherein according to a file reception termination time at which the second tuner unit (120, 120') has made

a switchover from the second reception processing to the first reception processing, a file size of a yet-to-receive file to be transmitted while the second reception processing is in progress, and a transmission rate of the yet-to-receive file, the transfer start time calculating unit (131) is configured to calculate a time at which to start transmission of a next file to be received, the next file being transmitted after the yet-to-receive file.

3. The broadcast receiver according to Claim 2, wherein the switching timing determining unit (132) is configured to determine a time that is a predetermined time before the time, calculated by the transfer start time calculating unit (131), at which to start the transmission of the next file to be received, as the switching time at which a switchover from the second reception processing to the first reception processing is to be made.

4. The broadcast receiver according to any one of Claims 1 to 3, further comprising:

a file information storage unit (134) that is configured to store identification information about a file that has been received in the first reception processing;

a file information acquiring unit (135) that is configured to acquire, after reception of one file has been terminated, identification information about a next file from the next file; and

a second switching control unit (136) that is configured to control the second tuner unit (120, 120') so that the second tuner unit (120, 120') makes a switchover from the first reception processing to the second reception processing if the identification information acquired by the file information acquiring unit (135) is already stored in the file information storage unit (134) when transmission of the next file starts after a switchover has been made by the second tuner unit (120, 120') from the second reception processing to the first reception processing.

5. The broadcast receiver according to any one of Claims 1 to 4, wherein the second reception processing is scan processing to create a service list in the digital broadcast.

6. The broadcast receiver according to any one of Claims 1 to 4, wherein the second reception processing is processing to receive a file of second data type, the second data type being different from a first data type related to a file in the data broadcast, the file being received in the first reception processing.

7. The broadcast receiver according to Claim 6, wherein:

until reception of all files of first data type is completed in the first reception processing, a switchover from the first reception processing to the second reception processing is made at a time at which reception of a file of first data type is terminated and a switchover from the second reception processing to the first reception processing is made at the switching time determined by the switching timing determining unit (132); and

after reception of all files of first data type has been completed in the first reception processing, a switchover from the second reception processing to the first reception processing is made at a time at which reception of a file of second data type is terminated and a switchover from the first reception processing to the second reception processing is made at the switching time determined by the switching timing determining unit (132).

8. The broadcast receiver according to Claim 7, wherein after reception of all files of second data type has also been completed in the second reception processing, a switchover from the first reception processing to the second reception processing is made at a time at which reception of a file of first data type is terminated and a switchover from the second reception processing to the first reception processing is made at the switching time determined by the switching timing determining unit (132).

9. A reception switching control method executed by a broadcast receiver (10) that has a first tuner unit (110) that receives program data in a digital broadcast and also has a second tuner unit (120, 120') that alternately executes first reception processing to receive a file in a data broadcast and second reception processing different from the first reception processing, the method comprising:

a transmission start time calculation step in which a transfer start time calculating unit (131) in the broadcast receiver (10) calculates a time at which to start transmission of a file to be received in the first reception processing;

a switching time determination step in which a switching timing determining unit (132) in the broadcast receiver (10) determines a switching time at which a switchover from the second reception processing to the first reception processing is to be made by the second tuner unit (120), according to the time, calculated by the transfer start time calculating unit (131), at which to start transmission of a file; and
a switching control step in which a switching control unit (133, 133') in the broadcast receiver (10) controls the second tuner unit (120, 120') so that

the second tuner unit (120, 120') makes a switchover from the second reception processing to the first reception processing according to the switching time determined by the switching timing determining unit (132).

5

10

15

20

25

30

35

40

45

50

55

FIG. 1

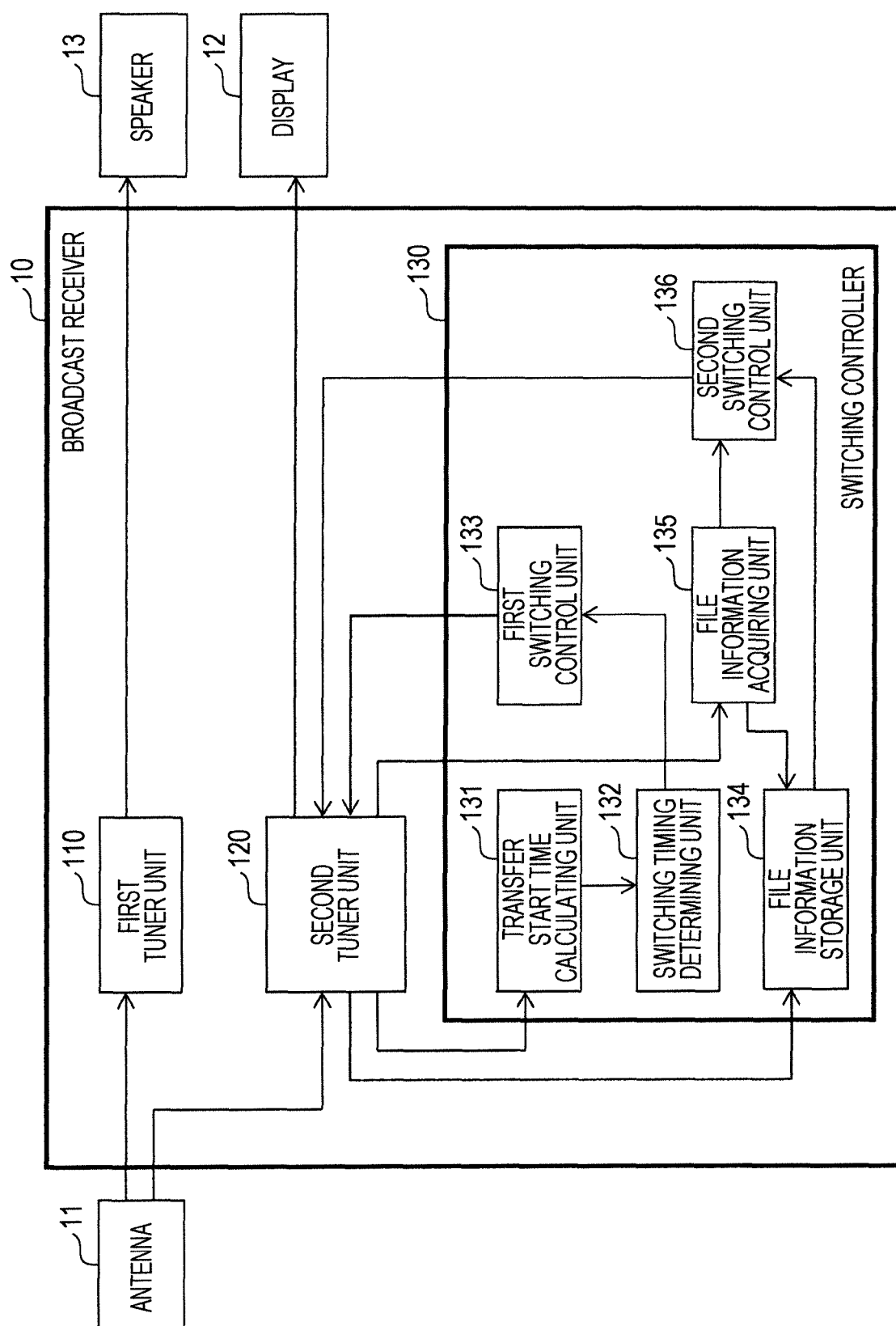


FIG. 2

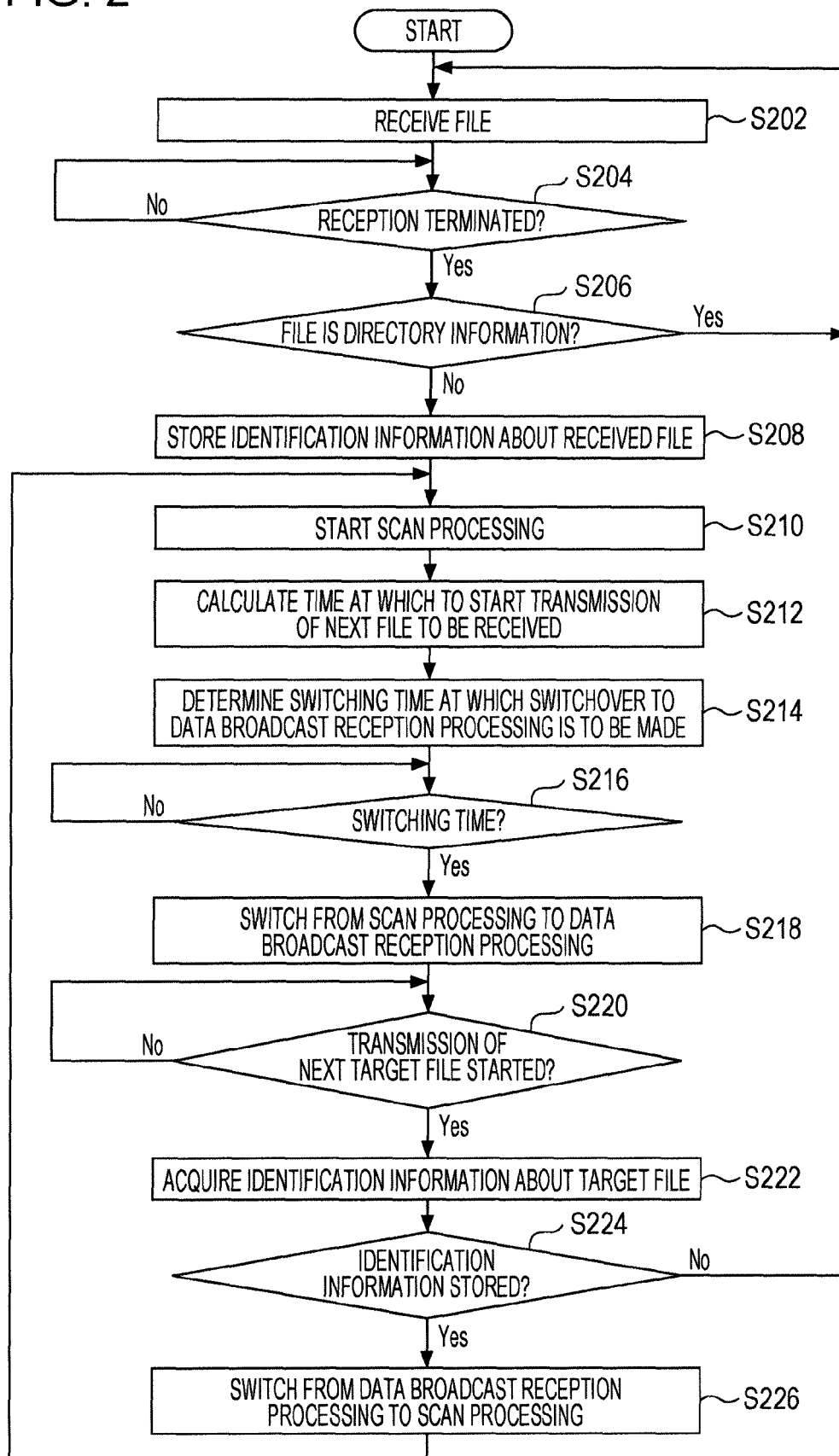


FIG. 3

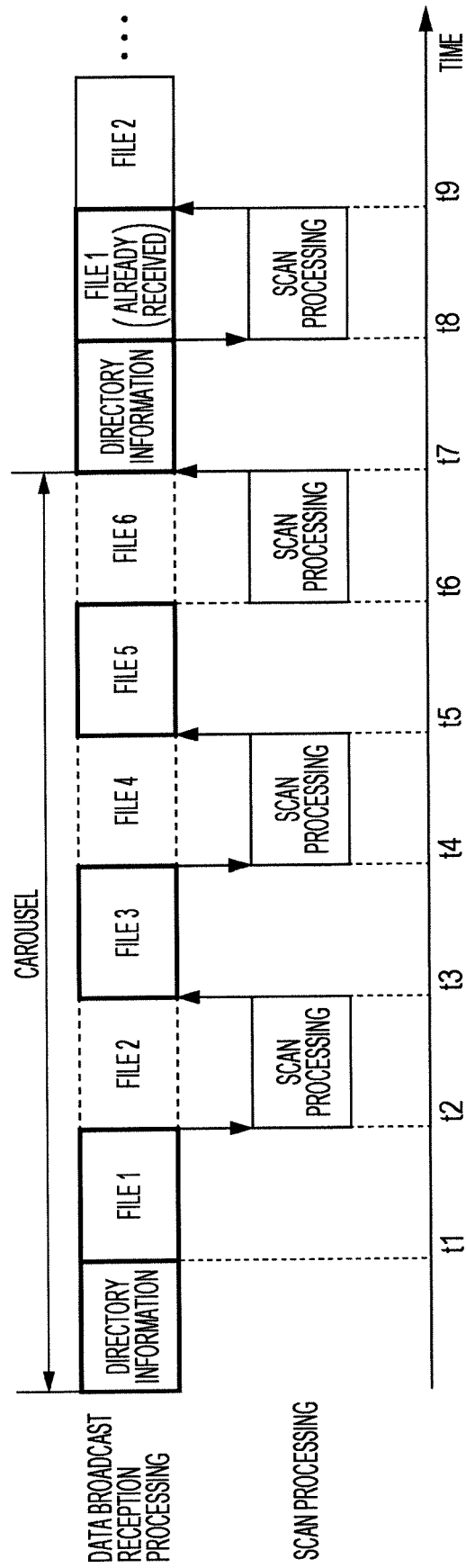


FIG. 4

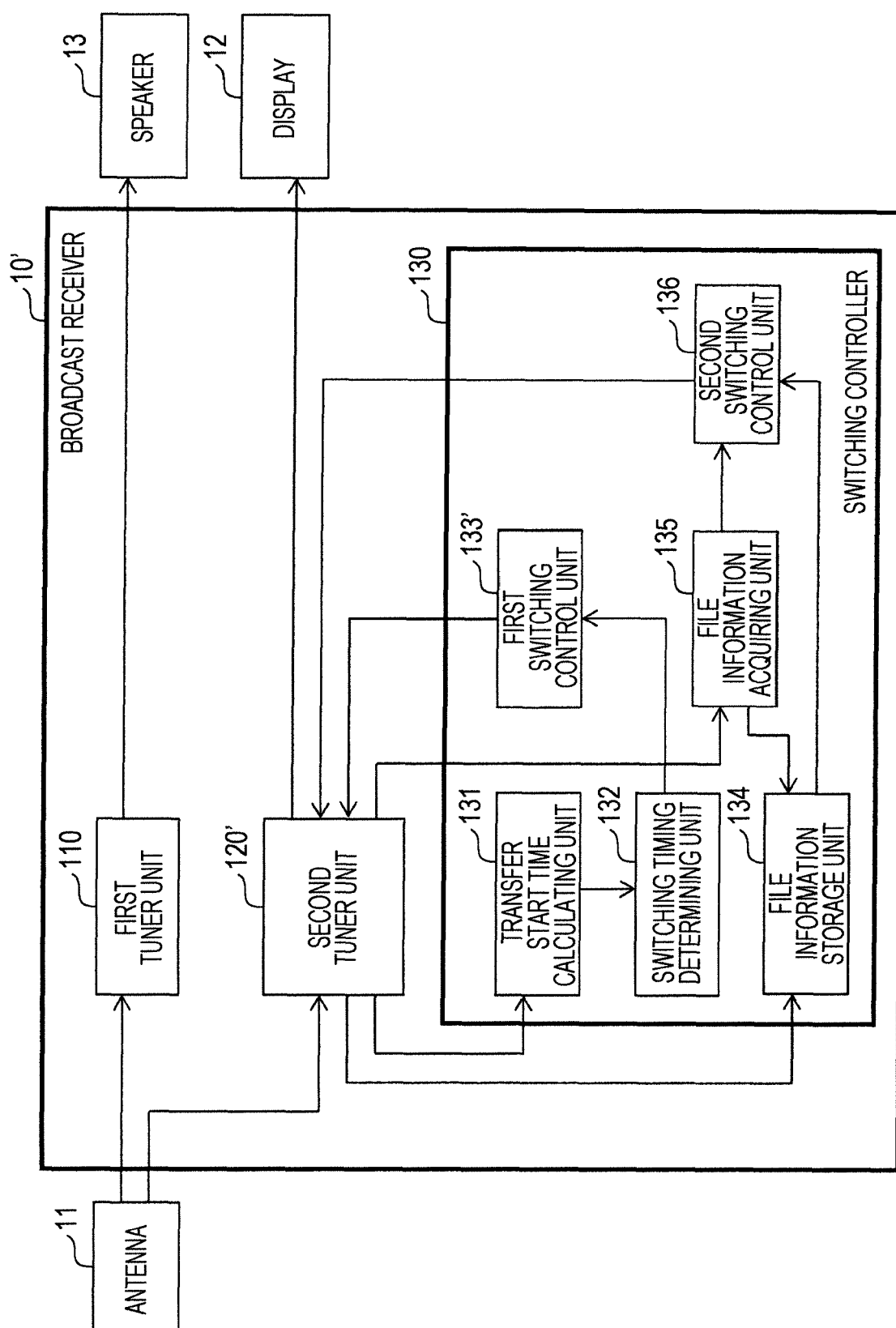


FIG. 5A

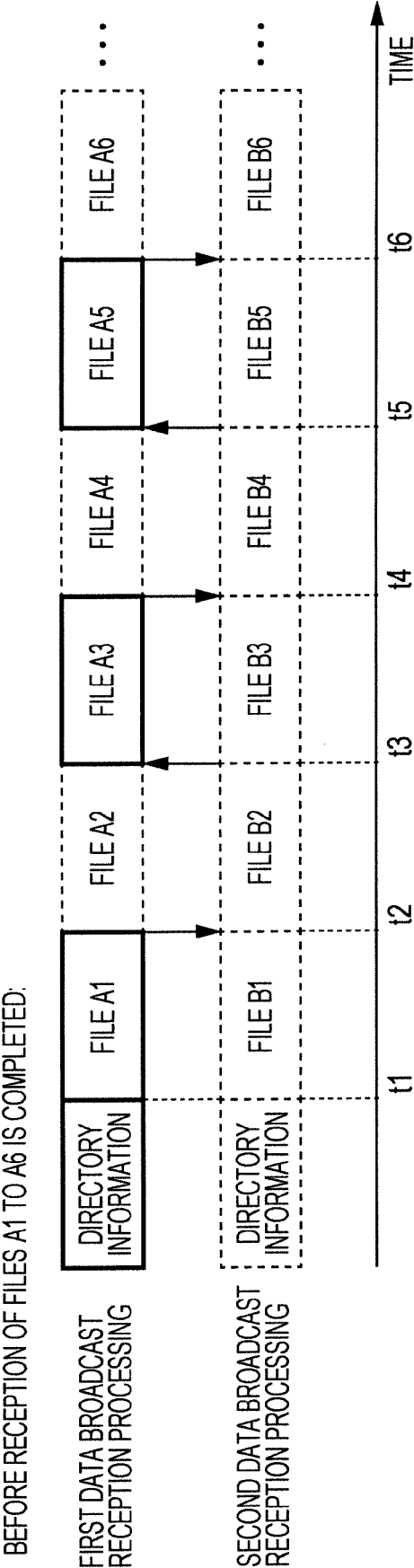


FIG. 5B

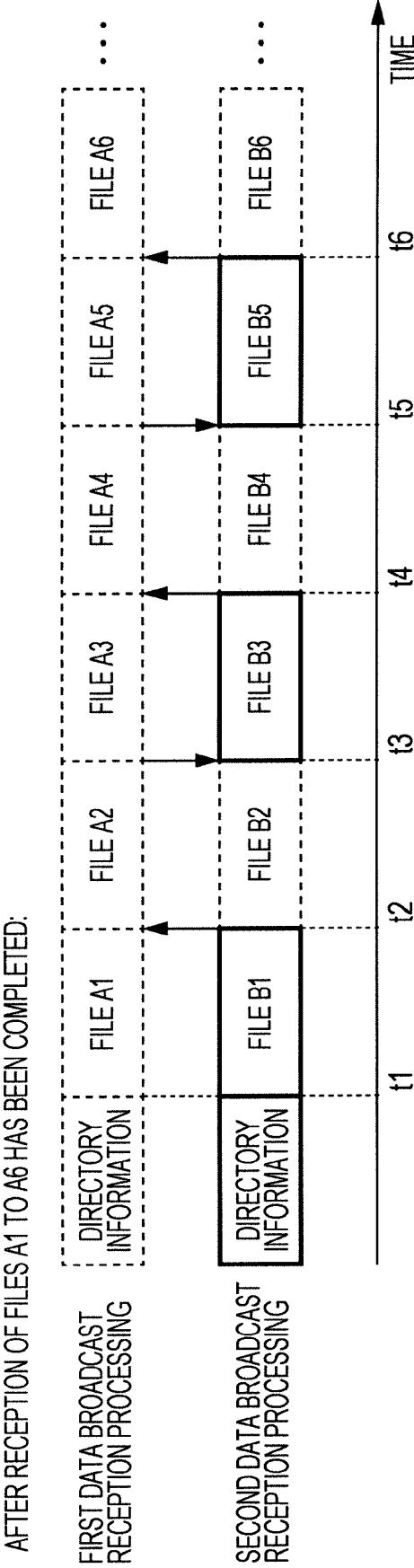
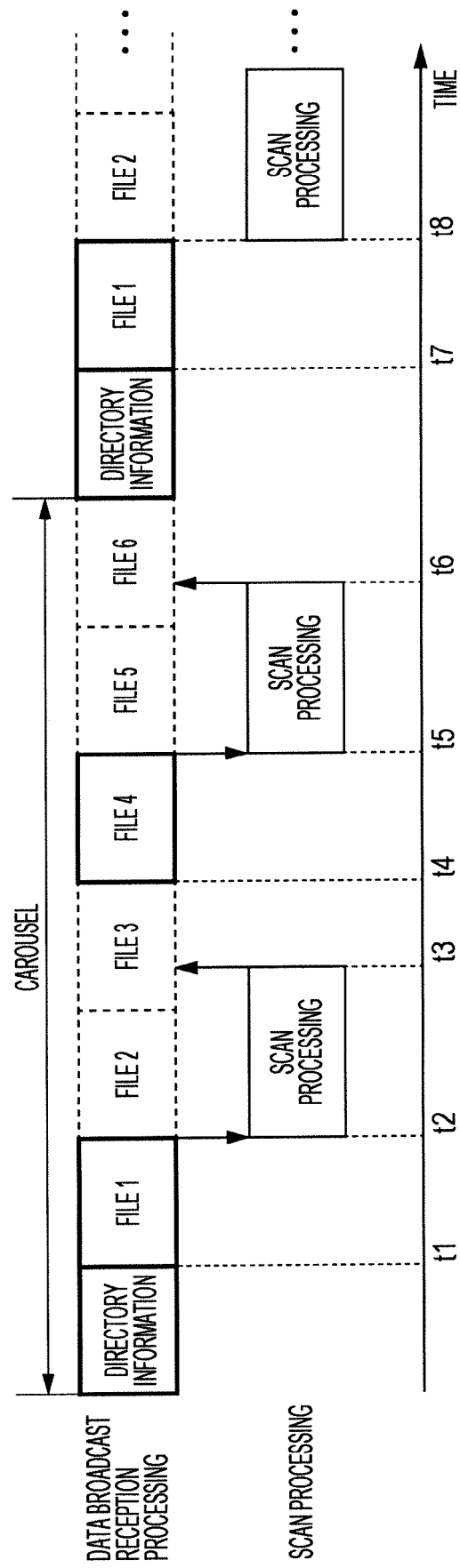


FIG. 6





EUROPEAN SEARCH REPORT

Application Number
EP 17 16 6857

5

10

15

20

25

30

35

40

45

50

55

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2012/207245 A1 (HAMAGUCHI TOMOYA [JP]) 16 August 2012 (2012-08-16)	1-5,9	INV. H04H20/42 H04H20/16 H04H60/25 H04H60/41
Y	* paragraphs [0012], [0026], [0027] - [0046], [0060] - [0065] * * figure 2 *	6-8	
X	EP 2 884 680 A1 (ALPINE ELECTRONICS INC [JP]) 17 June 2015 (2015-06-17) * paragraphs [0020], [0025] - [0036] * * figures 4A-4C *	1,9	
Y	EP 1 536 580 A2 (ALPINE ELECTRONICS INC [JP]) 1 June 2005 (2005-06-01) * paragraphs [0067] - [0068], [0073] *	6-8	
X	US 2011/122934 A1 (NAKATA KAZUHIRO [JP]) 26 May 2011 (2011-05-26) * paragraphs [0003], [0007], [0017], [0025] - [0030], [0036] - [0039], [0063] - [0072] * * figures 3, 5-7 *	1,9	TECHNICAL FIELDS SEARCHED (IPC)
X	EP 1 475 909 A1 (HARMAN BECKER AUTOMOTIVE SYS [DE]) 10 November 2004 (2004-11-10) * abstract; figures 3,4 * * paragraphs [0016] - [0017] *	1,9	H04H
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 23 June 2017	Examiner Iovescu, Vladimir
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 17 16 6857

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

23-06-2017

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2012207245 A1	16-08-2012	JP 5524106 B2	18-06-2014
		JP 2012169975 A	06-09-2012
		US 2012207245 A1	16-08-2012
EP 2884680 A1	17-06-2015	EP 2884680 A1	17-06-2015
		JP 2015115906 A	22-06-2015
EP 1536580 A2	01-06-2005	EP 1536580 A2	01-06-2005
		JP 4181021 B2	12-11-2008
		JP 2005159868 A	16-06-2005
US 2011122934 A1	26-05-2011	CN 102047569 A	04-05-2011
		DE 112009001277 T5	28-04-2011
		JP 4812899 B2	09-11-2011
		JP W02010004676 A1	22-12-2011
		US 2011122934 A1	26-05-2011
		WO 2010004676 A1	14-01-2010
EP 1475909 A1	10-11-2004	AT 526742 T	15-10-2011
		CN 1551518 A	01-12-2004
		EP 1475909 A1	10-11-2004
		JP 4429797 B2	10-03-2010
		JP 2004343745 A	02-12-2004
		US 2005037721 A1	17-02-2005

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP 2005159868 A [0005]
- JP 2004343745 A [0006]