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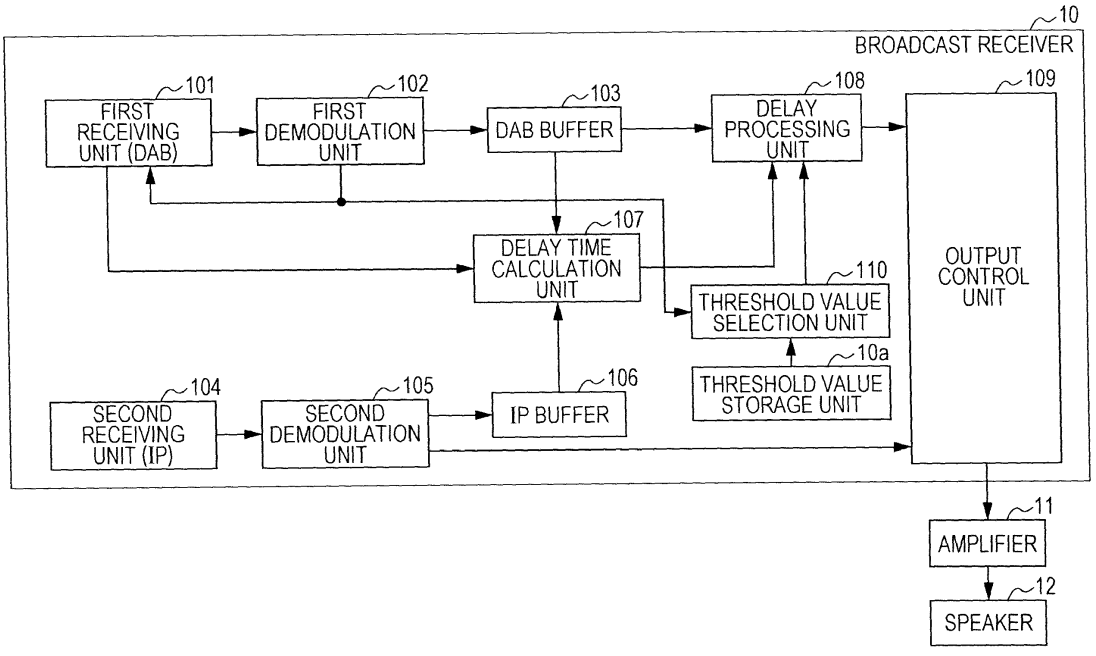
(54) BROADCAST RECEIVER AND OUTPUT CONTROL METHOD

(57) Broadcast receiver (10) that includes a delay processing unit (108) for performing delay processing on audio data of DAB broadcasting to synchronize with audio data of IP broadcasting in a case that a reception level of DAB broadcasting becomes lower than a predetermined threshold value. If there is no DAB alternate station switchable a threshold value is used, which is greater than a threshold value used in a case that there is the DAB alternate station so that, in a case that the switching to the DAB alternate station is not available while receiving the DAB broadcasting, delay processing on the DAB broadcasting is started at earlier timing compared to a case that the switching to the DAB alternate station is available. This prevents that switching to the IP broadcasting is performed even when the contents same as the DAB broadcasting is continuously available from an DAB alternate station.

FIG. 1



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Description

[0001] The present invention relates to a broadcast receiver and an output control method and is especially preferable to be applied to a broadcast receiver and an output control method that are configured to output broadcasting of different standards as selectively switching therebetween.

[0002] Conventionally, there has been proposed is a broadcast receiver that is capable of receiving two types of different standard broadcasting having the same contents (for example, digital audio broadcast (DAB) broadcasting and Internet protocol (IP) broadcasting, frequency modulation (FM) broadcasting and IP broadcasting, DAB broadcasting and FM broadcasting, or the like) and outputting the two types of broadcasting as selectively switching therebetween. With this proposal, for example, when the reception environment of one of the broadcasting becomes poor, the output is switched to the other of the broadcasting so that the user can continuously listen to the same contents.

[0003] However, there is a case that a time difference is generated between the two types of broadcasting received by the broadcast receiver. For example, regarding the broadcast receiver that is made to output DAB broadcasting and IP broadcasting as selectively switching therebetween, the IP broadcasting is transmitted to the broadcast receiver from the broadcast station via a provider, an Internet server, and the like. Thus, it is known that there is a time difference between the DAB broadcasting and IP broadcasting received by the broadcast receiver, which means that the IP broadcasting is received with a delay after the reception of the DAB broadcasting.

[0004] Thus, conventionally, there has been created a technique that realizes seamless switching between two types of broadcasting by synchronizing output timings of the two types of broadcasting to cancel the time difference between the two types of broadcasting.

[0005] For example, following Patent Literature 1 discloses a technique, for a radio broadcast receiver that can receive respective analog radio broadcasting and IP radio broadcasting, to calculate a time difference by comparing the time that the radio broadcasting data is acquired and the time of broadcasting included in data distributed from a server and synchronize them by executing delay processing based on the difference.

Citation List

Patent Literature

[0006] Patent Literature 1: JP 2011-014994 A

[0007] However, with the conventional broadcast receiver, there may be a case that a reception level of DAB broadcasting is reduced and DAB broadcasting cannot be received while delay processing of the DAB broadcasting is being executed. In this case, there occurs a problem that the delay processing of the DAB broadcasting is interrupted and the switching to the IP broadcasting cannot be performed seamlessly.

[0008] Figs. 11A and 11B are diagrams illustrating examples of an operation by a conventional broadcast receiver. In the examples illustrated in Figs. 11A and 11B, the conventional broadcast receiver is made so that, when a reception level of DAB broadcasting becomes lower than a predetermined threshold value th, delay processing of the DAB broadcasting is started. Further, when the reception level of the DAB broadcasting becomes lower than a reception possible level, it causes that the DAB broadcasting cannot be received.

[0009] Here, as illustrated in Fig. 11A, if the delay processing on the DAB broadcasting can be finished within a period after the reception level of the DAB broadcasting becomes lower than the threshold value th and the delay processing on the DAB broadcasting is started and before it becomes that the DAB broadcasting cannot be received (that is, before the reception level of the DAB broadcasting becomes lower than the reception possible level), the switching to the output of the IP broadcasting can be performed seamlessly at the timing that the DAB broadcasting output timing and IP broadcasting output timing are synchronized.

[0010] However, since the way how the reception level of the DAB broadcasting is reduced varies each time, as illustrated in Fig. 11B, there may be a case that the DAB broadcasting cannot be received since the reception level of the DAB broadcasting becomes lower than the reception possible level earlier than expected while executing the delay processing on the DAB broadcasting. In this case, since the delay processing of the DAB broadcasting is interrupted, the switching to output of the IP broadcasting cannot be performed seamlessly.

[0011] Here, it is possible to make the timing to perform delay processing on the DAB broadcasting earlier by setting the threshold value th relatively high; however, if the value is set higher than needed, switching from the DAB broadcasting to the IP broadcasting frequently occurs. Since the reception of the IP broadcasting requires a communication charge, it is preferable not to switch to the IP broadcasting as possible.

[0012] The present invention has been made to address the above problem and has an object to provide a broadcast receiver that synchronizes one broadcasting with another broadcasting in delay processing while preventing the switching to the another broadcasting as possible and performing seamless switching if the switching is performed.

[0013] The invention relates to a broadcast receiver and output control method according to the independent claims. Embodiments are disclosed in the dependent claims.

[0014] According to an embodiment of the present invention, in a broadcast receiver that is made to start a calculation of delay time between first standard broadcasting and second standard broadcasting and delay

processing on audio data of the first standard broadcasting when a reception level of the first standard broadcasting becomes lower than a predetermined threshold value and to synchronize output timing of the audio data of the first standard broadcasting with output timing of the audio data of the second standard broadcasting, in a case that there is no alternate station switchable from a broadcast station of the first standard broadcasting, it is made to determine whether or not the reception level of the first standard broadcasting becomes lower than the predetermined threshold value by using, as a predetermined threshold value, a threshold value which is greater than a threshold value which is used in a case that there is an alternate station.

[0015] According to an embodiment of the present invention having the above described configuration, in a case that the switching from the broadcast station to an alternate station cannot be performed while receiving the first standard broadcasting, the delay processing on the first standard broadcasting is started at earlier timing compared to a case that the switching can be performed. With this, the period of time that the delay processing on the first standard broadcasting can be performed before it fails to receive the first standard broadcasting can be practically extended. This can reduce the possibility that the delay processing on the first standard broadcasting is interrupted.

[0016] Further, according to the present invention, in a case that switching from the broadcast station to the alternate station is available while receiving the first standard broadcasting, the delay processing on the first standard broadcasting is started at later timing compared to the case that the switching is not available. This prevents that the switching to the second standard broadcasting is performed even though the same contents as the first standard broadcasting can be continuously received from the alternate station.

[0017] Thus, according to the present invention, while preventing the switching to another broadcasting as possible, the switching can be performed seamlessly if the switching is performed.

Brief Description of Drawings

[0018]

Fig. 1 is a block diagram illustrating a functional configuration example of a broadcast receiver according to a first embodiment of the present invention.

Fig. 2 is a flowchart illustrating an example of a process by the broadcast receiver according to the first embodiment of the present invention.

Figs. 3A and 3B are diagrams illustrating examples of operation by the broadcast receiver according to the first embodiment of the present invention.

Fig. 4 is a block diagram illustrating a functional configuration example of a broadcast receiver according to a second embodiment of the present invention.

Fig. 5 is a flowchart illustrating an example of a process by the broadcast receiver according to the second embodiment of the present invention.

Figs. 6A and 6B are diagrams illustrating examples of operation by the broadcast receiver according to the second embodiment of the present invention.

Fig. 7 is a block diagram illustrating a functional configuration example of a broadcast receiver according to a third embodiment of the present invention.

Fig. 8 is a flowchart illustrating an example of a process by the broadcast receiver according to the third embodiment of the present invention.

Figs. 9A and 9B are diagrams illustrating examples of operation by the broadcast receiver according to the third embodiment of the present invention.

Figs. 10A and 10B are diagrams illustrating examples of operation by the broadcast receiver according to the third embodiment of the present invention.

Figs. 11A and 11B are diagrams illustrating examples of operation by a conventional broadcast receiver.

Description of Embodiments

First Embodiment

[0019] Hereinafter, embodiments of the present invention will be explained with reference to the drawings. Fig. 1 is a block diagram illustrating a functional configuration example of a broadcast receiver 10 according to a first embodiment of the present invention. The broadcast receiver 10 of Fig. 1 is a device capable of receiving DAB broadcasting (an example of first standard broadcasting) and IP broadcasting (an example of second standard broadcasting) and outputting audio data of the DAB broadcasting and audio data of the IP broadcasting to a speaker 12 as selectively switching therebetween.

[0020] As illustrated in Fig. 1, the broadcast receiver 10 includes, as its functional configuration, a first receiving unit 101, a first demodulation unit 102, a DAB buffer 103, a second receiving unit 104, a second demodulation unit 105, an IP buffer 106, a delay time calculation unit 107, a delay processing unit 108, an output control unit 109, and a threshold value selection unit 110. Further, the broadcast receiver 10 includes a threshold value storage unit 10a.

[0021] The above respective function blocks 101 to 110 may be composed of any of hardware, a digital signal processor (DSP), and software. For example, when being composed of software, the above function blocks 101 to 110 are composed of a CPU, a RAM, a ROM and the like of an FM buffer and realized by operation of a program stored in a storage medium such as a RAM, a ROM, hard disk, a semiconductor memory, or the like.

[0022] The first receiving unit 101 receives a broadcast wave of the DAB broadcasting. The first demodulation unit 102 demodulates the broadcast wave of the DAB broadcasting received by the first receiving unit 101. The

DAB buffer 103 stores audio data of the DAB broadcasting which is generated by the demodulation of the broadcast wave of the DAB broadcasting by the first demodulation unit 102.

[0023] Here, in a case that there is an alternate station of DAB broadcasting (hereinafter, referred to as a "DAB alternate station") which can be switched from the broadcast station of the currently received DAB broadcasting, the first receiving unit 101 switches the broadcast station for receiving the broadcast wave of the DAB broadcasting from the broadcast station of the currently received DAB broadcasting to a switchable DAB alternate station when a reception level of the currently receiving broadcast station becomes lower than a predetermined reception level (hereinafter, referred to as a "DAB alternate station switch level"). Here, the alternate station of the DAB broadcasting that is switchable from the broadcast station of the currently received DAB broadcasting is a DAB alternate station that provides a service same as the currently receiving DAB broadcast station and has a reception level which is greater than the DAB alternate station switch level. The first receiving unit 101 can specify a DAB alternate station switchable from the broadcast station of the currently received DAB broadcasting by referring to service linking information included in DAB frame data output from the first demodulation unit 102 for example.

[0024] The second receiving unit 104 receives communication data of IP broadcasting. The second demodulation unit 105 demodulates the communication data of the IP broadcasting received by the second receiving unit 104. The IP buffer 106 stores audio data of the IP broadcasting generated by the demodulation of the communication data of the IP broadcasting by the second receiving unit 104.

[0025] The IP broadcasting received by the second receiving unit 104 has contents same as the DAB broadcasting received by the first receiving unit 101. It is noted that the IP broadcasting received by the second receiving unit 104 is received with a delay from the DAB broadcasting received by the first receiving unit 101. While the first receiving unit 101 directly receives the broadcast wave of the DAB broadcasting, the second receiving unit 104 receives the communication data of the IP broadcasting transmitted from a broadcast station via a provider and an Internet server.

[0026] The output control unit 109 outputs DAB broadcasting audio data generated by the first demodulation unit 102 and IP broadcasting audio data generated by the second demodulation unit 105 as selectively switching therebetween. Here, the output of the DAB broadcasting audio data is given priority over the output of the IP broadcasting audio data. For example, when the reception level of the DAB broadcasting is equal to or greater than a predetermined threshold value, the output control unit 109 outputs the DAB broadcasting audio data. On the other hand, when the reception level of the DAB broadcasting becomes lower than the predetermined threshold value, the output control unit 109 outputs the IP broadcasting audio data after the delay processing unit 108 finishes the delay processing on the DAB broadcasting audio data. The audio data output from the output control unit 109 is amplified by an amplifier 11 and outputs as sound from the speaker 12.

[0027] The delay time calculation unit 107 calculates delay time between the DAB broadcasting received by the first receiving unit 101 and the IP broadcasting received by the second receiving unit 104. For example, the delay time calculation unit 107 compares the DAB broadcasting audio data stored in the DAB buffer 103 and the IP broadcasting audio data stored in the IP buffer 106 and specifies same data between the DAB broadcasting audio data stored in the DAB buffer 103 and the IP broadcasting audio data stored in the IP buffer 106. Then, the delay time calculation unit 107 calculates delay time between the DAB broadcasting and the IP broadcasting based on a reception timing of the IP broadcasting audio data stored in the IP buffer 106 and a reception timing of the same data specified in the DAB buffer 103.

[0028] The delay processing unit 108 performs delay processing (time stretch) on the DAB broadcasting audio data according to the delay time calculated by the delay time calculation unit 107. With this, the delay processing unit 108 synchronizes an output timing of the DAB broadcasting audio data output from the output control unit 109 with an output timing of the IP broadcasting audio data output from the output control unit 109.

[0029] Here, the start timing of the delay processing by the delay processing unit 108 is defined by the predetermined threshold value which is used to determine switching to the IP broadcasting. As the predetermined threshold value, a different threshold value (a first threshold value th1 or a second threshold value th2) is selected by the threshold value selection unit 110 based on presence or absence of a DAB alternate station switchable from the broadcast station that is currently receiving the DAB broadcasting.

[0030] In a case that there is a DAB alternate station switchable from the broadcast station that is currently receiving the DAB broadcasting, the threshold value selection unit 110 selects the second threshold value th2 as the predetermined threshold value to determine the switching to the IP broadcasting from a plurality of threshold values stored in the threshold value storage unit 10a. On the other hand, in a case that there is no DAB alternate station switchable from the broadcast station that is currently receiving the DAB broadcasting, the threshold value selection unit 110 selects the first threshold value th1 which is greater than the second threshold value th2 as the predetermined threshold value to determine the switching to the IP broadcasting from the plurality of threshold values stored in the threshold value storage unit 10a.

[0031] By referring to the service linking information included in the DAB frame data which is output from the first demodulation unit 102 for example, the threshold

value selection unit 110 can specify the presence or absence of a DAB alternate station switchable from the broadcast station that is currently receiving the DAB broadcasting (a DAB alternate station having a reception level which is greater than the DAB alternate station switch level).

[0032] At timing when the reception level of the DAB broadcasting becomes lower than a predetermined threshold value that is selected by the threshold value selection unit 110, the delay processing unit 108 starts the delay time calculation by the delay time calculation unit 107 and the delay processing on the DAB broadcasting audio data. In other words, in a case that there is a DAB alternate station switchable from the broadcast station that is currently receiving the DAB broadcasting, at the timing when the reception level of the DAB broadcasting becomes lower than the second threshold value th2 selected by the threshold value selection unit 110, the delay processing unit 108 starts the delay time calculation by the delay time calculation unit 107 and the delay processing on the DAB broadcasting audio data. On the other hand, in a case that there is no DAB alternate station switchable from the broadcast station of currently received DAB broadcasting, at timing when the reception level of the DAB broadcasting becomes lower than the first threshold value th1 selected by the threshold value selection unit 110, the delay processing unit 108 starts the delay time calculation by the delay time calculation unit 107 and the delay processing on the DAB broadcasting audio data.

[0033] Here, the second threshold value th2 is smaller than the DAB alternate station switch level at the timing that the first receiving unit 101 switches to the DAB alternate station. This prevents that switching to the IP broadcasting is performed even when there is a DAB alternate station.

Example of Processes by Broadcast Receiver 10

[0034] Fig. 2 is a flowchart illustrating an example of a process by the broadcast receiver 10 according to the first embodiment of the present invention. The process illustrated in Fig. 2 is executed, for example, when the power of the broadcast receiver 10 is turned on.

[0035] Here, although it is not illustrated in Fig. 2, when the power of the broadcast receiver 10 is turned on, the first receiving unit 101 starts to receive the broadcast wave of the DAB broadcasting and, in response to this, the first demodulation unit 102 demodulates the broadcast wave of the DAB broadcasting and the DAB buffer 103 stores the DAB broadcasting audio data. Further, the second receiving unit 104 starts to receive the broadcast wave of the IP broadcasting and, in response to this, the second demodulation unit 105 demodulates the broadcast wave of the IP broadcasting and IP buffer 106 stores the IP broadcasting audio data.

[0036] Firstly, the threshold value selection unit 110 determines whether or not there is a DAB alternate station (step S202). Here, when the threshold value selection unit 110 determines that there is a DAB alternate station (step S202: Yes), the threshold value selection unit 110 selects the second threshold value th2 from the threshold value storage unit 10a (step S204).

[0037] After that, the first receiving unit 101 determines whether or not the reception level of the currently received DAB broadcasting is lower than the DAB alternate station switch level (step S206). Here, when the first receiving unit 101 determines that the reception level of the currently received DAB broadcasting is lower than the DAB alternate station switch level (step S206: Yes), the first receiving unit 101 switches the broadcast station for receiving the DAB broadcasting to the DAB alternate station (step S208). Then, the broadcast receiver 10 re-executes step S202 and subsequent processes. On the other hand, when the first receiving unit 101 determines that the reception level of the currently received DAB broadcasting is lower than the DAB alternate station switch level (step S206: No), the broadcast receiver 10 re-executes step S202 and subsequent processes.

[0038] On the other hand, when the threshold value selection unit 110 determines that there is no DAB alternate station (step S202: No), the threshold value selection unit 110 selects the first threshold value th1 from the threshold value storage unit 10a (step S210). After that, the first receiving unit 101 determines whether or not the reception level of the currently received DAB broadcasting is lower than the first threshold value th1 that is selected in step S210 (step S212).

[0039] Here, when the first receiving unit 101 determines that the reception level of the currently received DAB broadcasting is not lower than the first threshold value th1 (step S212: No), the broadcast receiver 10 re-executes step S202 and subsequent processes. On the other hand, when the first receiving unit 101 determines that the reception level of the currently received DAB broadcasting is lower than the first threshold value th1 (step S212: Yes), the delay time calculation unit 107 calculates delay time between the DAB broadcasting and the IP broadcasting (step S214). Then, the delay processing unit 108 starts the delay processing on the DAB broadcasting audio data corresponding to the delay time calculated in step S214 (step S216).

[0040] Then, the delay processing unit 108 determines whether or not the delay time calculated in step S214 has been canceled by the delay processing on the DAB broadcasting audio data which is started in step S216 (step S218). Here, when the delay processing unit 108 determines that the delay time has not been solved (step S218: No), the delay processing unit 108 re-executes the determination process of step S218.

[0041] On the other hand, when the delay processing unit 108 determines that the delay time has been canceled (step S218: Yes), the delay processing unit 108 ends the delay processing on the DAB broadcasting audio data (step S220). Then, the output control unit 109 switches from the output of the DAB broadcasting audio

data to the output of the IP broadcasting audio data (step S222). Then, the broadcast receiver 10 ends the series of the processes illustrated in Fig. 2.

Operation Example

[0042] Figs. 3A and 3B are diagrams illustrating examples of operation by the broadcast receiver 10 according to the first embodiment of the present invention. Fig. 3A illustrates an example of the operation by the broadcast receiver 10 in a case there is no DAB alternate station. Fig. 3B illustrates an example of the operation by the broadcast receiver 10 in a case that there is a DAB alternate station.

[0043] As illustrated in Fig. 3A, in a case that there is no DAB alternate station, the threshold value selection unit 110 selects the first threshold value th1 and the delay processing unit 108 starts the delay processing on the DAB broadcasting when the DAB broadcasting reception level becomes lower than the first threshold value th1. As illustrated in Fig. 3A, the first threshold value th1 is a value greater than the second threshold value th2 which is applied when there is a DAB alternate station. With this, the delay processing on the DAB broadcasting by the delay processing unit 108 is started at earlier timing compared to the case that there is a DAB alternate station. As a result, the switching to the IP broadcasting can be executed seamlessly since the delay processing of the DAB broadcasting can be ended at timing before it fails to receive the DAB broadcasting.

[0044] On the other hand, as illustrated in Fig. 3B, in a case that there is a DAB alternate station (DAB-2) while receiving the DAB broadcasting (DAB-1), the threshold value selection unit 110 selects the second threshold value th2 and the delay processing unit 108 starts the delay processing on the DAB broadcasting (DAB-1) when the reception level of the DAB broadcasting (DAB-1) becomes lower than the second threshold value th2. Here, as illustrated in Fig. 3B, the second threshold value th2 is set as a value lower than the DAB alternate station switch level. Thus, in a case that there is a DAB alternate station, switching to the DAB alternate station (DAB-2) is performed at timing when the reception level of the DAB broadcasting (DAB-1) becomes lower than the DAB alternate station switch level before the reception level of the DAB broadcasting (DAB-1) becomes lower than the second threshold value th2.

[0045] Here, the example illustrated in Fig. 3B shows a condition that there is no further switchable DAB alternate station at the timing when the switching to the DAB alternate station (DAB-2) is performed. Thus, the first threshold value th1 is selected by the threshold value selection unit 110 at the timing when the switching to the DAB alternate station (DAB-2) is performed. Accordingly, the delay processing unit 108 starts the delay processing on the DAB broadcasting (DAB-2) when the reception level of the DAB broadcasting (DAB-2) becomes lower than the first threshold value th1. In other words, the switching to the IP broadcasting can be performed seamlessly since the delay processing of the DAB broadcasting (DAB-2) can be started and ended at earlier timing before it fails to receive the DAB broadcasting (DAB-2), after being switched to the DAB alternate station (DAB-2), similarly to the example of Fig. 3A.

[0046] As described above, according to the first embodiment of the present invention, in a case that the switching to the DAB alternate station cannot be performed while receiving the DAB broadcasting, the delay processing on the DAB broadcasting is started at earlier timing compared to a case that when the switching can be executed. Thus, the period of time that the delay processing on the DAB broadcasting can be executed is practically extended before it fails to receive the DAB broadcasting. This can reduce the possibility that the delay processing on the DAB broadcasting is interrupted.

[0047] Further, according to the first embodiment of the present invention, in a case the switching to the DAB alternate station can be performed while receiving the DAB broadcasting, the delay processing on the DAB broadcasting is started at later timing compared to the case that the switching cannot be performed. This prevents that the switching to the IP broadcasting is executed even when the reception from the DAB alternate station is continuously available.

[0048] Thus, according to the first embodiment of the present invention, when the switching to the IP broadcasting is performed, the switching can be performed seamlessly as possible, while preventing the switching to the IP broadcasting as possible.

Second Embodiment

[0049] Next, a second embodiment of the present invention will be explained. Fig. 4 is a block diagram illustrating a functional configuration example of a broadcast receiver 20 according to the second embodiment of the present invention. The broadcast receiver 20 illustrated in Fig. 4 is a device capable of receiving FM broadcasting (an example of a first standard broadcasting) and IP broadcasting (an example of a second standard broadcasting) and outputting, to the speaker 12, FM broadcasting audio data and IP broadcasting audio data as selectively switching therebetween.

[0050] As illustrated in Fig. 4, the broadcast receiver 20 includes, as its functional configuration, a first receiving unit 201, a first demodulation unit 202, an FM buffer 203, a second receiving unit 204, a second demodulation unit 205, an IP buffer 206, a delay time calculation unit 207, a delay processing unit 208, an output control unit 209, and a threshold value selection unit 210. Further, the broadcast receiver 20 includes a threshold value storage unit 20a.

[0051] The above described function blocks 201 to 210 can be composed of any of hardware, a digital signal processor (DSP), and software. For example, when it is composed of software, the above function blocks 201 to

210 are actually composed of a CPU, a RAM, a ROM, and the like of a computer and are realized by operation of a program stored in a storage medium such as a RAM, a ROM, a hard disk, semiconductor memory and the like.

[0052] The first receiving unit 201 receives a broadcast wave of FM broadcasting. The first demodulation unit 202 demodulates the broadcast wave of the FM broadcasting received by the first receiving unit 201. The FM buffer 203 stores the FM broadcasting audio data which is generated by the demodulation of the broadcast wave of the FM broadcasting by the first demodulation unit 202.

[0053] Here, in a case that there is an alternate station of FM broadcasting which is switchable from a broadcast station of currently received FM broadcasting (hereinafter referred to as "FM alternate station"), when a reception level of the currently received broadcast station becomes lower than a predetermined reception level (hereinafter, referred to as "FM alternate station switch level"), the first receiving unit 201 switches the broadcast station for receiving the broadcast wave of the FM broadcasting from the broadcast station of currently received FM broadcasting to the switchable FM alternate station. Here, the alternate station of the FM broadcasting switchable from the broadcast station of the currently received FM broadcasting provides the same service as the currently receiving FM broadcast station and is an FM alternate station which has a reception level greater than the FM alternate station switch level. The first receiving unit 201 can specify the FM alternate station switchable from the broadcast station of the currently received FM broadcasting by referring to service linking information included in FM broadcasting data output from the first demodulation unit 202, for example.

[0054] The second receiving unit 204 receives communication data of IP broadcasting. The second demodulation unit 205 demodulates communication data of the IP broadcasting received by the second receiving unit 204. The IP buffer 206 stores IP broadcasting audio data which is generated by that the demodulation of the communication data of the IP broadcasting by the second receiving unit 204.

[0055] The IP broadcasting received by the second receiving unit 204 has the same contents as the FM broadcasting received by the first receiving unit 201. Here, the IP broadcasting received by the second receiving unit 204 is received with a delay after the FM broadcasting received by the first receiving unit 201. This is because, while the first receiving unit 201 directly receives the broadcast wave of the FM broadcasting, the second receiving unit 204 receives the communication data of the IP broadcasting transmitted from the broadcast station via a provider and an Internet server.

[0056] The output control unit 209 outputs the audio data of the FM broadcasting generated by the first demodulation unit 202 and the audio data of the IP broadcasting generated by the second demodulation unit 205 as selectively switching therebetween. Here, the output of the FM broadcasting audio data is given priority over the output of the IP broadcasting audio data. For example, when the reception level of the FM broadcasting is equal to or greater than the predetermined threshold value, the output control unit 209 outputs the FM broadcasting audio data. On the other hand, when the reception level of the FM broadcasting becomes lower than the predetermined threshold value, the output control unit 209 outputs the IP broadcasting audio data after the delay processing unit 208 finishes the delay processing on the FM broadcasting audio data. The audio data output from the output control unit 209 is amplified by the amplifier 11 and output as sound from the speaker 12.

[0057] The delay time calculation unit 207 calculates delay time between the FM broadcasting received by the first receiving unit 201 and the IP broadcasting received by the second receiving unit 204. For example, the delay time calculation unit 207 compares the FM broadcasting audio data stored in the FM buffer 203 and the IP broadcasting audio data stored in the IP buffer 206 and specifies the same data as the IP broadcasting audio data stored in the IP buffer 206 from the FM broadcasting audio data stored in the FM buffer 203. Then, the delay time calculation unit 207 calculates delay time between the IP broadcasting and the FM broadcasting based on the reception timing of the IP broadcasting audio data stores in the IP buffer 206 and the reception timing of the same data specified in the FM buffer 203.

[0058] The delay processing unit 208 executes delay processing (time stretch) on the FM broadcasting audio data according to the delay time calculated by the delay time calculation unit 207. With this, the delay processing unit 208 synchronizes the output timing of the FM broadcasting audio data output by the output control unit 209 with the output timing of the IP broadcasting audio data output by the output control unit 209.

[0059] Here, the start timing of the delay processing by the delay processing unit 208 is defined by a predetermined threshold value for determining switching to the IP broadcasting. As the predetermined threshold value, a different threshold value (a fourth threshold value th4 or a fifth threshold value th5) is selected by the threshold value selection unit 210 according to the presence or absence of an FM alternate station switchable from the broadcast station of the currently received FM broadcasting.

[0060] In a case that there is an FM alternate station switchable from the broadcast station of currently received the FM broadcasting, the threshold value selection unit 210 selects the fifth threshold value th5 (which is another example of the "second threshold value" described in the claims) from a plurality of threshold values stored in the threshold value storage unit 20a as a predetermined threshold value used to determine switching to the IP broadcasting. On the other hand, in a case that there is no FM alternate station switchable from the broadcast station of the currently received FM broadcasting, the threshold value selection unit 210 selects the fourth threshold value th4 (which is another example of

the "first threshold value" described in the claims) which is greater than the fifth threshold value th5 from the plurality of threshold values stored in the threshold value storage unit 20a as the predetermined threshold value used to determine the switching to the IP broadcasting.

[0061] The threshold value selection unit 210 can specify whether or not there is an FM alternate station switchable from the broadcast station of the currently received FM broadcasting (a DAB alternate station with a reception level greater than the FM alternate station switch level) by referring to the service linking information included in the FM broadcasting data output from the first demodulation unit 202, for example.

[0062] The delay processing unit 208 starts the delay time calculation by the delay time calculation unit 207 and delay processing on the FM broadcasting audio data at the timing when the FM broadcasting reception level becomes lower than the predetermined threshold value selected by the threshold value selection unit 210. In other words, in a case that there is an FM alternate station switchable from the broadcast station of the currently received FM broadcasting, the delay processing unit 208 starts the delay time calculation by the delay time calculation unit 207 and the delay processing on the FM broadcasting audio data at the timing when the FM broadcasting reception level becomes lower than the fifth threshold value th5 selected by the threshold value selection unit 210. On the other hand, in a case that there is no FM alternate station switchable from the broadcast station of the currently received FM broadcasting, the delay processing unit 208 starts the delay time calculation by the delay time calculation unit 207 and the delay processing on the FM broadcasting audio data at the timing when the FM broadcasting reception level becomes lower than the fourth threshold value th4 selected by the threshold value selection unit 210.

[0063] Here, the fifth threshold value th5 is smaller than the FM alternate station switch level which is used when the first receiving unit 201 performs switching to the FM alternate station. This prevents a case that the switching to the IP broadcasting is performed even when there is an FM alternate station.

Example of Process by Broadcast Receiver 20

[0064] Fig. 5 is a flowchart illustrating an example of a process by the broadcast receiver 20 according to the second embodiment of the present invention. The process illustrated in Fig. 5 is executed, for example, when the power of the broadcast receiver 20 is turned on.

[0065] Here, although it is not illustrated in Fig. 5, when the power of the broadcast receiver 20 is turned on, the first receiving unit 201 starts to receive a broadcast wave of the FM broadcasting and, in response to this, the first demodulation unit 202 starts to demodulate the broadcast wave of the FM broadcasting and the FM buffer 203 starts to store the FM broadcasting audio data. Further, the second receiving unit 204 starts to receive a broadcast wave of the IP broadcasting and, in response to this, the second demodulation unit 205 starts to demodulate the broadcast wave of the IP broadcasting and the IP buffer 206 starts to store IP broadcasting audio data.

[0066] Firstly, the threshold value selection unit 210 determines whether or not there is an FM alternate station (step S502). Here, when the threshold value selection unit 210 determines that there is an FM alternate station (step S502: Yes), the threshold value selection unit 210 selects the fifth threshold value th5 from the threshold value storage unit 20a (step S504).

[0067] After that, the first receiving unit 201 determines whether or not the reception level of the currently received FM broadcasting is lower than the FM alternate station switch level (step S506). Here, when the first receiving unit 201 determines that the reception level of the currently received FM broadcasting is lower than the FM alternate station switch level (step S506: Yes), the first receiving unit 201 switches the broadcast station for receiving the FM broadcasting to the FM alternate station (step S508). Then, the broadcast receiver 20 re-executes step S502 and subsequent processes. On the other hand, when the first receiving unit 201 determines that the reception level of the currently received FM broadcasting is not lower than the FM alternate station switch level (step S506: No), the broadcast receiver 20 re-executes step S502 and subsequent processes.

[0068] On the other hand, when the threshold value selection unit 210 determines that there is no FM alternate station (step S502: No), the threshold value selection unit 210 selects the fourth threshold value th4 from the threshold value storage unit 20a (step S510). After that, the first receiving unit 201 determines whether or not the reception level of the currently received FM broadcasting is lower than the fourth threshold value th4 selected by the step S510 (step S512).

[0069] Here, when the first receiving unit 201 determines that the reception level of the currently received FM broadcasting is not lower than the fourth threshold value th4 (step S512: No), the broadcast receiver 20 re-executes step S502 and subsequent processes. On the other hand, when the first receiving unit 201 determines that the reception level of the currently received FM broadcasting is lower than the fourth threshold value th4 (step S512: Yes), the delay time calculation unit 207 calculates delay time between the FM broadcasting and the IP broadcasting (step S514). Then, the delay processing unit 208 starts delay processing on the FM broadcasting audio data, according to the delay time calculated in step S514 (step S516).

[0070] Then, the delay processing unit 208 determines whether or not the delay time calculated in step S514 has been canceled by the delay processing on the FM broadcasting audio data, which is started in step S516 (step S518). Here, when the delay processing unit 208 determines that the delay time has not been canceled (step S518: No), the delay processing unit 208 re-executes the determination process in step S518.

[0071] On the other hand, when the delay processing unit 208 determines that the delay time has been canceled (step S518: Yes), the delay processing unit 208 ends the delay processing on the FM broadcasting audio data (step S520). Then, the output control unit 209 switches from the output of the FM broadcasting audio data to the output of the IP broadcasting audio data (step S522). Then, the broadcast receiver 20 ends the series of processes in Fig. 5.

Operation Example

[0072] Figs. 6A and 6B are diagrams illustrating examples of operation by the broadcast receiver 20 according to the second embodiment of the present invention. Fig. 6A illustrates an example of the operation by the broadcast receiver 20 in a case that there is no FM alternate station. Fig. 6B illustrates an example of the operation by the broadcast receiver 20 in a case that there is an FM alternate station.

[0073] As illustrated in Fig. 6A, when there is no FM alternate station, the fourth threshold value th4 is selected by the threshold value selection unit 210 and, when the reception level of the FM broadcasting becomes lower than the fourth threshold value th4, the delay processing unit 208 starts the delay processing on the FM broadcasting. As illustrated in Fig. 6A, the fourth threshold value th4 is a value greater than the fifth threshold value th5 which is used in a case that there is an FM alternate station. With this, the delay processing on the FM broadcasting by the delay processing unit 208 is started at earlier timing compared to the case that there is an FM alternate station. As a result, the switching to the IP broadcasting can be performed seamlessly since the delay processing on the FM broadcasting is ended at earlier timing before it fails to receive the FM broadcasting.

[0074] On the other hand, as illustrated in Fig. 6B, when there is an FM alternate station (FM-2) while receiving the FM broadcasting (FM-1), the fifth threshold value th5 is selected by the threshold value selection unit 210 and, when the reception level of the FM broadcasting (FM-1) becomes lower than the fifth threshold value th5, the delay processing unit 208 starts the delay processing on the FM broadcasting (FM-1). Here, as illustrated in Fig. 6B, the fifth threshold value th5 is set as a value smaller than the FM alternate station switch level. Thus, in a case that there is an FM alternate station, the switching to the FM alternate station (FM-2) is performed at the timing when the reception level of the FM broadcasting (FM-1) becomes lower than the FM alternate station switch level, before the reception level of the FM broadcasting (FM-1) becomes lower than the fifth threshold value th5.

[0075] Here, the example illustrated in Fig. 6B shows a condition that there is no further switchable FM alternate station at the timing when the switching to the FM alternate station (FM-2) is performed. Thus, at the timing of the switching to the FM alternate station (FM-2), the fourth threshold value th4 is being selected by the threshold value selection unit 210. In response to this, when the reception level of the FM broadcasting (FM-2) becomes lower than the fourth threshold value th4, the delay processing unit 208 starts the delay processing on the FM broadcasting (FM-2). In other words, the switching to the IP broadcasting can be performed seamlessly since the delay processing on the FM broadcasting (FM-2) can be ended at earlier timing before it fails to receive the FM broadcasting (FM-2), after switching to the FM alternate station (FM-2), similarly to the example of Fig. 6A.

[0076] As described above, according to the second embodiment of the present invention, in a case that the switching to the FM alternate station cannot be performed while receiving the FM broadcasting, the delay processing on the FM broadcasting is started at earlier timing compared to the case that the switching can be performed. Thus, the period of time that the delay processing on the FM broadcasting can be executed before it fails to receive the FM broadcasting can be practically extended. This reduces the possibility that the delay processing of the FM broadcasting is interrupted.

[0077] Further, according to the second embodiment of the present invention, in a case that the switching to the FM alternate station can be performed while receiving the FM broadcasting, the delay processing on the FM broadcasting is started at later timing compared to the case that the switching cannot be performed. This can prevent a case that the switching to the IP broadcasting is performed even when the reception from the FM alternate station is continuously available.

[0078] Thus, according to the second embodiment of the present invention, when the switching to the IP broadcasting is performed, the switching can be performed seamlessly as possible, while preventing the switching to the IP broadcasting as possible.

Third Embodiment

[0079] Next, a third embodiment of the present invention will be explained. Fig. 7 is a block diagram illustrating a functional configuration example of a broadcast receiver 30 according to the third embodiment of the present invention. The broadcast receiver 30 illustrated in Fig. 7 is a device that is capable of receiving DAB broadcasting (an example of first standard broadcasting), IP broadcasting (an example of second standard broadcasting), and FM broadcasting (an example of third standard broadcasting) and outputting, to the speaker 12, DAB broadcasting audio data, IP broadcasting audio data, and FM broadcasting audio data as selectively switching therebetween.

[0080] As illustrated in Fig. 7, the broadcast receiver 30 includes, as a functional configuration, a first receiving unit 301, a first demodulation unit 302, a DAB buffer 303, a second receiving unit 304, a second demodulation unit 305, an IP buffer 306, a delay time calculation unit 307, a delay processing unit 308, an output control unit 309,

a threshold value selection unit 310, a third receiving unit 311, a third demodulation unit 312, and an FM buffer 313. Further, the broadcast receiver 30 includes a threshold value storage unit 30a.

[0081] The above described function blocks 301 to 313 can be composed of any of hardware, a digital signal processor (DSP), and software. For example, when it is composed of software, the above described function blocks 301 to 313 are actually composed of a CPU, a RAM, a ROM or the like of a computer and realized by operation of a program stored in a storage medium such as a RAM, a ROM, a hard disk, a semiconductor memory and the like.

[0082] The first receiving unit 301 receives a broadcast wave of DAB broadcasting. The first demodulation unit 302 demodulates the broadcast wave of the DAB broadcasting received by the first receiving unit 301. The DAB buffer 303 stores DAB broadcasting audio data generated by the demodulation of the broadcast wave of the DAB broadcasting by the first demodulation unit 302.

[0083] The second receiving unit 304 receives communication data of IP broadcasting. The second demodulation unit 305 demodulates the communication data of the IP broadcasting received by the second receiving unit 304. The IP buffer 306 stores audio data of the IP broadcasting generated by the demodulation of the IP broadcasting communication data by the second receiving unit 304.

[0084] The IP broadcasting received by the second receiving unit 304 has the same contents as the DAB broadcasting received by the first receiving unit 301 (or the FM broadcasting received by third receiving unit 311). Here, the IP broadcasting received by the second receiving unit 304 is received with a delay after the DAB broadcasting received by the first receiving unit 301 (or the FM broadcasting received by the third receiving unit 311). This is because that while the first receiving unit 301 directly receives the broadcast wave of the DAB broadcasting (or the third receiving unit 311 directly receives the broadcast wave of the FM broadcasting), the second receiving unit 304 receives the IP broadcasting communication data transmitted from the broadcast station via a provider and an Internet server.

[0085] The third receiving unit 311 receives broadcast wave of FM broadcasting. The third demodulation unit 312 demodulates the broadcast wave of FM broadcasting received by the third receiving unit 311. The FM buffer 313 stores FM broadcasting audio data generated by the demodulation of the broadcast wave of the FM broadcasting by the third demodulation unit 312.

[0086] In a case that there is a DAB alternate station switchable from a broadcast station of the currently received DAB broadcasting, when the reception level of the currently received DAB broadcasting becomes lower than a predetermined reception level (hereinafter, referred to as a "DAB alternate station switch level"), the first receiving unit 301 switches the broadcast station for receiving the DAB broadcasting to the DAB alternate station switchable from the broadcast station of the currently received DAB broadcasting.

[0087] Further, in a case that there is an FM broadcasting alternate station switchable from the broadcast station of the currently received FM broadcasting, when the reception level of the currently receiving broadcast station becomes lower than a predetermined reception level (hereinafter, referred to as an "FM alternate station switch level"), the third receiving unit 311 switches the broadcast station for receiving the broadcast wave of FM broadcasting to the FM alternate station switchable from the broadcast station of the currently received FM broadcasting.

[0088] Further, in a case that there is an FM alternate station switchable from the broadcast station of the currently received DAB broadcasting, when the reception level of the currently received DAB broadcasting becomes lower than a predetermined reception level (hereinafter, referred to as a "DAB-FM alternate station switch level"), the broadcast receiver 30 switches from the DAB broadcasting reception by the first receiving unit 301 to the FM broadcasting reception by the third receiving unit 311.

[0089] In a case that the first receiving unit 301 is receiving the DAB broadcasting, the output control unit 309 outputs DAB broadcasting audio data when the reception level of DAB broadcasting is equal to or greater than a predetermined threshold value (any one of the first threshold value th1, second threshold value th2, and third threshold value th3). On the other hand, when the reception level of the DAB broadcasting becomes lower than the predetermined threshold value, the output control unit 309 outputs IP broadcasting audio data after the delay processing unit 308 executes the delay processing on the DAB broadcasting.

[0090] Further, in a case that the third receiving unit 311 is receiving the FM broadcasting, the output control unit 309 outputs FM broadcasting audio data when the reception level of FM broadcasting is equal to or greater than a predetermined threshold value (the fourth threshold value th4 or fifth threshold value th5). On the other hand, when the reception level of the FM broadcasting becomes lower than the predetermined threshold value, the output control unit 309 outputs IP broadcasting audio data after the delay processing unit 308 executes the delay processing on FM broadcasting.

[0091] Further, when the DAB broadcasting reception by the first receiving unit 301 is switched to the FM broadcasting reception by the third receiving unit 311 in response to that the reception level of the currently received DAB broadcasting becomes lower than the DAB-FM alternate station switch level, the output control unit 309 switches from output of the DAB broadcasting audio data to output of the FM broadcasting audio data.

[0092] Here, the audio data output from the output control unit 309 is amplified by the amplifier 11 and output as sound from the speaker 12.

[0093] When switching from the DAB broadcasting to

the IP broadcasting, the delay time calculation unit 307 calculates delay time between the IP broadcasting received by the second receiving unit 304 and the DAB broadcasting received by the first receiving unit 301. For example, the delay time calculation unit 307 compares the DAB broadcasting audio data stored in the DAB buffer 303 and the IP broadcasting audio data stored in the IP buffer 306 and specifies the same data as the IP broadcasting audio data stored in the IP buffer 306 from the DAB broadcasting audio data stored in the DAB buffer 303. Then, the delay time calculation unit 307 calculates delay time between the IP broadcasting and the DAB broadcasting based on the reception timing of the IP broadcasting audio data stored in the IP buffer 306 and the reception timing of the same data specified in the DAB buffer 303.

[0094] On the other hand, when switching from the FM broadcasting to the IP broadcasting, the delay time calculation unit 307 calculates delay time between the IP broadcasting received by the second receiving unit 304 and the FM broadcasting received by the third receiving unit 311. For example, the delay time calculation unit 307 compares the FM broadcasting audio data stored in the FM buffer 313 and the IP broadcasting audio data stored in the IP buffer 306 and specifies the same data as the IP broadcasting audio data stored in the IP buffer 306 from the FM broadcasting audio data stored in the FM buffer 313. Then, the delay time calculation unit 307 calculates delay time between the IP broadcasting and the FM broadcasting based on the reception timing of the IP broadcasting audio data stored in the IP buffer 306 and the reception timing of the same data specified in the FM buffer 313.

[0095] When switching from the DAB broadcasting to the IP broadcasting, the delay processing unit 308 performs delay processing (time stretch) on the DAB broadcasting audio data according to the delay time between the DAB broadcasting and IP broadcasting, which is calculated by the delay time calculation unit 307. With this configuration, the delay processing unit 308 synchronizes the output timing of the DAB broadcasting audio data output by the output control unit 309 with the output timing of the IP broadcasting audio data output by the output control unit 309.

[0096] On the other hand, when switching from the FM broadcasting to the IP broadcasting, the delay processing unit 308 performs delay processing (time stretch) on the FM broadcasting audio data according to delay time between the FM broadcasting and the IP broadcasting, which is calculated by the delay time calculation unit 307. With this configuration, the delay processing unit 308 synchronizes the output timing of the FM broadcasting audio data output by the output control unit 309 with the output timing of the IP broadcasting audio data output by the output control unit 309.

[0097] Here, the start timing of the delay processing by the delay processing unit 308 is determined based on the reception level of the DAB broadcasting or FM broadcasting and the predetermined threshold value used to determine the switching to the IP broadcasting. As the predetermined threshold value, a different threshold value (the first threshold value th1, second threshold value th2, third threshold value th3, fourth threshold value th4, or fifth threshold value th5) is selected by the threshold value selection unit 310 based on the presence or absence of a DAB alternate station or an FM alternate station switchable from the broadcast station of currently received DAB broadcasting or the presence or absence of an FM alternate station switchable from the broadcast station of the currently received FM broadcasting.

[0098] For example, in a case that the first receiving unit 301 is receiving the DAB broadcasting, when there is no DAB alternate station switchable from the broadcast station of the currently received DAB broadcasting and there is an FM alternate station switchable from the broadcast station of the currently received DAB broadcasting, the threshold value selection unit 310 selects the third threshold value th3 as a predetermined threshold value used to determine the switching to the IP broadcasting from the plurality of threshold values stored in the threshold value storage unit 30a.

[0099] Further, in a case that the first receiving unit 301 is receiving the DAB broadcasting, when there is a DAB alternate station switchable from the broadcast station of the currently received DAB broadcasting, the threshold value selection unit 310 selects the second threshold value th2, which is greater than the third threshold value th3, as a predetermined threshold value used to determine the switching to the IP broadcasting from the plurality of threshold values stored in the threshold value storage unit 30a.

[0100] Further, in a case that the first receiving unit 301 is receiving the DAB broadcasting, when there is no DAB alternate station switchable from the broadcast station of the currently received DAB broadcasting and there is no FM alternate station switchable from the broadcast station of currently received DAB broadcasting either, the threshold value selection unit 310 selects the first threshold value th1, which is greater than the second threshold value th2, as a predetermined threshold value used to determine the switching to the IP broadcasting from the plurality of threshold values stored in the threshold value storage unit 30a.

[0101] On the other hand, in a case that the third receiving unit 311 is receiving the FM broadcasting, when there is an FM alternate station switchable from the broadcast station of the currently received FM broadcasting, the threshold value selection unit 310 selects the fifth threshold value th5 as a predetermined threshold value used to determine the switching to the IP broadcasting from the plurality of threshold values stored in the threshold value storage unit 30a.

[0102] Further, in a case that the third receiving unit 311 is receiving the FM broadcasting, when there is no FM alternate station switchable from the broadcast station of the currently received FM broadcasting, the

threshold value selection unit 310 selects the fourth threshold value th4, which is greater than the fifth threshold value th5, as a predetermined threshold value used to determine the switching to the IP broadcasting from the plurality of threshold values stored in the threshold value storage unit 30a.

[0103] The delay processing unit 308 starts the delay time calculation by the delay time calculation unit 307 and the delay processing on audio data of DAB broadcasting or FM broadcasting at the timing when the reception level of the DAB broadcasting or FM broadcasting becomes lower than the predetermined threshold value selected by the threshold value selection unit 310.

[0104] In other words, in a case that the first receiving unit 301 is receiving DAB broadcasting, when there is no DAB alternate station switchable from the broadcast station of the currently received DAB broadcasting and there is an FM alternate station switchable from the broadcast station of the currently received DAB broadcasting, the delay processing unit 308 starts the delay time calculation by the delay time calculation unit 307 and the delay processing on the DAB broadcasting audio data at timing when the DAB broadcasting reception level becomes lower than the third threshold value th3 selected by the threshold value selection unit 310.

[0105] Further, in a case that the first receiving unit 301 is receiving the DAB broadcasting, when there is a DAB alternate station switchable from the broadcast station of the currently received DAB broadcasting, the delay processing unit 308 starts the delay time calculation by the delay time calculation unit 307 and the delay processing on the DAB broadcasting audio data at the timing when the DAB broadcasting reception level becomes lower than the second threshold value th2 selected by the threshold value selection unit 310.

[0106] Further, in a case that the first receiving unit 301 is receiving DAB broadcasting, when there is no DAB alternate station switchable from the broadcast station of the currently received DAB broadcasting and there is no FM alternate station switchable from the broadcast station of the currently received DAB broadcasting either, the delay processing unit 308 starts the delay time calculation by the delay time calculation unit 307 and the delay processing on the DAB broadcasting audio data at the timing when the DAB broadcasting reception level becomes lower than the first threshold value th1 selected by the threshold value selection unit 310.

[0107] On the other hand, in a case that the third receiving unit 311 is receiving the FM broadcasting, when there is an FM alternate station switchable from the broadcast station of the currently received FM broadcasting, the delay processing unit 308 starts the delay time calculation by the delay time calculation unit 307 and the delay processing on the FM broadcasting audio data at the timing when the FM broadcasting reception level becomes lower than the fifth threshold value th5 selected by the threshold value selection unit 310.

[0108] Further, in a case that the third receiving unit 311 is receiving the FM broadcasting, when there is no FM alternate station switchable from the broadcast station of the currently received FM broadcasting, the delay processing unit 308 starts the delay time calculation by the delay time calculation unit 307 and the delay processing on the FM broadcasting audio data at the timing when the FM broadcasting reception level becomes lower than the fourth threshold value th4 selected by the threshold value selection unit 310.

[0109] Here, the second threshold value th2 is smaller than the DAB alternate station switch level used to switch the current reception of DAB broadcasting to the DAB alternate station. This prevents a case that the switching to the IP broadcasting is performed when the DAB broadcasting reception condition by the first receiving unit 301 becomes poor, even if there is a DAB alternate station.

[0110] Further, the third threshold value th3 is smaller than the DAB-FM alternate station switch level used to switch the current reception of the DAB broadcasting to the FM alternate station. This prevents a case that the switching to the IP broadcasting is performed when the reception condition of the DAB broadcasting by the first receiving unit 301 becomes poor, even if there is an FM alternate station.

[0111] Further, the fifth threshold value th5 is smaller than the FM alternate station switch level used to switch the current reception of the FM broadcasting to the FM alternate station. This prevents a case that the switching to the IP broadcasting is performed when the reception condition of the FM broadcasting by the third receiving unit 311 becomes poor, even if there is an FM alternate station.

Example of Process by Broadcast receiver 30

[0112] Fig. 8 is a flowchart illustrating an example of a process by the broadcast receiver 30 according to the third embodiment of the present invention. The process illustrated in Fig. 8 is, for example, executed when the power of the broadcast receiver 30 is turned on.

[0113] Here, although it is not illustrated in Fig. 8, when the power of the broadcast receiver 30 is turned on, the first receiving unit 301 starts to receive a broadcast wave of the DAB broadcasting and, in response to this, the first demodulation unit 302 demodulates the broadcast wave of the DAB broadcasting and the DAB buffer 303 stores DAB broadcasting audio data. Further, the second receiving unit 304 starts to receive a broadcast wave of the IP broadcasting, and in response to this, the second demodulation unit 305 demodulates the broadcast wave of the IP broadcasting and the IP buffer 306 stores IP broadcasting audio data.

[0114] Further, the third receiving unit 311 starts to receive a broadcast wave of the FM broadcasting, and in response to this, the third demodulation unit 312 demodulates the broadcast wave of the FM broadcasting and the FM buffer 313 stores FM broadcasting audio data.

[0115] Firstly, the broadcast receiver 30 determines

whether or not the DAB broadcasting is being received (step S801). Here, when the broadcast receiver 30 determines that the DAB broadcasting is being received (step S801: Yes), the broadcast receiver 30 proceeds the process to step S802. On the other hand, when the broadcast receiver 30 determines that the DAB broadcasting is not being received (in other words, the FM broadcasting is being received) (step S801: No), the broadcast receiver 30 ends the series of processes illustrated in Fig. 8 and executes the process during the reception of the FM broadcasting by the third receiving unit 311 (the explanation is omitted since the process is same as that in Fig. 5) (step S818).

[0116] In step S802, the threshold value selection unit 310 determines whether or not there is a DAB alternate station. Here, when the threshold value selection unit 310 determines that there is a DAB alternate station (step S802: Yes), the threshold value selection unit 310 selects the second threshold value th2 from the threshold value storage unit 30a (step S804). After that, the first receiving unit 301 determines whether or not the reception level of the currently received DAB broadcasting becomes lower than the DAB alternate station switch level (step S806).

[0117] Here, when the first receiving unit 301 determines that the reception level of the currently received DAB broadcasting is lower than the DAB alternate station switch level (step S806: Yes), the first receiving unit 301 switches the broadcast station for receiving the DAB broadcasting to the DAB alternate station (step S808). Then, the broadcast receiver 30 re-executes step S802 and subsequent processes. On the other hand, when the first receiving unit 301 determines that the reception level or the currently received DAB broadcasting is not lower than the DAB alternate station switch level (step S806: No), the broadcast receiver 30 re-executes step S802 and subsequent processes.

[0118] On the other hand, when the threshold value selection unit 310 determines that there is no DAB alternate station (step S802: No), the threshold value selection unit 310 determines whether or not there is an FM alternate station (step S810).

[0119] In step S810, when the threshold value selection unit 310 determines that there is an FM alternate station (step S810: Yes), the threshold value selection unit 310 selects the third threshold value th3 from the threshold value storage unit 30a (step S812). After that, the first receiving unit 301 determines whether or not the reception level of the currently received DAB broadcasting becomes lower than the DAB-FM alternate station switch level (step S814).

[0120] In step S814, when the first receiving unit 301 determines that the reception level of the currently received DAB broadcasting is lower than the DAB-FM alternate station switch level (step S814: Yes), the broadcast receiver 30 switches from the reception of DAB broadcasting by the first receiving unit 301 to reception of FM broadcasting by the third receiving unit 311 (step S816). After that, the broadcast receiver 30 ends the series of the processes illustrated in Fig. 8 and executes the process during the process during the reception of the FM broadcasting by the third receiving unit 311 (the explanation is omitted since the process is same as that in Fig. 5) (step S818).

[0121] On the other hand, in step S814, when the first receiving unit 301 determines that the reception level of the currently received DAB broadcasting is not lower than the DAB-FM alternate station switch level (step S814: No), the broadcast receiver 30 re-executes step S802 and subsequent processes.

[0122] In step S810, when the threshold value selection unit 310 determines that there is no FM alternate station (step S810: No), the threshold value selection unit 310 selects the first threshold value th1 from the threshold value storage unit 30a (step S820). After that, the first receiving unit 301 determines whether or not the reception level of the currently received DAB broadcasting becomes lower than the first threshold value th1 selected in step S820 (step S822).

[0123] Here, when the first receiving unit 301 determines that the reception level of the currently received DAB broadcasting is not lower than the first threshold value th1 (step S822: No), the broadcast receiver 30 re-executes step S802 and subsequent processes. On the other hand, when the first receiving unit 301 determines that the reception level of the currently received DAB broadcasting is lower than the first threshold value th1 (step S822: Yes), the delay time calculation unit 307 calculates delay time between the IP broadcasting and the DAB broadcasting (step S824). Then, the delay processing unit 308 starts the delay processing on the DAB broadcasting audio data according to the delay time calculated in step S824 (step S826).

[0124] Then, the delay processing unit 308 determines whether or not the delay time calculated in step S824 by the delay processing on the DAB broadcasting audio data, which is started in step S826, has been canceled (step S828). Here, when the delay processing unit 308 determines that the delay time has not been canceled (step S828: No), the delay processing unit 308 re-executes the determination process in step S828.

[0125] On the other hand, when the delay processing unit 308 determines that the delay time has been canceled (step S828: Yes), the delay processing unit 308 ends the delay processing on the DAB broadcasting audio data (step S830). Then, the output control unit 309 switches from output of DAB broadcasting audio data to output of IP broadcasting audio data (step S832). Then, the broadcast receiver 30 ends the series of the processes in Fig. 8.

Operation Example

[0126] Figs. 9A, 9B, 10A, and 10B are diagrams illustrating examples of operation by the broadcast receiver 30 according to the third embodiment of the present invention.

[0127] Fig. 9A illustrates an example of the operation by the broadcast receiver 30 in a case that there is no DAB alternate station or FM alternate station while receiving DAB broadcasting. Further, Fig. 9B illustrates an example of the operation by the broadcast receiver 30 in a case that there is a DAB alternate station while receiving the DAB broadcasting. Further, Figs. 10A and 10B illustrate examples of the operation by the broadcast receiver 30 in a case that there is no DAB alternate station and there is an FM alternate station while receiving the DAB broadcasting.

[0128] As illustrated in Fig. 9A, in a case that there is no DAB alternate station or FM alternate station while receiving the DAB broadcasting, the first threshold value th1 is selected by the threshold value selection unit 310 and, when the reception level of DAB broadcasting becomes lower than the first threshold value th1, the delay processing unit 308 starts the delay processing on DAB broadcasting. As illustrated in Fig. 9A, the first threshold value th1 is a value greater than the second threshold value th2, which is applied when there is a DAB alternate station. With this, the delay processing on the DAB broadcasting by the delay processing unit 308 is started at earlier timing compared to the case that there is a DAB alternate station. As a result, the switching to the IP broadcasting can be performed seamlessly since the delay processing on the DAB broadcasting can be ended before it fails to receive the DAB broadcasting.

[0129] Further, as illustrated in Fig. 9B, in a case that there is a DAB alternate station (DAB-2) while receiving the DAB broadcasting (DAB-1), the second threshold value th2 is selected by the threshold value selection unit 310 and, when the reception level of the DAB broadcasting (DAB-1) becomes lower than the second threshold value th2, the delay processing unit 308 starts the delay processing on the DAB broadcasting (DAB-1). Here, as illustrated in Fig. 9B, the second threshold value th2 is a value smaller than the DAB alternate station switch level. Thus, in a case that there is a DAB alternate station, the switching to the DAB alternate station (DAB-2) is performed at timing when the reception level of the DAB broadcasting (DAB-1) becomes lower than the DAB alternate station switch level before the timing that the reception level of the DAB broadcasting (DAB-1) becomes lower than the second threshold value th2.

[0130] Here, in the example illustrated in Fig. 9B, there is no switchable DAB alternate station or FM alternate station at the timing when the switching to the DAB alternate station (DAB-2) is performed. Thus, at the timing when the switching to the DAB alternate station (DAB-2) is performed, the first threshold value th1 is selected by the threshold value selection unit 310. In response to this, when the reception level of the DAB broadcasting (DAB-2) becomes lower than the first threshold value th1, the delay processing unit 308 starts the delay processing on the DAB broadcasting (DAB-2). In other words, after the switching to the DAB alternate station (DAB-2) is performed, similarly to the example of Fig. 9A, the switching to the IP broadcasting can be performed seamlessly since the delay processing on the DAB broadcasting (DAB-2) is started and ended before it fails to receive the DAB broadcasting (DAB-2).

[0131] Further, as illustrated in Fig. 10A, in a case that there is no DAB alternate station and there is an FM alternate station while receiving the DAB broadcasting, the third threshold value th3 is selected by the threshold value selection unit 310 and, when the reception level of the DAB broadcasting becomes lower than the third threshold value th3 and the delay processing unit 308 starts the delay processing on the DAB broadcasting. Here, as illustrated in Fig. 10A, the third threshold value th3 is set as a value smaller than the DAB-FM alternate station switch level. Thus, in a case that there is an FM alternate station, the switching from output of DAB broadcasting audio data to output of FM broadcasting audio data from the FM alternate station is performed at the timing when the reception level of the DAB broadcasting becomes lower than the DAB-FM alternate station switch level before the reception level of the DAB broadcasting becomes lower than the third threshold value th3. In this manner, when the switching to the output of the FM broadcasting audio data is performed, the broadcast receiver 30 performs the process during the output of the FM broadcasting as illustrated in Fig. 10B (see the process flow in Fig. 5).

[0132] Fig. 10B illustrates an example of the operation by the broadcast receiver 30 after the switching to reception of the FM broadcasting is performed. In the example illustrated in Fig. 10B, at the timing when the switching to the reception of the FM broadcasting is performed, there is no further switchable FM alternate station. Thus, at the timing when the switching to the reception of the FM broadcasting is performed, the fourth threshold value th4 is selected by the threshold value selection unit 310. With this configuration, when the reception level of the FM broadcasting becomes lower than the fourth threshold value th4, the delay processing unit 308 starts delay processing on the FM broadcasting. In other words, the switching to the IP broadcasting can be performed seamlessly since the delay processing on the FM broadcasting can be started and ended before it fails to receive the FM broadcasting after switching to the reception of the FM broadcasting is performed.

[0133] As described above, according to the third embodiment of the present invention, in a case that the switching to the DAB alternate station and FM alternate station cannot be performed while receiving the DAB broadcasting, the delay processing on the DAB broadcasting is started at earlier timing compared to the case that the switching can be performed. Thus, the period of time that the delay processing on the DAB broadcasting can be performed before it fails to receive the DAB broadcasting is practically extended. Thus, this can reduce the possibility that the delay processing on the DAB broadcasting is interrupted.

[0134] Further, according to the third embodiment of

the present invention, in a case that the switching to the DAB alternate station or FM alternate station can be performed while receiving the DAB broadcasting, the delay processing on the DAB broadcasting is started at later timing compared to the case that the switching cannot be performed. This prevents a case that the switching to the IP broadcasting is performed even when the reception of the DAB alternate station or FM alternate station is continuously available.

[0135] Further, according to the third embodiment of the present invention, in a case that switching to the FM alternate station cannot be performed while receiving the FM broadcasting, the delay processing on the FM broadcasting is started at earlier timing compared to the case that the switching is available. Thus, the period of time that the delay processing on the FM broadcasting can be performed before it fails to receive the FM broadcasting is practically extended. This can reduce the possibility that the delay processing of the FM broadcasting is interrupted.

[0136] Further, according to the third embodiment of the present invention, in a case that the switching to the FM alternate station can be performed while receiving the FM broadcasting, the delay processing on the FM broadcasting is started at later timing compared to the case that the switching is not available. This prevents a case that the switching to the IP broadcasting is performed even when the reception from the FM alternate station is continuously available.

[0137] Thus, according to the third embodiment of the present invention, the switching to the IP broadcasting can be performed seamlessly while preventing the switching to the IP broadcasting as possible.

[0138] In addition, the above described embodiments are respectively made only to describe specified examples to realize the present invention and the technical scope of the present invention should not be limited. In other words, the present invention can be implemented in various ways within the scope of the claims.

Reference Signs List

[0139]

10, 20, 30	broadcast receiver
10a, 20a, 30a	threshold value storage unit
11	amplifier
12	speaker
101, 201, 301	first receiving unit
102, 202, 302	first demodulation unit
103, 303	DAB buffer
203, 313	FM buffer
104, 204, 304	second receiving unit
105, 205, 305	second demodulation unit
106, 206, 306	IP buffer
107, 207, 307	delay time calculation unit
108, 208, 308	delay processing unit
109, 209, 309	output control unit
110, 210, 310	threshold value selection unit
311	third receiving unit
312	third demodulation unit

Claims

1. A broadcast receiver (10, 20, 30) comprising:

a first receiving unit (101, 201, 301) configured to receive first standard broadcasting;
a second receiving unit (104, 204, 304) configured to receive second standard broadcasting with a delay from the first standard broadcasting;
a delay time calculation unit (107, 207, 307) configured to calculate delay time between the first standard broadcasting received by the first receiving unit (101, 201, 301) and the second standard broadcasting received by the second receiving unit (104, 204, 304); and
a delay processing unit (108, 208, 308) configured to synchronize output timing of audio data of the first standard broadcasting with output timing of audio data of the second standard broadcasting by starting the calculation of the delay time by the delay time calculation unit (107, 207, 307) and delay processing on the audio data of the first standard broadcasting when a reception level of the first standard broadcasting becomes lower than a predetermined threshold value, wherein

in a case that there is no alternate station switchable from a broadcast station of the first standard broadcasting, the delay processing unit (108, 208, 308) is configured to determine whether or not the reception level of the first standard broadcasting becomes lower than the predetermined threshold value by using, as the predetermined threshold value, a threshold value which is greater than a threshold value used in a case that there is an alternate station.

2. The broadcast receiver (10, 20, 30) according to claim 1, wherein
in a case that there is no alternate station of the first standard broadcasting switchable from the broadcast station of the first standard broadcasting, the delay processing unit (108, 208, 308) is configured to make the determination based by using, as the predetermined threshold value, a first threshold value greater than a second threshold value used in a case that there is the alternate station.

3. The broadcast receiver (10, 20, 30) according to claim 2, wherein
the second threshold value is smaller than a predetermined reception level for switching from the broadcast station of the first standard broadcasting

to the alternate station of the first standard broadcasting.

4. The broadcast receiver (10, 20, 30) according to one of claims 1 to 3, wherein
the first standard broadcasting is DAB broadcasting and the second standard broadcasting is IP broadcasting.

5. The broadcast receiver (10, 20, 30) according to one of claims 1 to 3, wherein
the first standard broadcasting is FM broadcasting and the second standard broadcasting is IP broadcasting.

6. The broadcast receiver (10, 20, 30) according to one of claims 1 to 5, further comprising
a third receiving unit (311) configured to receive third standard broadcasting, wherein
the delay processing unit (108, 208, 308) is configured to
make the determination by using, as the predetermined threshold value, a first threshold value in a case that there is no alternate station of the first standard broadcasting or alternate station of the third standard broadcasting switchable from the broadcast station of the first standard broadcasting from which the first receiving unit (101, 201, 301) is receiving,
to make the determination by using, as the predetermined threshold value, a second threshold value smaller than the first threshold value in a case that there is an alternate station of the first standard broadcasting switchable from the broadcast station of the first standard broadcasting from which the first receiving unit (101, 201, 301) is receiving, and
to make the determination by using, as the predetermined threshold value, a third threshold value smaller than the second threshold value in a case that there is an alternate station of the third standard broadcasting switchable from the broadcast station of the first standard broadcasting from which the first receiving unit (101, 201, 301) is receiving.

7. The broadcast receiver (10, 20, 30) according to claim 6, wherein
the third threshold value is smaller than a predetermined reception level for switching from the broadcast station of the first standard broadcasting to the alternate station of the third standard broadcasting.

8. The broadcast receiver (10, 20, 30) according to claim 6 or 7, wherein
the first standard broadcasting is DAB broadcasting, the second standard broadcasting is IP broadcasting, and the third standard broadcasting is FM broadcasting.

9. An output control method of a broadcast receiver (10, 20, 30) that includes an output control unit (109, 209, 309) for outputting as selectively switching audio data of first standard broadcasting and audio data of second standard broadcasting which has a delay from the first standard broadcasting, the output control method comprising
a delay processing step that, in a case that a reception level of the first standard broadcasting becomes lower than a predetermined threshold value, a delay processing unit (108, 208, 308) of the broadcast receiver (10, 20, 30) starts calculation, by a delay time calculation unit (107, 207, 307) of the broadcast receiver (10, 20, 30), of delay time between the first standard broadcasting and the second standard broadcasting and delay processing on audio data of the first standard broadcasting, and synchronizes output timing of the first standard broadcasting audio data with output timing of the second standard broadcasting audio data, wherein
in the delay processing, in a case that there is no alternate station switchable from the first standard broadcasting, the delay processing unit (108, 208, 308) determines whether a reception level of the first standard broadcasting becomes lower than the predetermined threshold value by using, as the predetermined threshold value, a threshold value which is greater than a threshold value used in a case that there is the alternate station.

FIG. 1

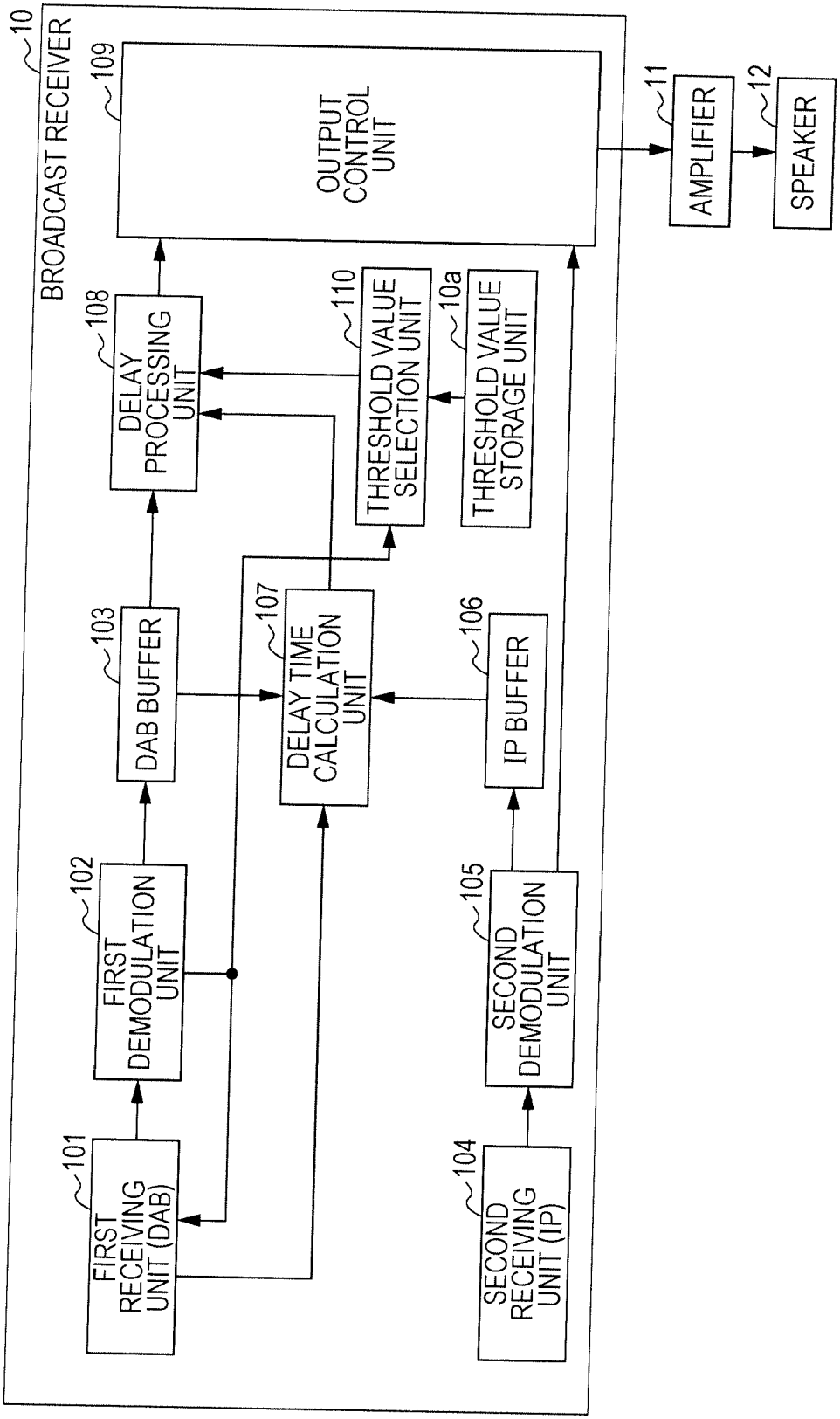

10
BROADCAST RECEIVER
109
OUTPUT CONTROL UNIT
11
AMPLIFIER
12
SPEAKER
108
DELAY PROCESSING UNIT
110
THRESHOLD VALUE SELECTION UNIT
10a
THRESHOLD VALUE STORAGE UNIT
103
DAB BUFFER
107
DELAY TIME CALCULATION UNIT
106
IP BUFFER
102
FIRST DEMODULATION UNIT
105
SECOND DEMODULATION UNIT
101
FIRST RECEIVING UNIT (DAB)
104
SECOND RECEIVING UNIT (IP)

FIG. 2

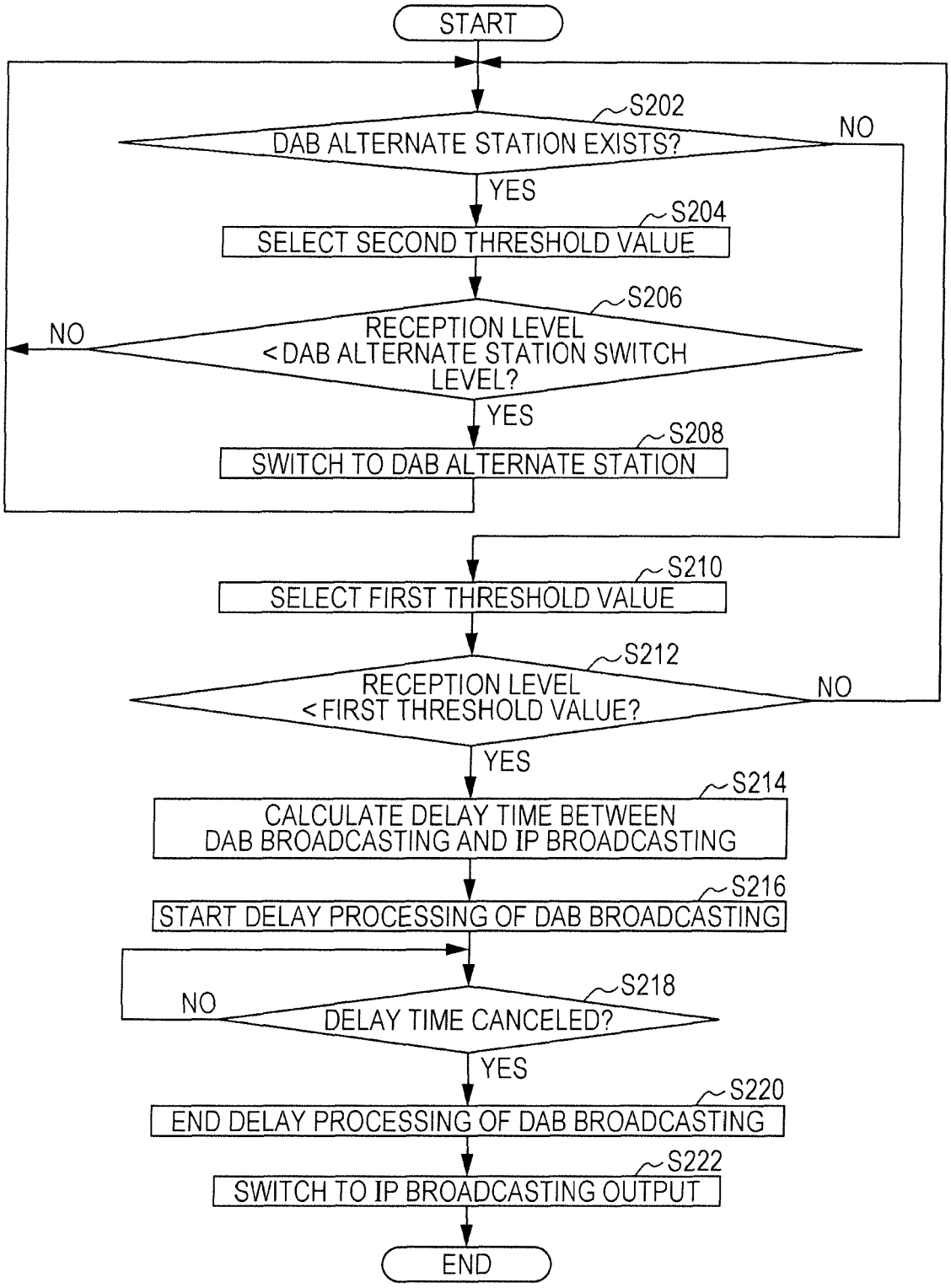

START
S202
DAB ALTERNATE STATION EXISTS?
NO
YES
S204
SELECT SECOND THRESHOLD VALUE
S206
RECEPTION LEVEL < DAB ALTERNATE STATION SWITCH LEVEL?
NO
YES
S208
SWITCH TO DAB ALTERNATE STATION
S210
SELECT FIRST THRESHOLD VALUE
S212
RECEPTION LEVEL < FIRST THRESHOLD VALUE?
NO
YES
S214
CALCULATE DELAY TIME BETWEEN DAB BROADCASTING AND IP BROADCASTING
S216
START DELAY PROCESSING OF DAB BROADCASTING
S218
NO
DELAY TIME CANCELED?
YES
S220
END DELAY PROCESSING OF DAB BROADCASTING
S222
SWITCH TO IP BROADCASTING OUTPUT
END

FIG. 3A

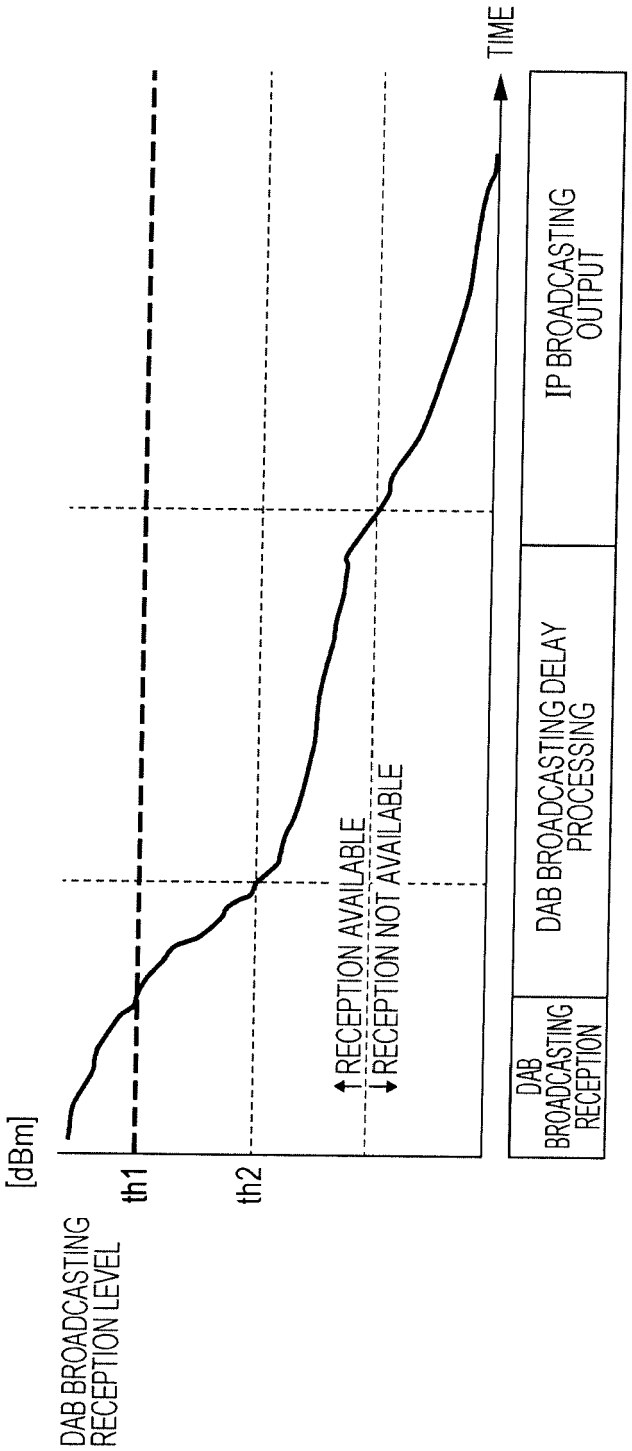

TIME
IP BROADCASTING OUTPUT
DAB BROADCASTING DELAY PROCESSING
DAB BROADCASTING RECEPTION
RECEPTION AVAILABLE
RECEPTION NOT AVAILABLE
th1
th2
[dBm]
DAB BROADCASTING RECEPTION LEVEL

FIG. 3B

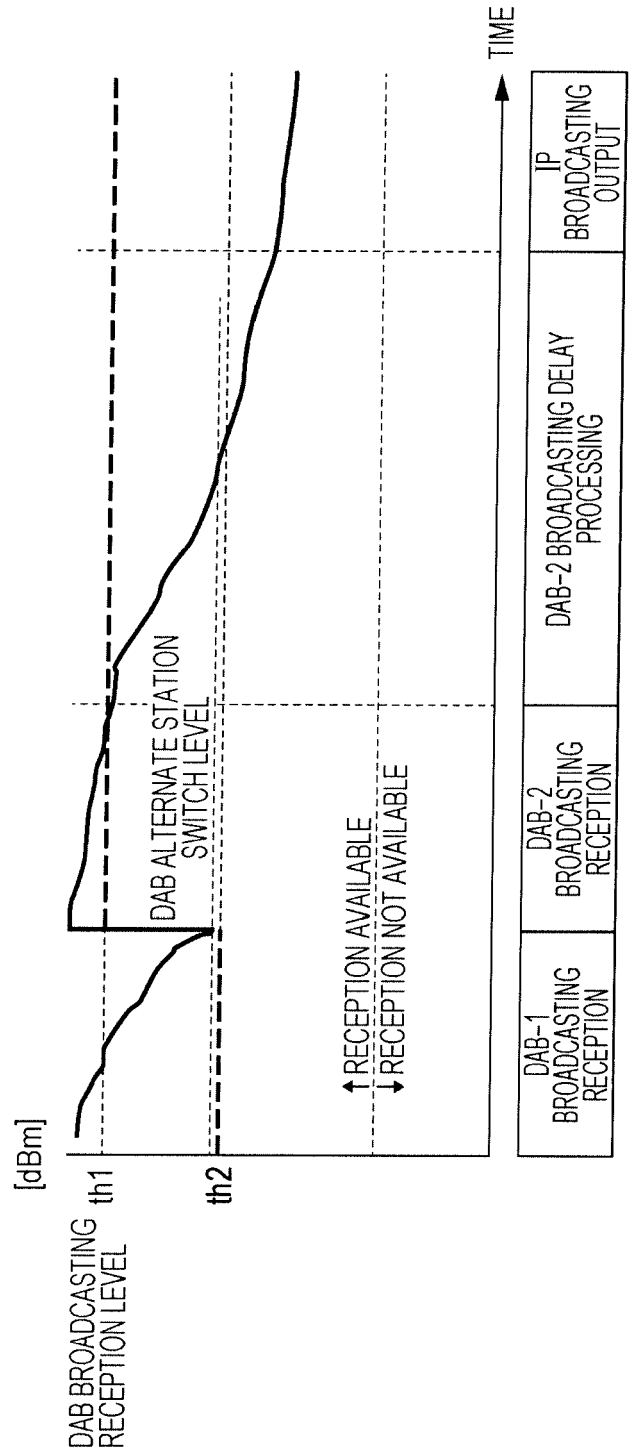

DAB BROADCASTING RECEPTION LEVEL
[dBm]
th1
th2
DAB ALTERNATE STATION SWITCH LEVEL
RECEPTION AVAILABLE
RECEPTION NOT AVAILABLE
TIME
DAB-1 BROADCASTING RECEPTION
DAB-2 BROADCASTING RECEPTION
DAB-2 BROADCASTING DELAY PROCESSING
IP BROADCASTING OUTPUT

FIG. 4

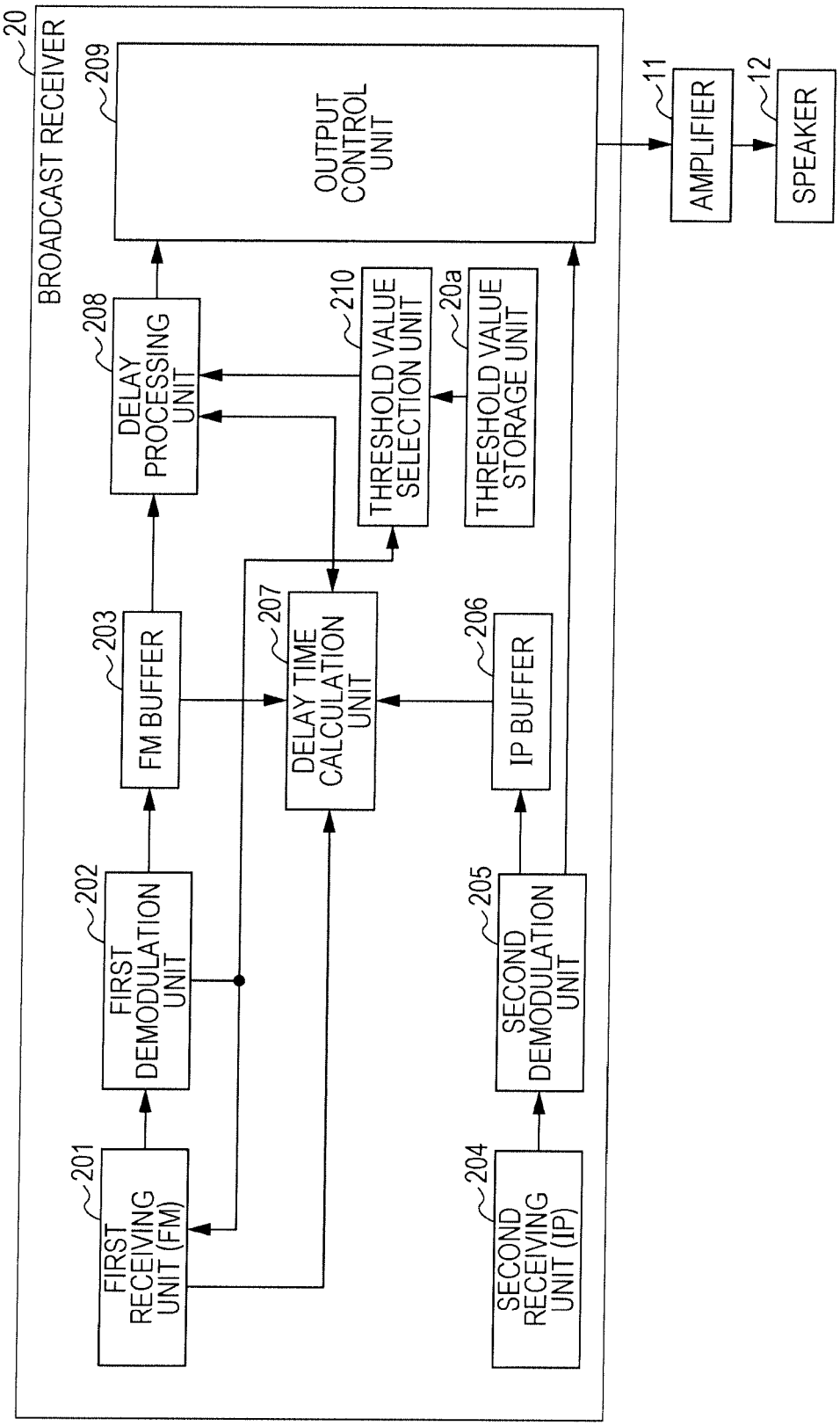

20
BROADCAST RECEIVER
209
OUTPUT CONTROL UNIT
11
AMPLIFIER
12
SPEAKER
208
DELAY PROCESSING UNIT
210
THRESHOLD VALUE SELECTION UNIT
20a
THRESHOLD VALUE STORAGE UNIT
203
FM BUFFER
207
DELAY TIME CALCULATION UNIT
206
IP BUFFER
202
FIRST DEMODULATION UNIT
205
SECOND DEMODULATION UNIT
201
FIRST RECEIVING UNIT (FM)
204
SECOND RECEIVING UNIT (IP)

FIG. 5

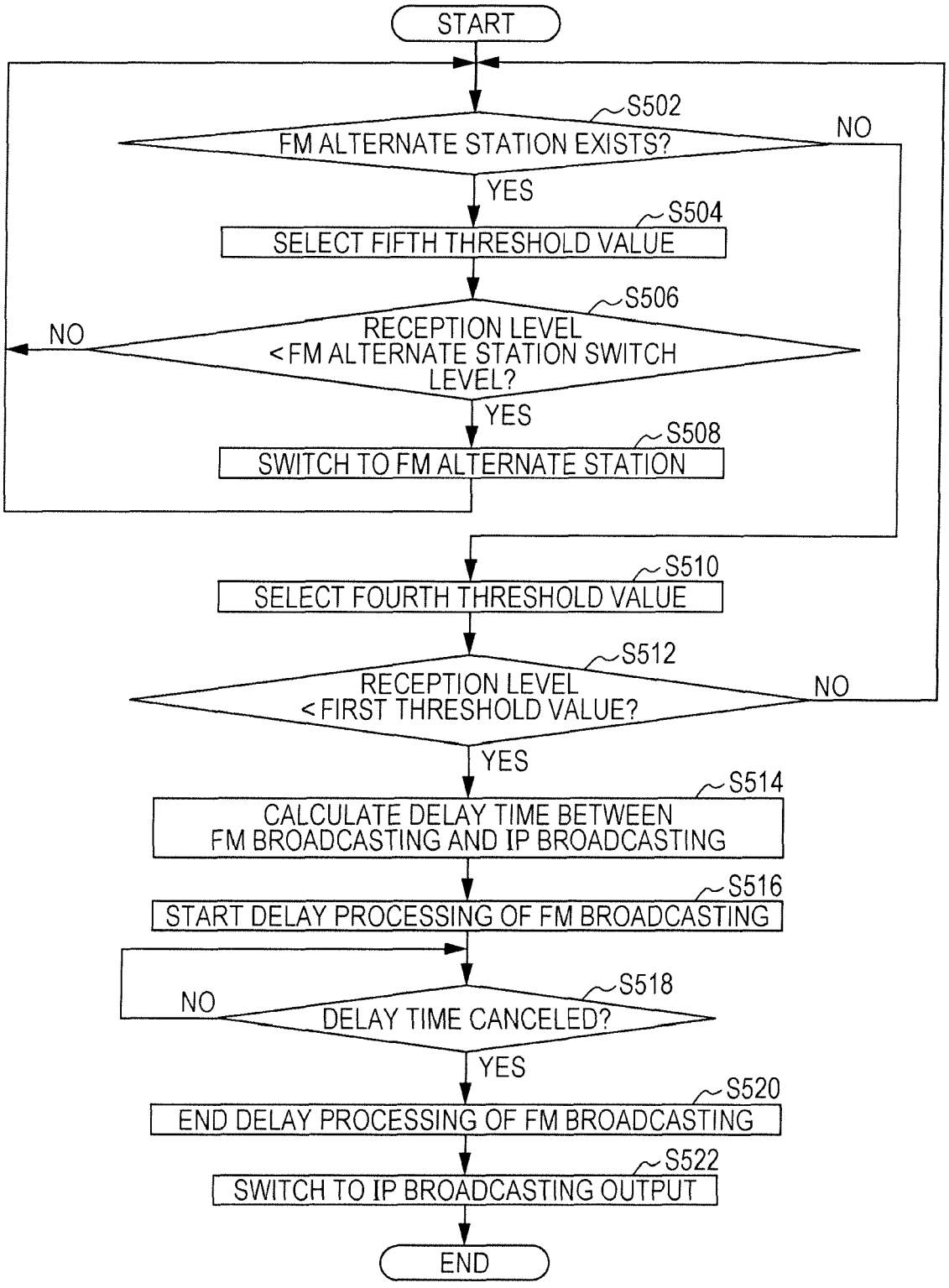

START
S502
FM ALTERNATE STATION EXISTS?
NO
YES
S504
SELECT FIFTH THRESHOLD VALUE
S506
RECEPTION LEVEL < FM ALTERNATE STATION SWITCH LEVEL?
NO
YES
S508
SWITCH TO FM ALTERNATE STATION
S510
SELECT FOURTH THRESHOLD VALUE
S512
RECEPTION LEVEL < FIRST THRESHOLD VALUE?
NO
YES
S514
CALCULATE DELAY TIME BETWEEN FM BROADCASTING AND IP BROADCASTING
S516
START DELAY PROCESSING OF FM BROADCASTING
S518
NO
DELAY TIME CANCELED?
YES
S520
END DELAY PROCESSING OF FM BROADCASTING
S522
SWITCH TO IP BROADCASTING OUTPUT
END

FIG. 6A

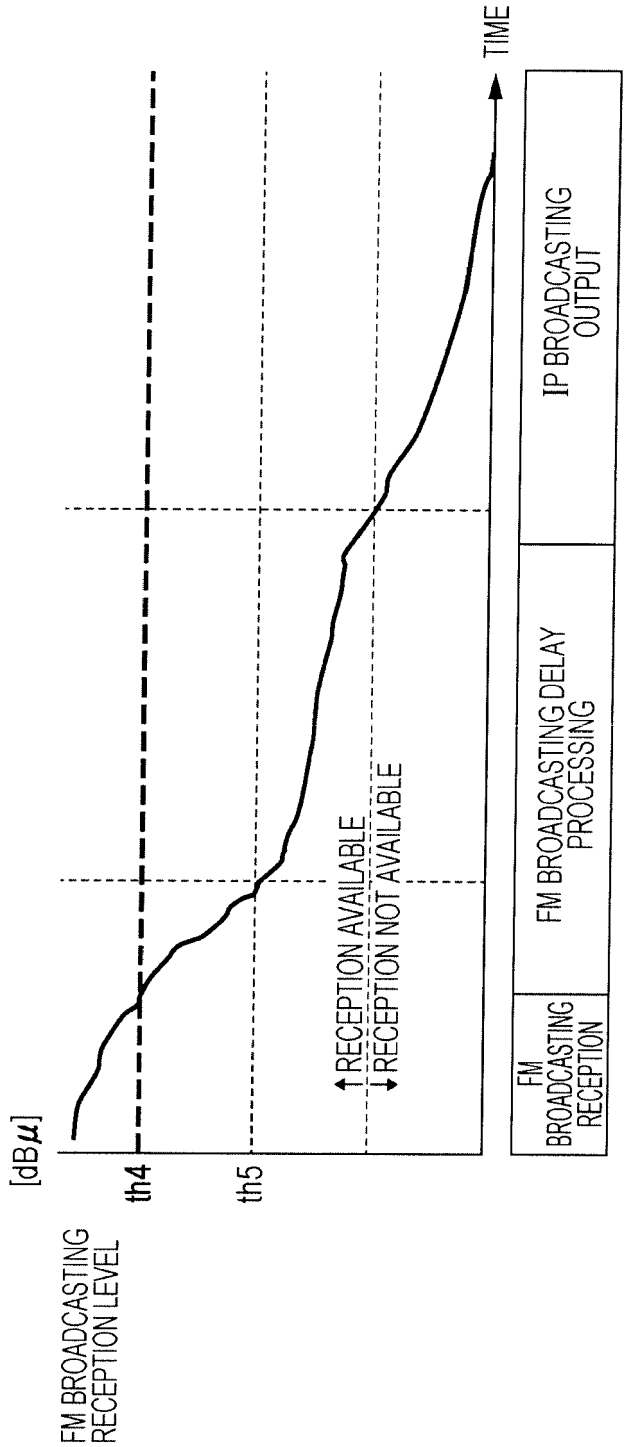

FM BROADCASTING RECEPTION LEVEL
[dBμ]
th4
th5
RECEPTION AVAILABLE
RECEPTION NOT AVAILABLE
TIME
FM BROADCASTING RECEPTION
FM BROADCASTING DELAY PROCESSING
IP BROADCASTING OUTPUT

FIG. 6B

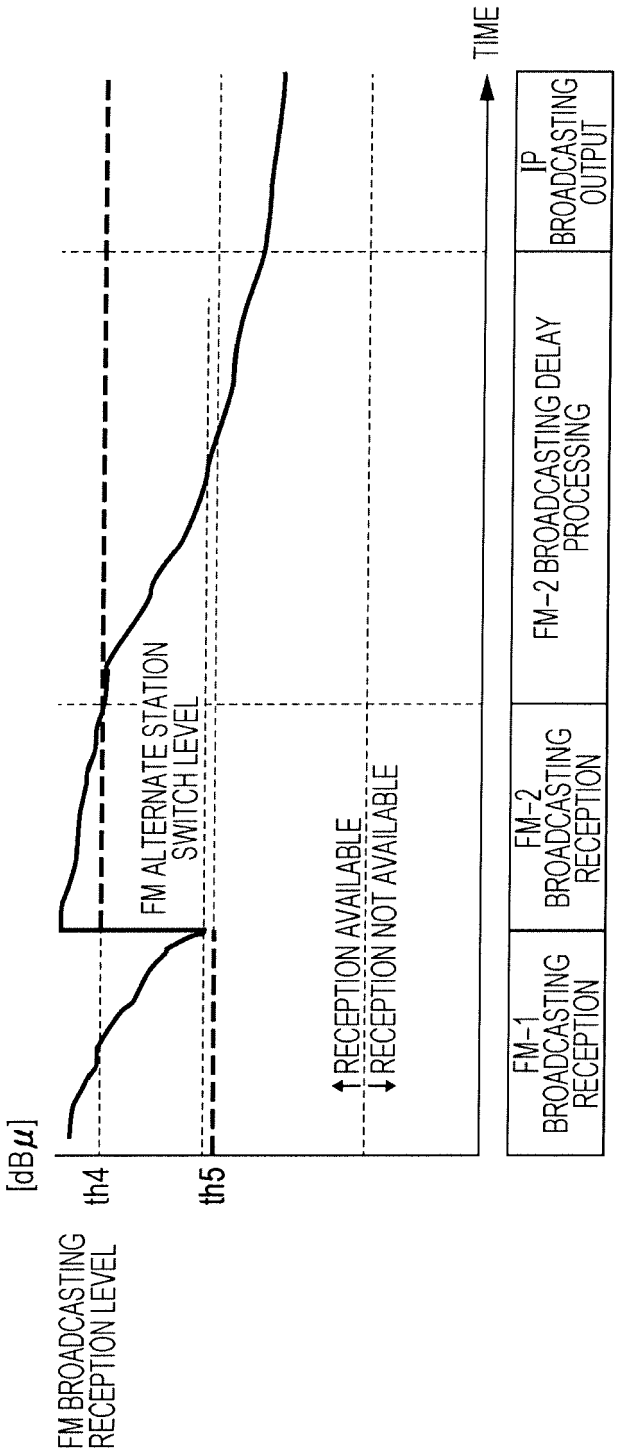

FM BROADCASTING RECEPTION LEVEL
[dBμ]
th4
th5
FM ALTERNATE STATION SWITCH LEVEL
RECEPTION AVAILABLE
RECEPTION NOT AVAILABLE
TIME
FM-1 BROADCASTING RECEPTION
FM-2 BROADCASTING RECEPTION
FM-2 BROADCASTING DELAY PROCESSING
IP BROADCASTING OUTPUT

FIG. 7

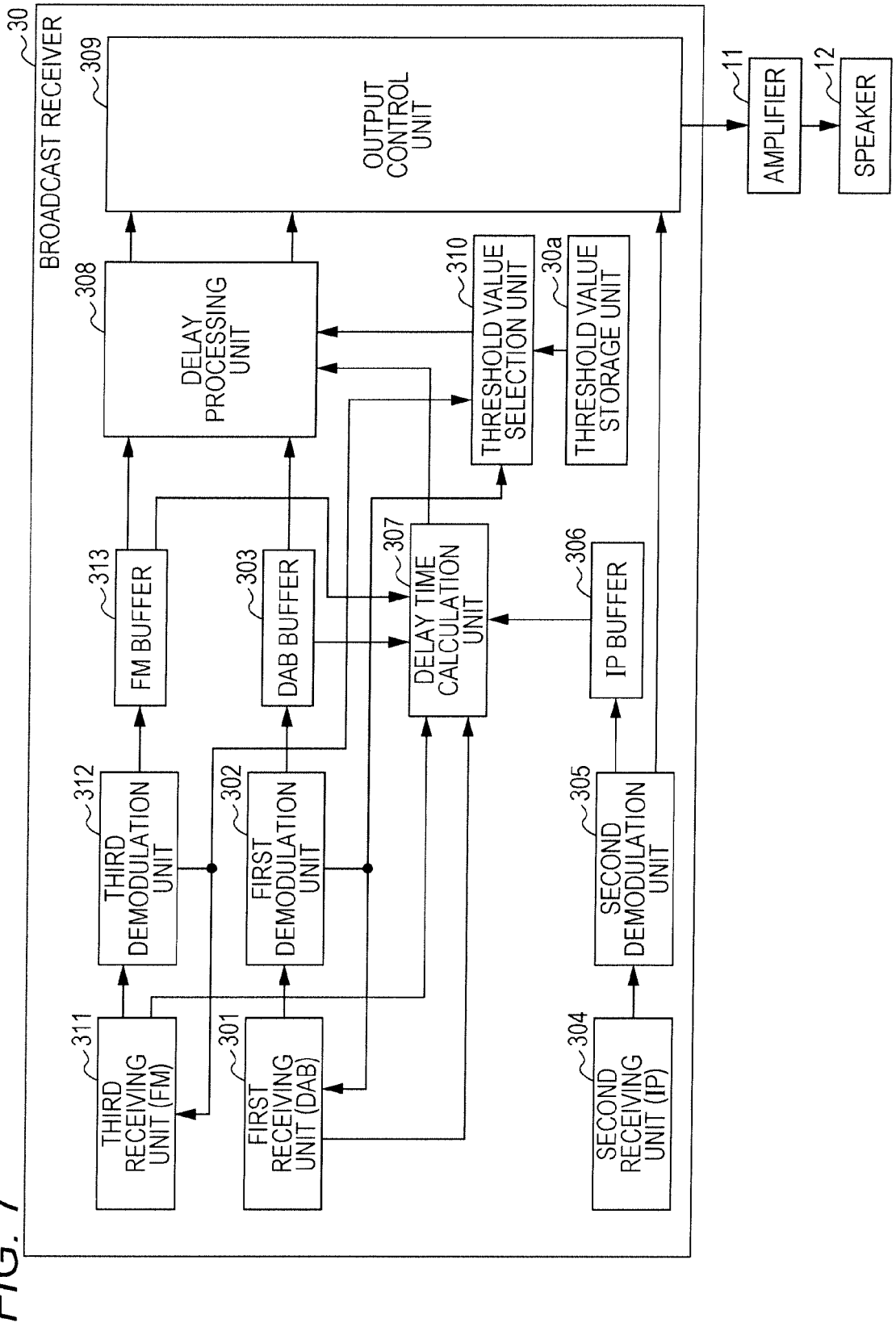

30
BROADCAST RECEIVER
309
OUTPUT CONTROL UNIT
11
AMPLIFIER
12
SPEAKER
308
DELAY PROCESSING UNIT
310
THRESHOLD VALUE SELECTION UNIT
30a
THRESHOLD VALUE STORAGE UNIT
313
FM BUFFER
303
DAB BUFFER
307
DELAY TIME CALCULATION UNIT
306
IP BUFFER
312
THIRD DEMODULATION UNIT
302
FIRST DEMODULATION UNIT
305
SECOND DEMODULATION UNIT
311
THIRD RECEIVING UNIT (FM)
301
FIRST RECEIVING UNIT (DAB)
304
SECOND RECEIVING UNIT (IP)

FIG. 8

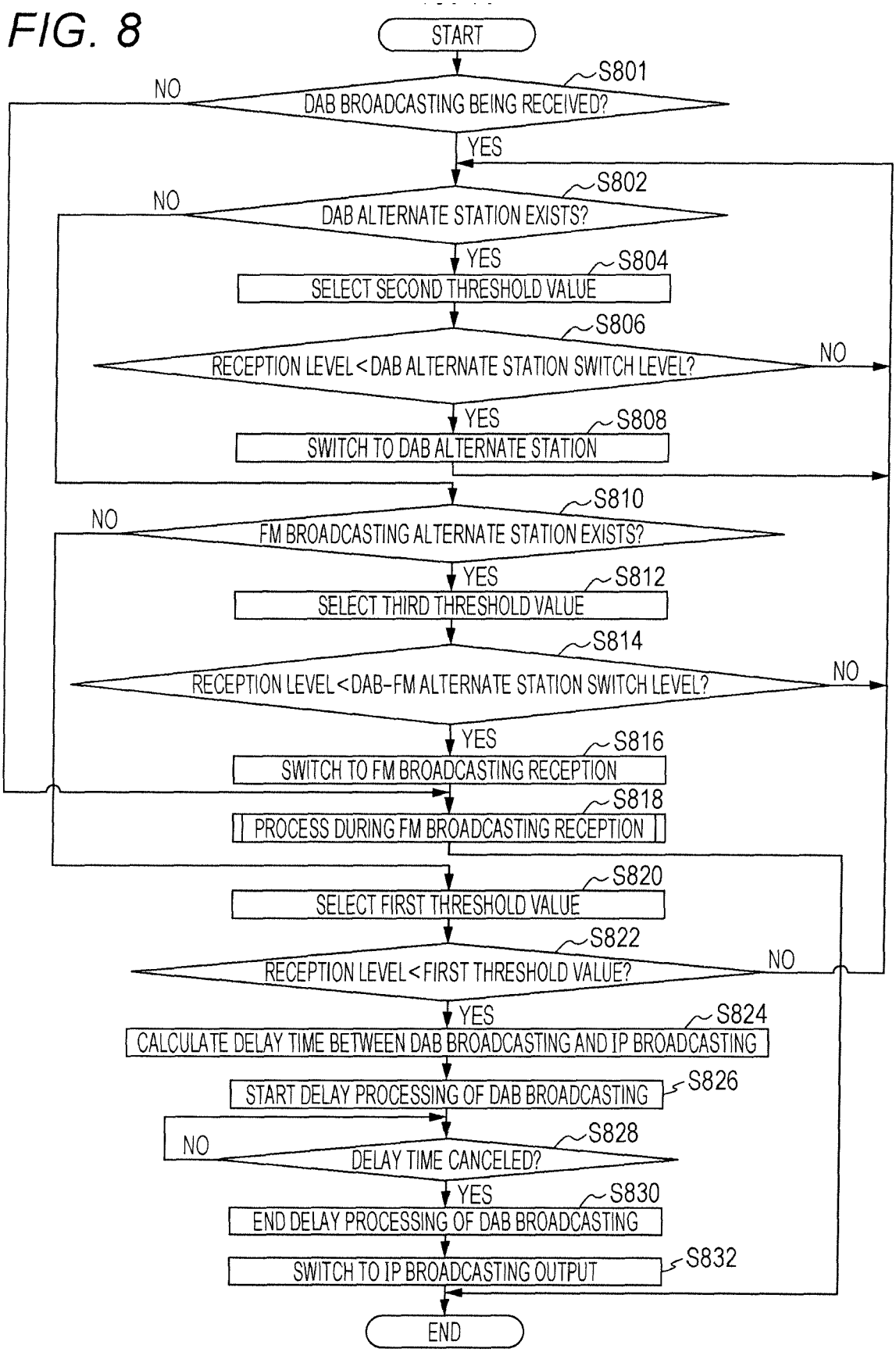

START
S801
DAB BROADCASTING BEING RECEIVED?
NO
YES
S802
DAB ALTERNATE STATION EXISTS?
NO
YES
S804
SELECT SECOND THRESHOLD VALUE
S806
RECEPTION LEVEL < DAB ALTERNATE STATION SWITCH LEVEL?
NO
YES
S808
SWITCH TO DAB ALTERNATE STATION
S810
FM BROADCASTING ALTERNATE STATION EXISTS?
NO
YES
S812
SELECT THIRD THRESHOLD VALUE
S814
RECEPTION LEVEL < DAB-FM ALTERNATE STATION SWITCH LEVEL?
NO
YES
S816
SWITCH TO FM BROADCASTING RECEPTION
S818
PROCESS DURING FM BROADCASTING RECEPTION
S820
SELECT FIRST THRESHOLD VALUE
S822
RECEPTION LEVEL < FIRST THRESHOLD VALUE?
NO
YES
S824
CALCULATE DELAY TIME BETWEEN DAB BROADCASTING AND IP BROADCASTING
S826
START DELAY PROCESSING OF DAB BROADCASTING
S828
NO
DELAY TIME CANCELED?
YES
S830
END DELAY PROCESSING OF DAB BROADCASTING
S832
SWITCH TO IP BROADCASTING OUTPUT
END

FIG. 9A

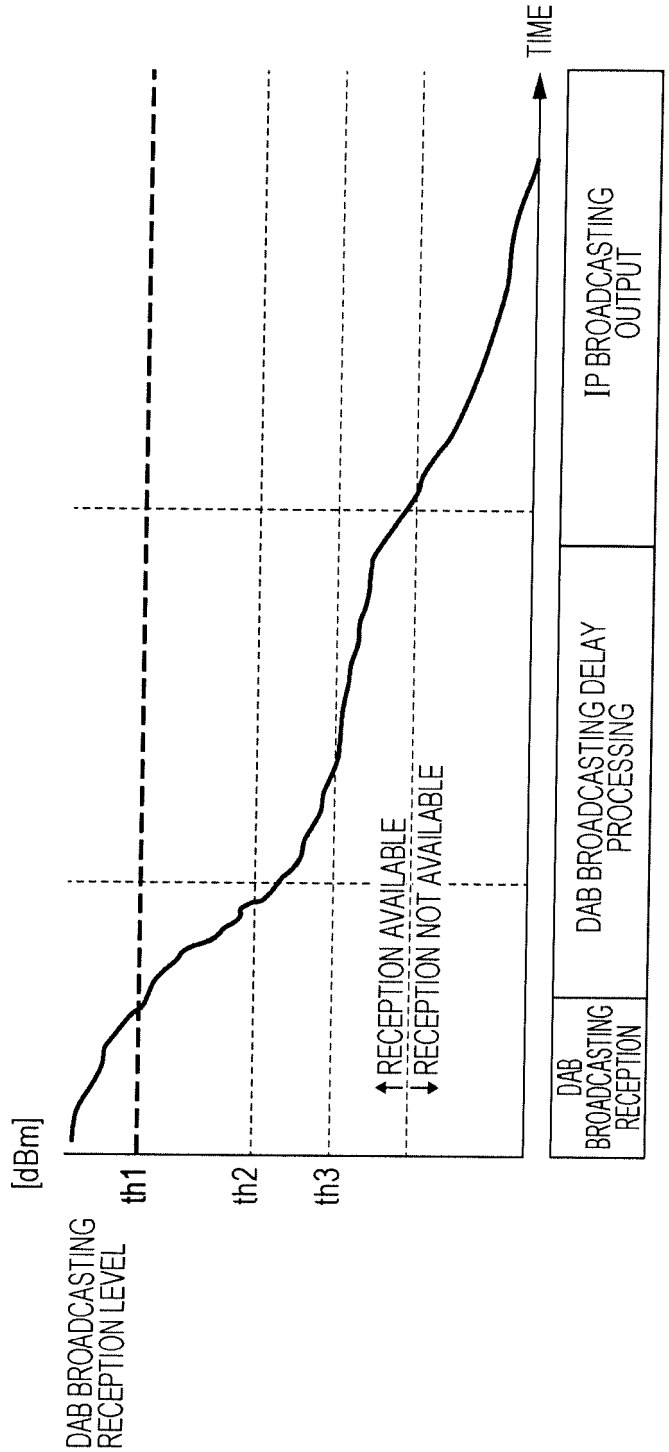

DAB BROADCASTING RECEPTION LEVEL
[dBm]
th1
th2
th3
RECEPTION AVAILABLE
RECEPTION NOT AVAILABLE
TIME
DAB BROADCASTING RECEPTION
DAB BROADCASTING DELAY PROCESSING
IP BROADCASTING OUTPUT

FIG. 9B

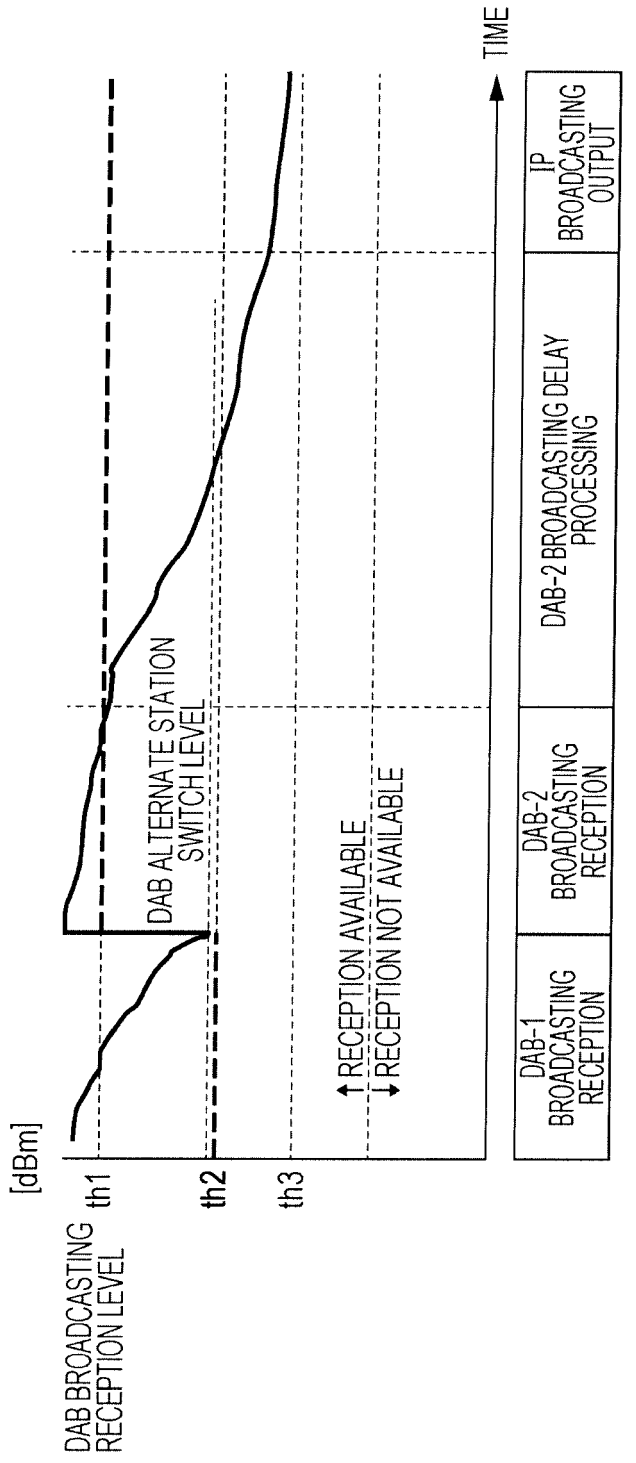

DAB BROADCASTING RECEPTION LEVEL
[dBm]
th1
th2
th3
DAB ALTERNATE STATION SWITCH LEVEL
RECEPTION AVAILABLE
RECEPTION NOT AVAILABLE
TIME
DAB-1 BROADCASTING RECEPTION
DAB-2 BROADCASTING RECEPTION
DAB-2 BROADCASTING DELAY PROCESSING
IP BROADCASTING OUTPUT

FIG. 10A

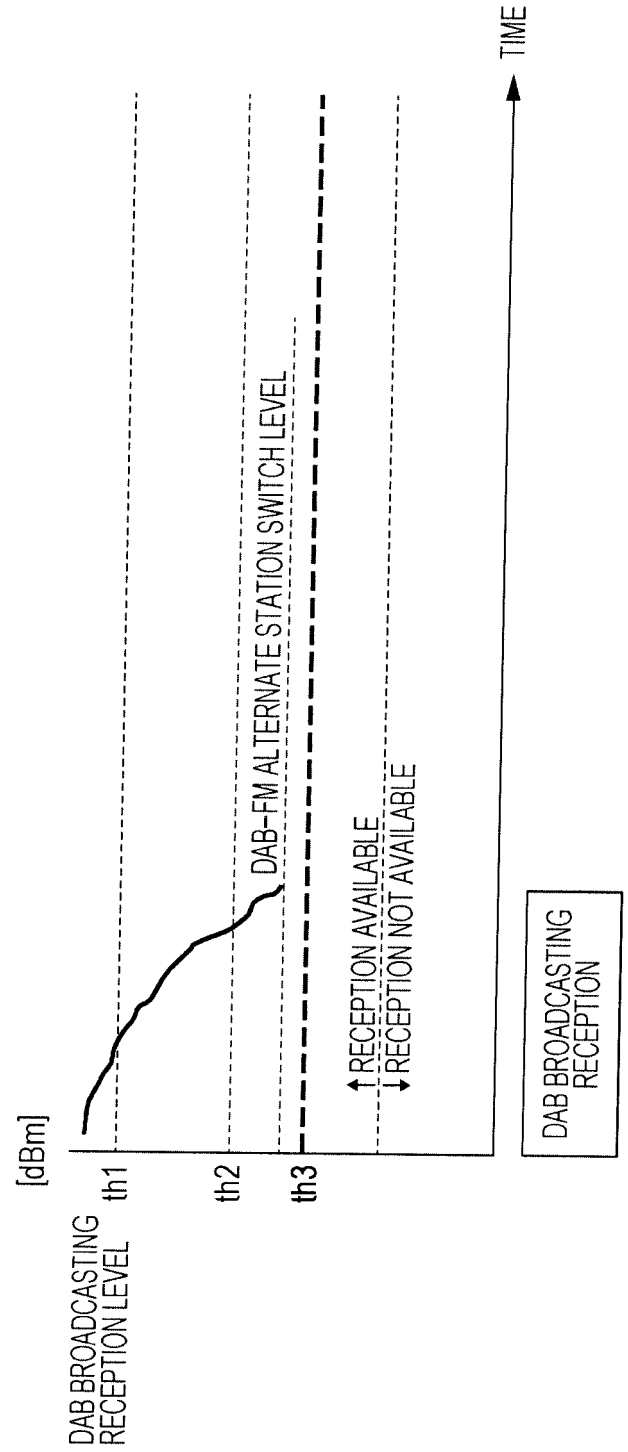

TIME
[dBm]
DAB BROADCASTING RECEPTION LEVEL
th1
th2
th3
DAB-FM ALTERNATE STATION SWITCH LEVEL
RECEPTION AVAILABLE
RECEPTION NOT AVAILABLE
DAB BROADCASTING RECEPTION

FIG. 10B

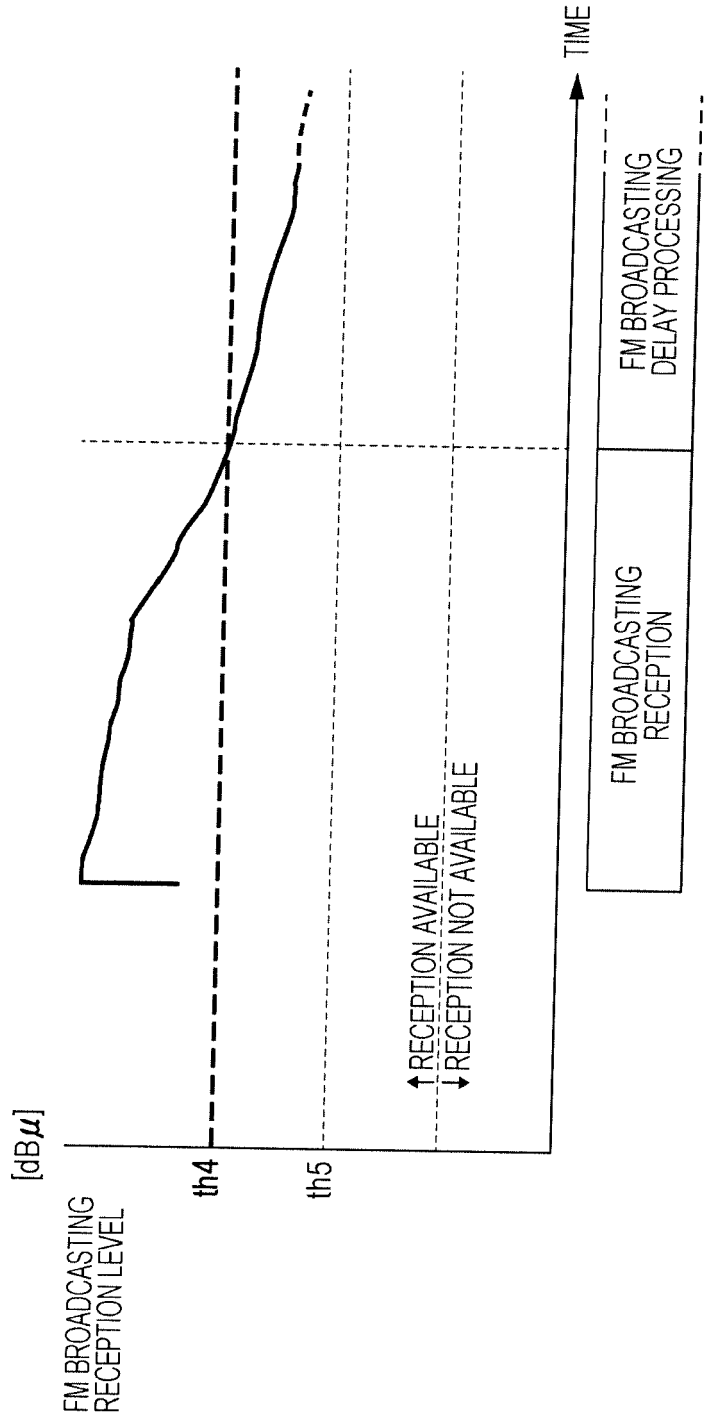

FM BROADCASTING RECEPTION LEVEL
[dBμ]
th4
th5
RECEPTION AVAILABLE
RECEPTION NOT AVAILABLE
TIME
FM BROADCASTING RECEPTION
FM BROADCASTING DELAY PROCESSING

FIG. 11A

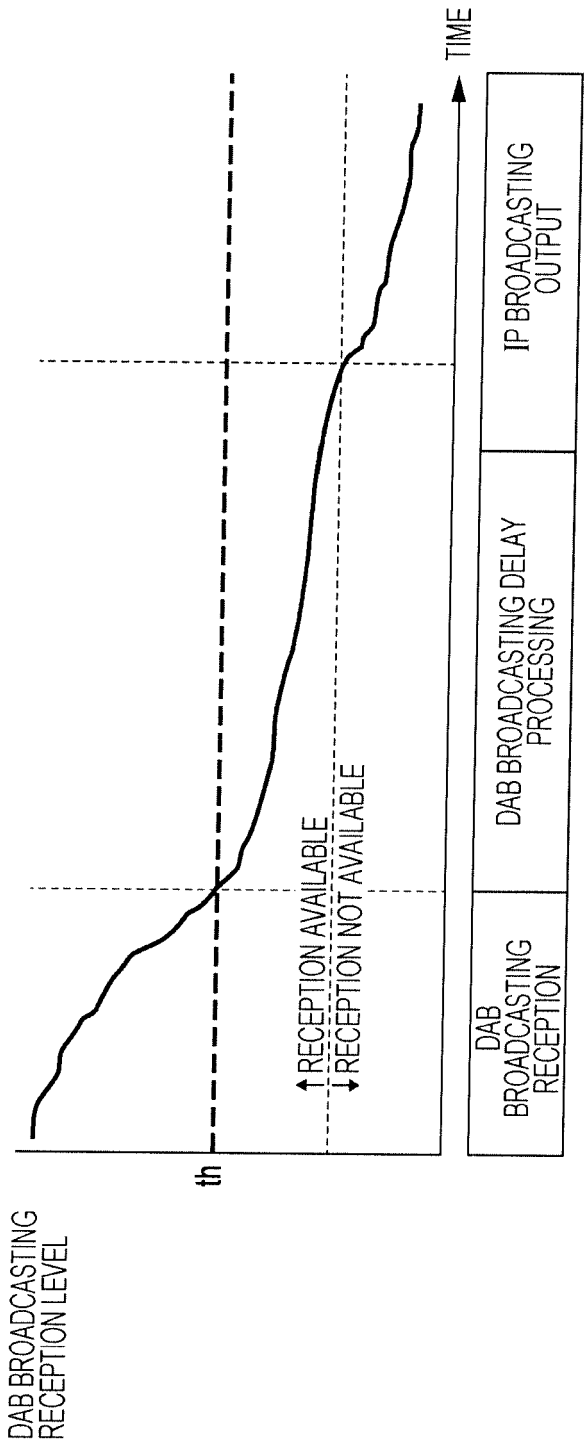
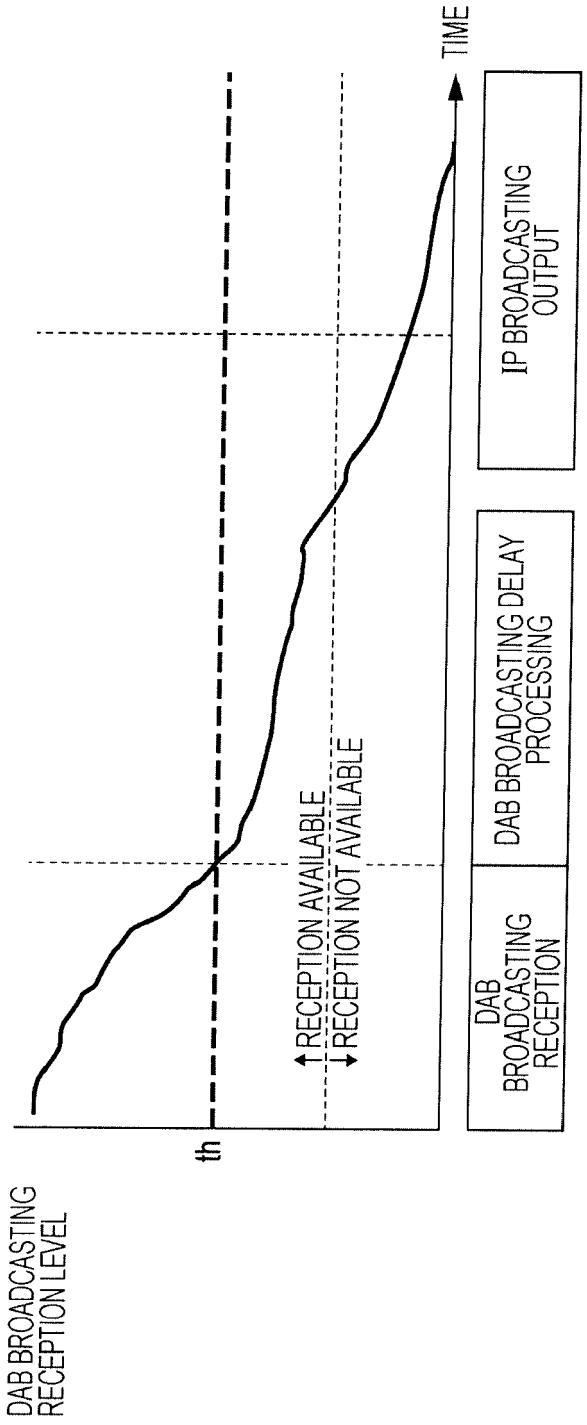

DAB BROADCASTING RECEPTION LEVEL
th
RECEPTION AVAILABLE
RECEPTION NOT AVAILABLE
TIME
DAB BROADCASTING RECEPTION
DAB BROADCASTING DELAY PROCESSING
IP BROADCASTING OUTPUT

FIG. 11B


DAB BROADCASTING RECEPTION LEVEL
th
TIME
RECEPTION AVAILABLE
RECEPTION NOT AVAILABLE
DAB BROADCASTING RECEPTION
DAB BROADCASTING DELAY PROCESSING
IP BROADCASTING OUTPUT

Europäisches Patentamt
European Patent Office
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EUROPEAN SEARCH REPORT

Application Number
EP 16 19 4357

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	US 2013/053058 A1 (LI XINTIAN [US]) 28 February 2013 (2013-02-28) * paragraphs [0019] - [0021] * * paragraph [0027] * * paragraph [0033] * * paragraphs [0037] - [0042] *	1-9	INV. H04H20/24 H04H20/26
Y	US 2008/139109 A1 (EWERTZ CARL CHRISTIAN [SE]) 12 June 2008 (2008-06-12) * paragraphs [0001] - [0003] * * paragraph [0007] * * paragraphs [0010] - [0011] * * figure 2 *	1-9	
A	WO 2014/194970 A1 (AUDI AG [DE]) 11 December 2014 (2014-12-11) * page 12, lines 4-5 * * page 14, line 33 - page 15, line 1 *	4,6-8	

TECHNICAL FIELDS SEARCHED (IPC)
H04H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	17 February 2017	Torcal Serrano, C

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

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17-02-2017

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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US 2008139109 A1	12-06-2008	US 2008139109 A1	12-06-2008
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		DE 102013009670 A1	11-12-2014
		EP 3005591 A1	13-04-2016
		US 2016119066 A1	28-04-2016
		WO 2014194970 A1	11-12-2014

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2011014994 A **[0006]**