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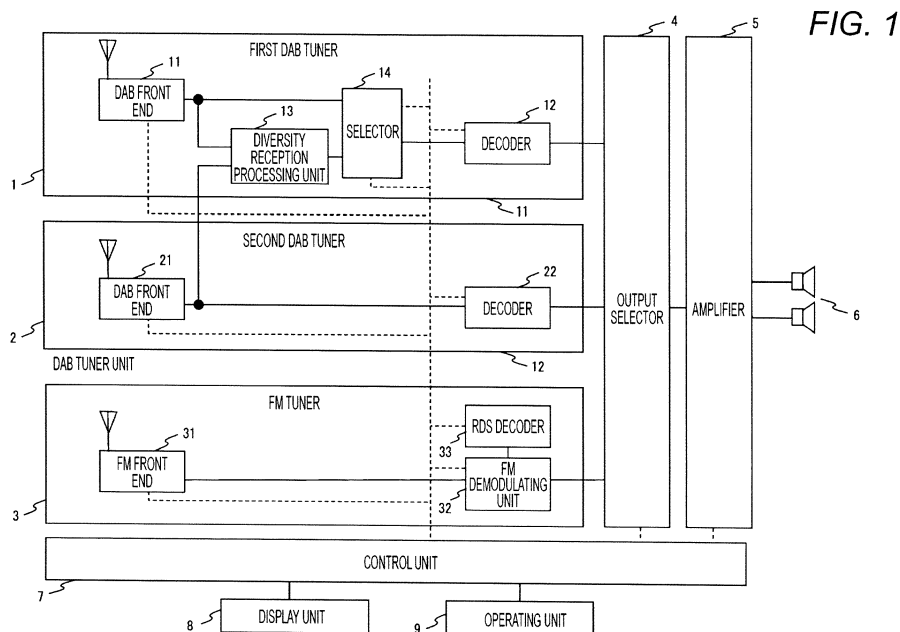
BROADCASTING RECEPTION DEVICE AND BROADCASTING RECEPTION CONTROL METHOD

(57)

There are provided a broadcasting reception device and a broadcasting reception control method for follow and diversity reception of a service, inhibiting occurrence of interruption of reception by using two reception systems.

In a DAB single reception mode, a current reception system receives a service to be received and a background reception system performs a DAB search for checking reception quality of an alternative service. When reception quality of a service S1 during reception

by the current reception system degrades more than a threshold value Th1 (T1), it is determined whether a service S2 having reception quality at a level Qa or more is present. Only in a case where the service S2 is not present, a DAB diversity reception mode is determined and diversity reception starts using the current reception system and the background reception system. In a case where the service S2 is present, the DAB single reception mode remains.



Description

[0001] The present invention relates to a technique in a broadcasting reception device, capable of switching a broadcasting service to be received from a broadcasting service during reception to another broadcasting service that has been broadcasting the same content as the broadcasting service.

[0002] As a technique in a broadcasting reception device, capable of switching a broadcasting service to be received from a broadcasting service during reception to another broadcasting service that has been broadcasting the same content as the broadcasting service, it has been known a technique in a radio broadcasting reception device that receives digital audio broadcasting (DAB), capable of switching a broadcasting service to be received from a DAB service during reception to another DAB service that has been broadcasting the same content as the DAB service (for example, Patent Literature 1).

[0003] In addition, it has been known a technique in a radio broadcasting reception device that receives DAB and FM broadcasting, capable of switching a broadcasting service to be received from a DAB service during reception to an FM broadcasting station that has been broadcasting the same content as the DAB service (for example, Patent Literature 2).

[0004] As a technique in a radio broadcasting reception device, capable of improving reception quality, it has been known a diversity reception technique based on a maximum ratio combining (MRC) method (for example, Patent Literature 3 and Patent Literature 4). The MRC method basically synchronizes a broadcasting signals received by reception systems corresponding to respective antennas, in phase, and weights the broadcasting signals in response to reception levels so as to combine the broadcasting signals.

Citation List

Patent Literature

[0005]

Patent Literature 1: JP 10-200499 A
 Patent Literature 2: JP 11-340853 A
 Patent Literature 3: JP 2015-29164 A
 Patent Literature 4: JP 2010-226233 A

[0006] In a radio reception device including two reception systems that receive DAB, one of the reception systems is used for receiving a DAB service and the other reception system is used for searching other DAB services that have been broadcasting the same content as the DAB service during reception. When another DAB service is found in a reception state better than that of the DAB service during the reception, it is thought that DAB follow operation that switches a DAB service to be received to the other DAB service, is performed.

[0007] In the radio reception device, when reception quality of the DAB service during the reception degrades, it is thought that diversity reception is performed using the two reception systems so that the reception quality of the DAB service during the reception is improved.

[0008] However, in this manner, a search for the DAB services that have been broadcasting the same content as the DAB service during the reception, cannot be performed during a period during which the diversity reception based on the MRC method has been performed. Thus, the following problems interfering with a benefit of the above DAB follow operation, occur.

[0009] That is, even when the other DAB service that has been broadcasting the same content as the DAB service during the reception and that can be received in a better reception state, occurs during a period during which the diversity reception has been performed, the DAB service to be received cannot immediately switch to the other DAB service.

[0010] In this case, for example, a search starts for the other DAB service in a reception state better than that of the DAB service during the reception after the diversity reception is completed due to a reason that even the diversity reception cannot correctly receive the DAB service, for example. Thus, the reception of the DAB service is interrupted until the other DAB service is found from a point at which the diversity reception is completed.

[0011] Therefore, in a broadcasting reception device that includes two reception systems that receive broadcasting services, one reception system being used for receiving a broadcasting service, the other reception system being used for searching other broadcasting services that have been broadcasting the same content as the broadcasting service during reception, the broadcasting reception device configured to perform broadcasting service follow operation that switches a broadcasting service to be received to another broadcasting service in a reception state better than that of the broadcasting service during the reception, an object of the present invention is to perform diversity reception with as little damage to a benefit of the broadcasting service follow operation as possible.

[0012] The invention relates to a broadcasting reception device and method according to the independent claims. Embodiments are disclosed in the dependent claims.

[0013] According to an embodiment of the present invention, a broadcasting reception device configured to receive broadcasting, includes: a first reception system configured to receive broadcasting; a second reception system configured to receive broadcasting; a diversity reception unit configured to perform diversity reception of broadcasting, using the first reception system and the second reception system; an output means configured to output content of the received broadcasting; and a control unit. The control unit includes a first operating mode and a second operating mode as an operating mode. In the first operating mode, the control unit deter-

mines one of the first reception system and the second reception system as a current reception system and another as a background reception system, causes the current reception system to receive broadcasting to be received, causes the output means to output content of the broadcasting received by the current reception system, causes the background reception system to detect reception states of respective pieces of broadcasting that have been broadcasting same content as the broadcasting to be received, and causes the broadcasting to be received to switch to any of pieces of broadcasting that have been broadcasting the same content as the broadcasting, in a favorable reception state, at predetermined timing. In the second operating mode, the control unit causes the diversity reception unit to perform diversity reception of the broadcasting to be received, using the first reception system and the second reception system, and causes the output means to output content of the broadcasting received by the diversity reception unit. When the operating mode is in the first operating mode, in a case where the reception state of the broadcasting to be received in the current reception system degrades more than a predetermined first level, and in a case where an alternative broadcasting candidate is not present, the alternative broadcasting candidate being broadcasting in which the reception state detected by the background reception system is more favorable than a predetermined second level and that has been broadcasting the same content as the broadcasting to be received, the control unit switches the operating mode to the second operating mode, and in a case where the alternative broadcasting candidate is present, the control unit retains the operating mode in the first operating mode.

[0014] The broadcasting reception device may have a configuration in which, in the first operating mode, the control unit switches the broadcasting to be received to alternative broadcasting at the predetermined timing at which the alternative broadcasting is detected by the background reception system, the alternative broadcasting broadcasting the same content as the broadcasting to be received, in the reception state more favorable than the reception state of the broadcasting to be received in the current reception system.

[0015] The broadcasting reception device may have a configuration in which when the operating mode is in the second operating mode, the control unit switches the operating mode to the first operating mode in at least one case of a case where duration of the second operating mode has passed over predetermined time and a case where the broadcasting to be received cannot be correctly received by the diversity reception of the diversity reception unit.

[0016] In the broadcasting reception device, the broadcasting may be, for example, FM audio broadcasting or digital audio broadcasting.

[0017] According to the broadcasting reception device, in the broadcasting reception device including the two reception systems having the first reception system and

the second reception system as a reception system for receiving the broadcasting, one of the reception systems being used for receiving the broadcasting to be received, the other being used for searching the broadcasting that has been broadcasting the same content as the broadcasting to be received, and the first operating mode in which the broadcasting to be received switches to other broadcasting detected by the broadcasting search, in a favorable reception state at the predetermined timing, when the reception state of the broadcasting to be received degrades more than the first level during the first operating mode, and only in a case where the alternative broadcasting candidate is not detected by the search, the alternative broadcasting candidate being broadcasting that has been broadcasting the same content as the broadcasting to be received, at a level more favorable than the second level, the first operating mode switches to the second operating mode and then the diversity reception starts with the first reception system and the second reception system. When the alternative broadcasting candidate is detected, the first operating mode remains.

[0018] Here, the second level is set appropriately. Thus, the alternative broadcasting candidate can be expected to be broadcasting that can be favorably received in the near future. Therefore, according to the embodiment of the present invention, in a case where broadcasting that can be expected to be broadcasting that can be favorably received in the near future, is present, when a reception state of the broadcasting becomes favorable, standby of switching of the broadcasting to be received to the broadcasting can be performed in preference to a start of the diversity reception. The above operation inhibits occurrence of the above problems due to occurrence of broadcasting that has been broadcasting the same content as the broadcasting to be received, in a favorable state, during the diversity reception.

[0019] As described above, according to an embodiment of the present invention, in a broadcasting reception device that includes two reception systems that receive broadcasting services, one reception system being used for receiving a broadcasting service, the other reception system being used for searching other broadcasting services that have been broadcasting the same content as the broadcasting service during reception, the broadcasting reception device configured to perform broadcasting service follow operation that switches the broadcasting service to be received to another broadcasting service in a reception state better than that of the broadcasting service during the reception, diversity reception can be performed with as little damage to a benefit of the broadcasting service follow operation as possible.

Brief Description of Drawings

[0020]

FIG. 1 is a block diagram of a configuration of a radio broadcasting reception device according to an em-

bodiment of the present invention.

FIG. 2 is a flow chart of mode switching processing according to an embodiment of the present invention.

FIGS. 3a to 3c are diagrams of exemplary reception operation of the radio broadcasting reception device according to an embodiment of the present invention.

[0021] Embodiments of the present invention will be described below.

[0022] FIG. 1 illustrates a configuration of a radio broadcasting reception device according to an embodiment.

[0023] Here, the radio broadcasting receiver according to the present embodiment is a radio broadcasting receiver with a position of the radio broadcasting receiver to be varied, such as a radio receiver built in a motor vehicle or a portable radio receiver.

[0024] As illustrated, the radio broadcasting receiver includes a first DAB tuner 1, a second DAB tuner 2, an FM tuner 3, an output selector 4, an amplifier 5, a speaker 6, a control unit 7, a display unit 8, and an operating unit 9.

[0025] Here, the second DAB tuner 2 is a receiving unit that receives radio broadcasting based on DAB broadcasting standards. The second DAB tuner 2 includes a DAB front end 21 and a decoder 22. From the control unit 7, the DAB front end 21 detects a broadcasting signal on a frequency channel on which a service set as a reception service is broadcasted, and outputs the broadcasting signal as a reception signal. The decoder 22 decodes an audio signal of the reception service from the reception signal received by the DAB front end 21, and outputs the decoded audio signal to the output selector 4. Here, the decoder 22 also performs processing of extracting and transmitting control information included in the reception signal to the control unit 7.

[0026] Note that the DAB can broadcast a plurality of pieces of audio broadcasting on one frequency channel. A piece of sound broadcasting corresponds to one service.

[0027] The first DAB tuner 1 is a receiving unit that receives radio broadcasting based on DAB broadcasting standards. The first DAB tuner 1 includes a DAB front end 11, a decoder 12, a diversity reception processing unit 13, and a selector 14. From the control unit 7, the DAB front end 11 detects a broadcasting signal on a frequency channel on which a service set as a reception service is broadcasted, and outputs the broadcasting signal as a reception signal. The diversity reception processing unit 13 combines the reception signal output by the DAB front end 11 and the reception signal output by the DAB front end 21 of the second tuner, based on the MRC method. The diversity reception processing unit 13 outputs a combined reception signal. The selector 14 outputs one of the reception signal output by the DAB front end 11 and the reception signal output by the diversity reception processing unit 13, to the decoder 12. The de-

coder 12 decodes an audio signal of a reception service from the reception signal output from the selector 14, and outputs the decoded sound signal to the output selector 4. The decoder 12 also performs processing of extracting and transmitting control information included in the reception signal, to the control unit 7.

[0028] The FM tuner 3 is a receiving unit that receives radio broadcasting based on broadcasting standards of FM broadcasting. The FM tuner 3 includes an FM front end 31, an FM demodulating unit 32, and an RDS decoder 33. The FM front end 31 receives a frequency channel of a station set as a reception station, from the control unit 7. The FM demodulating unit 32 demodulates an audio signal from a reception signal received by the FM front end 31, and outputs the audio signal to the output selector 4. The RDS decoder 33 decodes control information from a data signal that has been multiplexed in an audio signal and has been transmitted, and transmits the decoded control information to the control unit 7.

[0029] Note that FM broadcasting performs a piece of audio broadcasting on one frequency channel. A piece of audio broadcasting corresponds to one station.

[0030] In accordance with control of the control unit 7, the output selector 4 selects and outputs any of the audio signals output by the respective first DAB tuner 1, second DAB tuner 2, and FM tuner 3, to the amplifier 5. The amplifier 5 amplifies the audio signal output from the output selector 4, and outputs the amplified audio signal to the speaker 6.

[0031] Here, the DAB front end 11 and the decoder 12 of the first DAB tuner 1 and the DAB front end 21 and the decoder 22 of the second DAB tuner 2 notify the control unit 7 of information according to reception quality of a DAB service during reception, such as reception electric field intensity, SN ratio, and an error rate of reception data. The FM front end 31 of the FM tuner 3 notifies the control unit 7 of information according to reception quality of a station during reception, such as reception electric field intensity and SN ratio.

[0032] The control unit 7 calculates the reception quality of the DAB service in which the first DAB tuner 1 and the second DAB tuner 2 have been performing reception operation, from the information according to the reception quality of the DAB service, notified by the first DAB tuner 1 and the second DAB tuner 2. The control unit 7 calculates the reception quality of the FM broadcasting station in which the FM tuner 3 has been performing reception operation, from the information according to the reception quality of the FM broadcasting notified by the FM front end 31 of the FM tuner 3.

[0033] Next, the control information transmitted to the control unit 7 by the decoder 12 of the first DAB tuner 1 and the decoder 22 of the second DAB tuner 2, includes, for example, an SID indicating identification of the service during the reception, service linking information and following information that indicate a DAB service and an FM broadcasting station broadcasting a program with the same content. The control information transmitted to the

control unit 7 by the RDS decoder 33 of the FM tuner 3, includes, for example, a program identifier PI to be an identifier of a program that is FM-broadcasted from the station on the frequency channel during the reception, and an AF indicating an FM broadcasting station that has been broadcasting a program with the same content.

[0034] The control unit 7 identifies the DAB service and the FM broadcasting station that have been broadcasting the program with the same content, based on these pieces of control information transmitted by the first DAB tuner 1, the second DAB tuner 2, and the FM tuner 3.

[0035] This type of radio broadcasting reception device includes a DAB single reception mode, a DAB diversity reception mode, and an FM reception mode, as an operating mode controlled by the control unit 7.

[0036] During a period during which the DAB single reception mode has been set, the control unit 7 sets one of the first DAB tuner 1 and the second DAB tuner 2 as a current tuner and the other as a background tuner. A service to be received is set, as a reception service, into the current tuner. Then, reception of the service to be received is performed, and also the output selector 4 outputs an audio signal output by the current tuner, to the speaker 6 through the amplifier 5. The control unit 7 cyclically sets DAB services broadcasting a program with the same content as the service to be received, as a reception service, into the background tuner. The control unit 7 performs a DAB search that detects reception quality of each of the DAB services that have been broadcasting the program with the same content as the service to be received. Note that, in the DAB single reception mode, the selector 14 of the first DAB tuner 1 is set so as to output the reception signal output by the DAB front end 11 to the decoder 12.

[0037] During the period during which the DAB single reception mode has been set, when the current tuner finds another service that has been broadcasting a program with the same content as the service during the reception by the current tuner and that has reception quality better than that of the service during the reception by the current tuner, by the DAB search using the background tuner, the control unit 7 performs DAB follow control operation that switches the service to be received to the found other service. Note that the DAB follow control operation may be performed by renewing the reception service of the current tuner to the found other service. Alternatively, after reception of the other service found by the background tuner starts, the background tuner and the current tuner are interchanged so that an output audio of the speaker 6 is seamless and continuous before and after switching. In this manner, the DAB follow control operation may be performed.

[0038] During the period during which the DAB single reception mode has been set, the control unit 7 cyclically sets FM broadcasting stations that have been broadcasting a program with the same content as the service to be received, as a reception station, into the FM tuner 3. Thus, the control unit 7 performs a FM search that detects

reception quality of each of the FM broadcasting stations that have been broadcasting the program with the same content as the service to be received.

[0039] Next, during a period during which the DAB diversity reception mode has been set, the control unit 7 causes both of the first DAB tuner 1 and the second DAB tuner 2 to receive the service to be received. The selector 14 of the first DAB tuner 1 outputs the reception signal output by the diversity reception processing unit 13, to the decoder 12. The output selector 4 outputs the audio signal output by the first DAB tuner 1 to the speaker 6 through the amplifier 5. Then, diversity reception of the service to be received is performed.

[0040] During the period during which the DAB diversity reception mode has been set, the control unit 7 uses the FM tuner 3 so as to perform the above FM search.

[0041] Next, during a period during which the FM reception mode has been set, the control unit 7 causes the FM tuner 3 to receive a station to be received. The output selector 4 outputs the audio signal output by the FM tuner 3 to the speaker 6 through the amplifier 5.

[0042] During the period during which the FM reception mode has been set, the control unit 7 sets the second DAB tuner 2 as the background tuner. The control unit 7 performs the DAB search that cyclically detects the reception quality of each of the DAB services that have been broadcasting a program with the same content as the station to be received, using the background tuner.

[0043] Mode switching processing performed by the control unit 7 in order to switch the above operation mode, will be described below. Here, the mode switching processing starts when indication for starting broadcasting reception is received from a user.

[0044] FIG. 2 illustrates a process of the mode switching processing.

[0045] In the processing as illustrated, the DAB single reception mode is set (Step 202). A service designated by the user or a previous and latest service to be received is set as a service to be received, and reception of the service to be received starts (Step 204).

[0046] It is monitored whether reception quality QCR of the service to be received in the above current tuner degrades more than a predetermined threshold value Th1 (Step 206). When the reception quality QCR degrades more than the predetermined threshold value Th1, it is examined whether an alternative DAB service candidate is present (Step 208).

[0047] Here, the threshold value Th1 is previously set as a value of a predetermined margin added to the reception quality in which the service cannot be correctly received.

[0048] The alternative DAB service candidate is a DAB service that has been broadcasting a program with the same content as the service to be received in the current tuner. The alternative DAB service is a service in which the reception quality detected by the above DAB search is at a level Qa or more. As a value of the level Qa, a minimum value of the reception quality in which the serv-

ice can be correctly received or a value close to the minimum value of the reception quality in which the service can be correctly received, is previously set.

[0049] When the alternative DAB service candidate is present (Step 208), the processing goes back to Step 206.

[0050] Meanwhile, when the alternative DAB service candidate is not present, the operating mode switches to the DAB diversity reception mode (Step 210). As described above, the diversity reception of the service to be received that has been received by the current tuner, starts.

[0051] When the diversity reception starts, occurrence of a state where duration of the DAB diversity reception mode is T1 (for example, 240 sec) or more (Step 212), occurrence of a state where the reception quality QCR of the service to be received in the first DAB tuner 1 or the second DAB tuner 2 is more favorable than a predetermined threshold value Th0 (Step 214), occurrence of a state where the reception quality QCR is less than a predetermined threshold value Th3 (Step 216), and occurrence of a state where the reception quality QCR is less than a predetermined threshold value Th2 (Step 218), are monitored.

[0052] Here, the following expression is satisfied: $Th0 > Th1 > Th2 > Th3$. Th0 is a minimum value of the reception quality in which the service can be sufficiently and favorably received. Th2 is a maximum value of the reception quality in which a defect occurs in the reception of the service even by the diversity reception. Th3 is the reception quality indicating that the service has not been received.

[0053] When any of the state where the duration of the DAB diversity reception mode is T1 (for example, 240 sec) or more (Step 212), the state where the reception quality QCR of the service to be received in the first DAB tuner 1 or the second DAB tuner 2 is more favorable than the predetermined threshold value Th0 (Step 214), and the state where the reception quality QCR is less than the predetermined threshold value Th3 (Step 216), occurs, the operation mode switches back to the DAB single reception mode (Step 226). The processing goes back to Step 206.

[0054] Meanwhile, when the state where the reception quality QCR is less than the predetermined threshold value Th2, occurs (Step 218), it is examined whether an alternative FM station is present (Step 220). Here, the alternative FM station is a station at a level at which the reception quality detected by the above FM search can be correctly received, in the FM broadcasting stations that have been broadcasting a program with the same content as the service to be received during the diversity reception.

[0055] When the alternative FM station is not present, the operating mode switches back to the DAB single reception mode (Step 226). The processing goes back to Step 206.

[0056] Meanwhile, when the alternative FM station is

present, the FM reception mode is set as the operating mode. The alternative FM station is set as the station to be received. The station to be received is set as a reception station into the FM tuner 3. Then, reception of the alternative FM station starts (Step 222).

[0057] When the FM reception mode is set, occurrence of the alternative DAB service is waited (Step 224). When the alternative DAB service occurs, the operating mode switches back to the DAB single reception mode (Step 226). The alternative DAB service is set as the service to be received. The service to be received is set as the reception service into the current tuner. The processing goes back to Step 206.

[0058] Here, the alternative DAB service is a service at a level at which the reception quality detected by the above DAB search is sufficient and favorable, in the DAB services that have been broadcasting a program with the same content as the station to be received that has been received by the FM tuner 3.

[0059] The mode switching processing performed by the control unit 7 has been described above.

[0060] Here, FIGS. 3a to 3c illustrate the exemplary reception operation of the radio broadcasting reception device by the above mode switching processing.

[0061] As illustrated in FIG. 3b, at time T0, the DAB single reception mode is determined as the operating mode and a service S1 is set as the service to be received. The service S1 and a service S2 are DAB services that have been broadcasting a program with the same content.

[0062] Under the above conditions, as illustrated in FIG. 3a, in a case where reception quality of the service S1 degrades as time passes and reception quality of the service S2 improves as the time passes, when the reception quality of the service S1 to be received degrades more than the threshold value Th1 at time T1, it is examined whether the alternative DAB service candidate is present. At the time T1, the reception quality of the service S2 has improved by the level Qa or more. Thus, the service S2 becomes the alternative DAB service candidate. At this point, switching of the operation mode is not performed. The DAB single reception mode, the reception of the service S1 as the service to be received in the current tuner, and the DAB search in the background tuner continue.

[0063] After that, when the DAB search detects that the reception quality of the service S2 has been more favorable than the reception quality of the service S1 at time T2, the service to be received switches from the service S1 to the service S2.

[0064] After that, when the reception quality of the service S2 to be received has been more favorable than the threshold value Th1 at time T3, the reception of the service S2 to be received is stably performed on and after.

[0065] Here, FIG. 3c illustrates, as a comparative example, the operation in a case where the operating mode has switched to the DAB diversity reception mode when the reception quality of the service S1 to be received

degrades more than the threshold value Th1 at the time T1.

[0066] As illustrated, in a case where the operating mode has switched to the DAB diversity reception mode at the time T1, the diversity reception of the service S1 to be received using the first DAB tuner 1 and the second DAB tuner 2 starts from the time T1. The DAB search is not performed by the background tuner.

[0067] When the reception quality of the service S1 to be received degrades more than the threshold value Th3 and cannot be received at time T4, the operating mode switches back to the DAB single reception mode and then the DAB search by the background tuner resumes.

[0068] When the DAB search detects the service S2 having reception quality more favorable than that of the service S1 to be received, the service to be received switches from the service S1 to the service S2. Then, the reception of the service S2 starts.

[0069] Here, in the example in FIG. 3c as illustrated, time Td is required to find the service S2 by the DAB search until the service to be received switches to the service S2 after the operating mode has switched back to the DAB single reception mode. During the time Td, the service cannot be received and cannot be output to the user.

[0070] Meanwhile, according to the present embodiment, no condition in which the service cannot be received and cannot be output to the user, occurs as illustrated in FIG. 3b with respect to the condition in FIG. 3a.

[0071] Note that, in the condition illustrated in FIG. 3a, when the service S2 that has been broadcasting a program with the same content as the service S1 to be received, is not present, the operating mode immediately switches to the DAB diversity reception mode at the time T1. Then, the diversity reception of the service S1 to be received starts using the first DAB tuner 1 and the second DAB tuner 2 from the time T1.

[0072] An embodiment of the present invention has been described above.

[0073] In the above embodiment, a case where automatic switching (follow) to the broadcasting service that has been broadcasting a program with the same content as the diversity reception of the digital audio broadcasting (DAB), has been described. The present embodiment can be also applied to a case where diversity reception and follow of other broadcasting, except the DAB, such as FM broadcasting and digital television broadcasting together with data broadcasting, based on an RDS, are performed. Reference Signs List

- 1 first DAB tuner
- 2 second DAB tuner
- 3 FM tuner
- 4 output selector
- 5 amplifier
- 6 speaker
- 7 control unit
- 8 display unit

- 9 operating unit
- 11 DAB front end
- 12 decoder
- 13 diversity reception processing unit
- 5 14 selector
- 21 DAB front end
- 22 decoder
- 31 FM front end
- 32 FM demodulating unit
- 10 33 RDS decoder

Claims

- 15 1. A broadcasting reception device configured to receive broadcasting, **characterized in that** the broadcasting reception device comprises:
 - a first reception system configured to receive broadcasting;
 - a second reception system configured to receive broadcasting;
 - a diversity reception unit configured to perform diversity reception of broadcasting, using the first reception system and the second reception system;
 - an output means configured to output content of the received broadcasting; and
 - a control unit, and
- 20 the control unit includes a first operating mode and a second operating mode as an operating mode,
- 25 in the first operating mode, the control unit is configured to determine one of the first reception system and the second reception system as a current reception system and another as a background reception system, to cause the current reception system to receive broadcasting to be received, to cause the output means to output content of the broadcasting received by the current reception system, to cause the background reception system to detect reception states of respective pieces of broadcasting that have been broadcasting same content as the broadcasting to be received, and to cause the broadcasting to be received to switch to any of pieces of broadcasting that have been broadcasting the same content as the broadcasting, in a favorable reception state, at predetermined timing,
- 30 in the second operating mode, the control unit is configured to cause the diversity reception unit to perform diversity reception of the broadcasting to be received, using the first reception system and the second reception system, and to cause the output means to output content of the broadcasting received by the diversity reception unit, and
- 35 when the operating mode is in the first operating
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mode, in a case where the reception state of the broadcasting to be received in the current reception system degrades more than a predetermined first level, and in a case where an alternative broadcasting candidate is not present, the alternative broadcasting candidate being broadcasting in which the reception state detected by the background reception system is more favorable than a predetermined second level and that has been broadcasting the same content as the broadcasting to be received, the control unit is configured to switch the operating mode to the second operating mode, and in a case where the alternative broadcasting candidate is present, the control unit is configured to retain the operating mode in the first operating mode.

2. The broadcasting reception device according to claim 1,

characterized in that, in the first operating mode, the control unit is configured to switch the broadcasting to be received to alternative broadcasting at the predetermined timing at which the alternative broadcasting is detected by the background reception system, the alternative broadcasting broadcasting the same content as the broadcasting to be received, in the reception state more favorable than the reception state of the broadcasting to be received in the current reception system.

3. The broadcasting reception device according to claim 1 or 2,

characterized in that, when the operating mode is in the second operating mode, the control unit is configured to switch the operating mode to the first operating mode in at least one case of a case where duration of the second operating mode has passed over predetermined time and a case where the broadcasting to be received cannot be correctly received by the diversity reception of the diversity reception unit.

4. The broadcasting reception device according to any of claims 1 to 3,

characterized in that the broadcasting is FM audio broadcasting or digital audio broadcasting.

5. A broadcasting reception control method for controlling broadcasting reception in a broadcasting reception device comprising: a first reception system configured to receive broadcasting; a second reception system configured to receive broadcasting; a diversity reception unit configured to perform diversity reception of broadcasting using the first reception system and the second reception system; and an output means configured to output content of the received broadcasting, **characterized in that** the broadcast-

ing reception control method comprises:

switching broadcasting to be received to any of pieces of broadcasting that have been broadcasting same content as the broadcasting in a favorable reception state at predetermined timing by determining one of the first reception system and the second reception system as a current reception system and another as a background reception system, causing the current reception system to receive the broadcasting to be received, causing the output means to output content of the broadcasting received by the current reception system, and then causing the background reception system to detect reception states of respective pieces of broadcasting that have been broadcasting the same content as the broadcasting to be received, during a period during which a first operating mode has been set as an operating mode, by the broadcasting reception device;

causing the output means to output content of broadcasting received by the diversity reception unit by causing the diversity reception unit to perform the diversity reception of the broadcasting to be received with the first reception system and the second reception system, during a period during which a second operating mode has been set as the operating mode, by the broadcasting reception device; and

switching the operating mode to the second operating mode, when the operating mode is in the first operating mode, in a case where a reception state of the broadcasting to be received in the current reception system degrades more than a predetermined first level, and in a case where an alternative broadcasting candidate is not present, the alternative broadcasting candidate being broadcasting in which the reception state detected by the background reception system is more favorable than a predetermined second level and that has been broadcasting the same content as the broadcasting to be received, and retaining the operating mode in the first operating mode in a case where the alternative broadcasting candidate is present, by the broadcasting reception device.

6. The broadcasting reception control method according to claim 5, further comprising switching the broadcasting to be received to alternative broadcasting at the predetermined timing at which the alternative broadcasting is detected by the background reception system, the alternative broadcasting broadcasting the same content as the broadcasting to be received, in the reception state more favorable than the reception state of the broadcasting to be received in the current reception system, during the period

during which the first operating mode has been set,
by the broadcasting reception device.

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FIG. 1

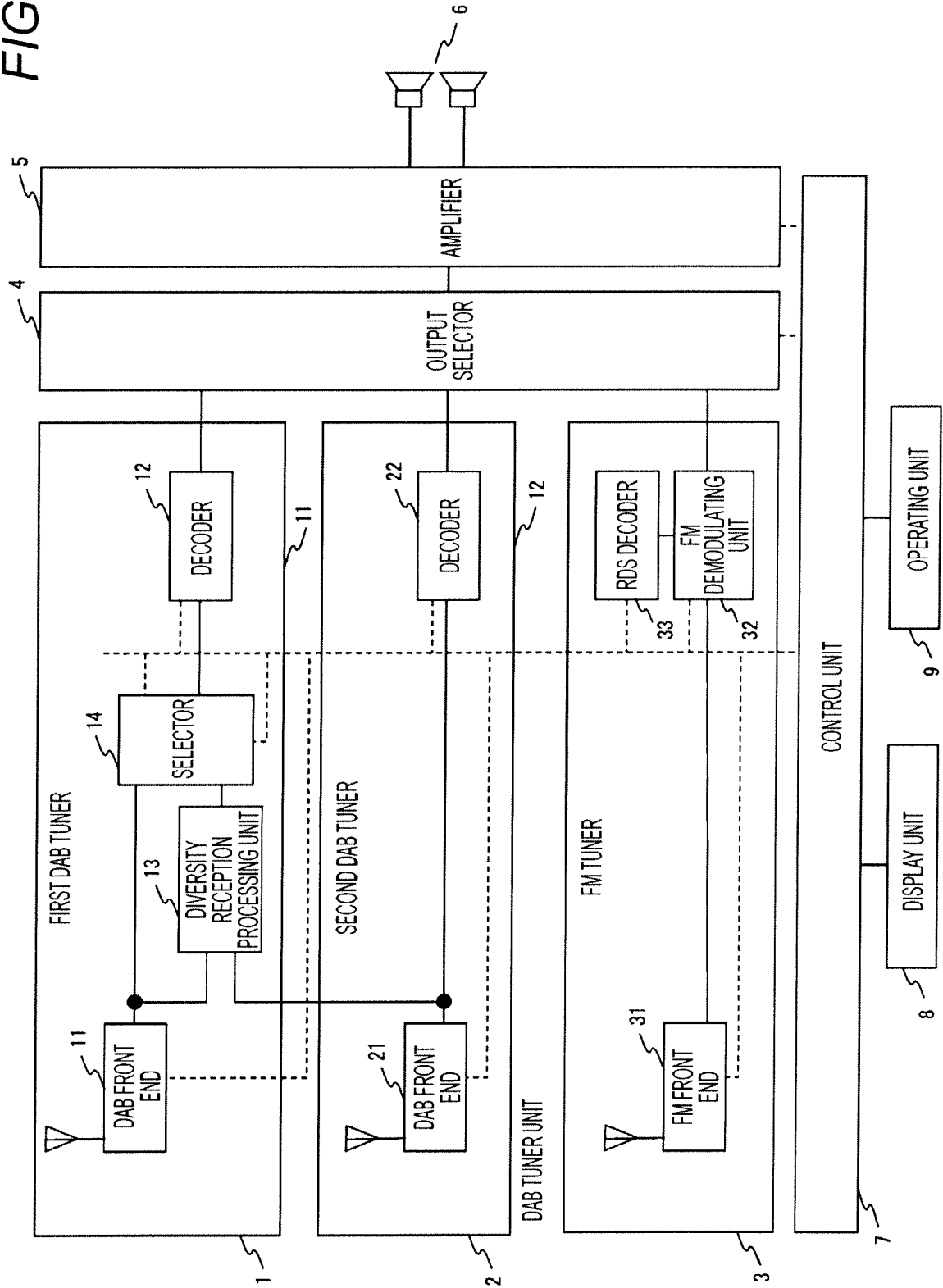


FIG. 2

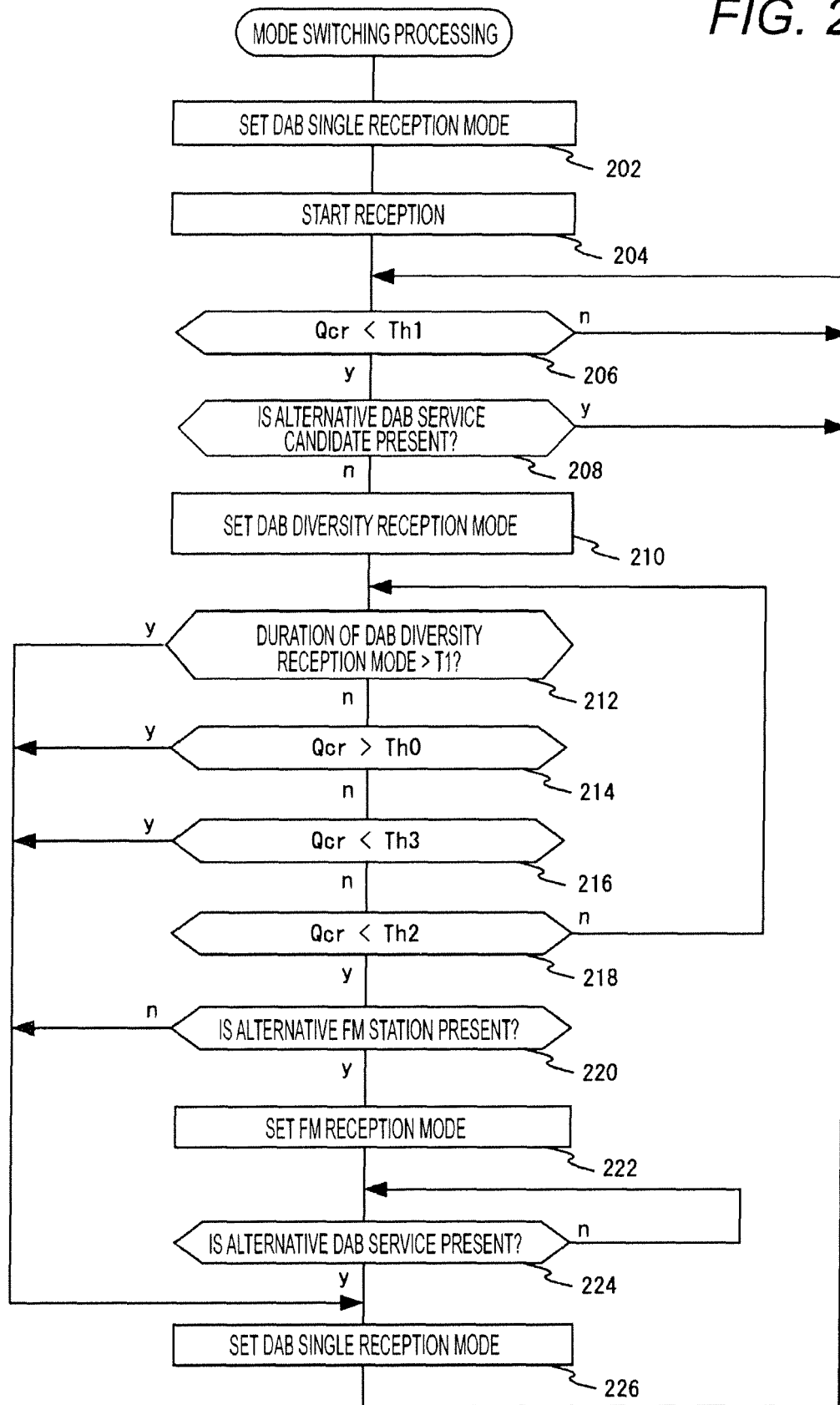
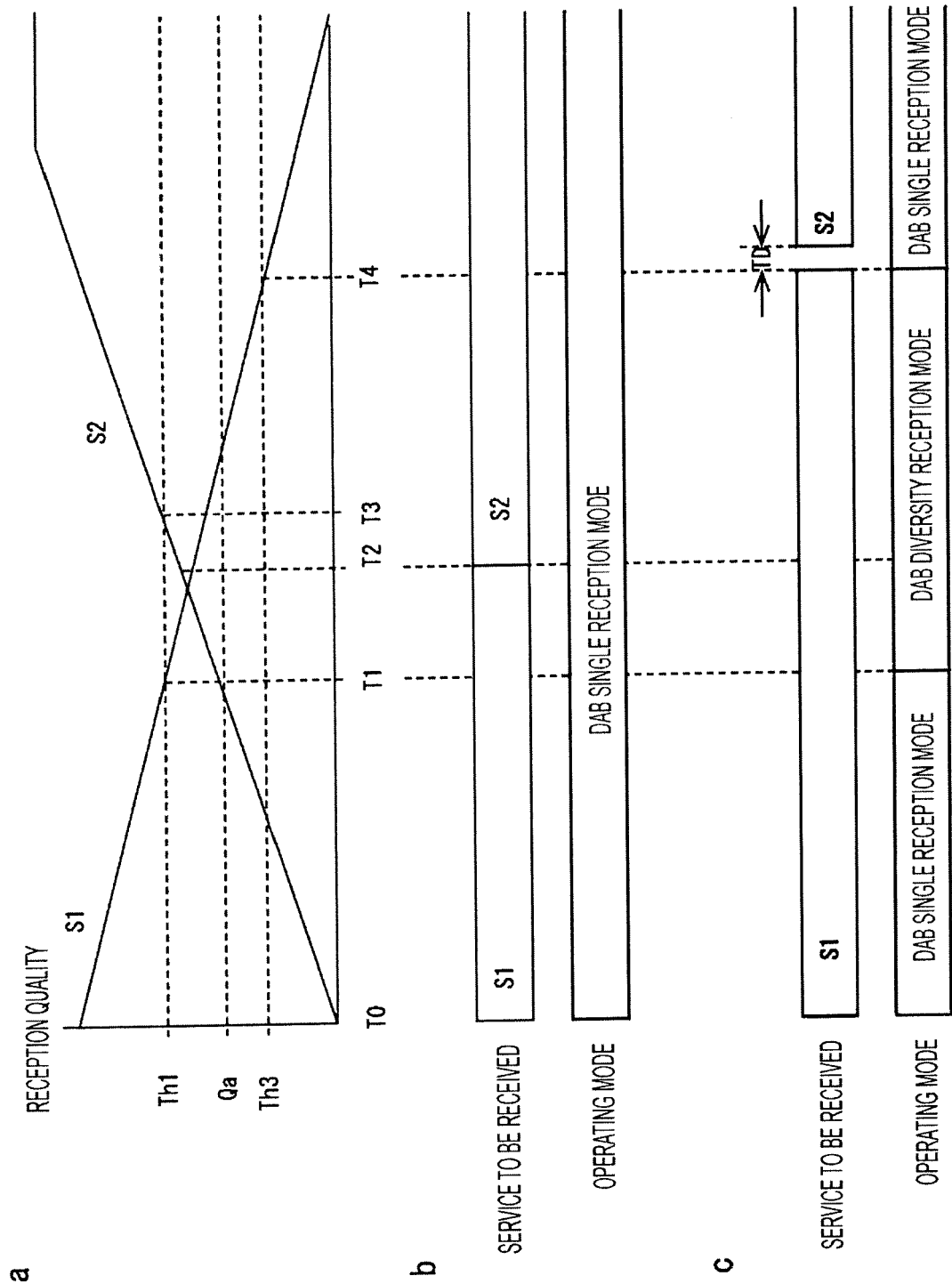


FIG. 3





EUROPEAN SEARCH REPORT

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 2 372 926 A1 (PIONEER CORP [JP]) 5 October 2011 (2011-10-05) * paragraphs [0016] - [0018], [0029] - [0030], [0059], [0064] - [0066], [0069] - [0074], [0079] - [0080], [0118], [0121] * * figures 1-4,8 * -----	1-6	INV. H04H20/26 H04H20/22
			TECHNICAL FIELDS SEARCHED (IPC)
			H04H
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 17 March 2017	Examiner Iovescu, Vladimir
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ON EUROPEAN PATENT APPLICATION NO.

EP 16 19 7847

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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17-03-2017

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 2372926 A1	05-10-2011	EP 2372926 A1	05-10-2011
		JP 5033924 B2	26-09-2012
		WO 2010061439 A1	03-06-2010

EPO FORM P0459

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

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Patent documents cited in the description

- JP 10200499 A [0005]
- JP 11340853 A [0005]
- JP 2015029164 A [0005]
- JP 2010226233 A [0005]