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Mail Stop ISSUE/EE  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
or Fax  
(571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address, and/or (b) indicating a separate ‘FEE ADDRESS’ for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

KED & ASSOCIATES, LLP  
P.O. Box 8638  
Reston, VA 20195

APPLICATION NO.  FILING DATE  FIRST NAMED INVENTOR  ATTORNEY DOCKET NO.  CONFIRMATION NO.  
11/872,282  10/15/2007  Ho Yi  EZ-0005  8550

TITLE OF INVENTION: TUNER SELECTION IN DIGITAL BROADCASTING RECEIVER HAVING MULTIPLE TUNERS

APPLN. TYPE  SMALL ENTITY  ISSUE FEE DUE  PUBLICATION FEE DUE  PREV. PAID ISSUE FEE  TOTAL FEE(S) DUE  DATE DUE

nonprovisional  NO  $1740  $300  $0  $2040  06/29/2012

EXAMINER  ART UNIT  CLASS-SUBCLASS

DUBASKY, GIGI L  2421  348-731000

1. Change of correspondence address or indication of “Fee Address” (37 CFR 1.363).
   Change of correspondence address or Change of Correspondence Address form PTO/SB/122) attached.  
   “Fee Address” indication or “Fee Address” Indication form PTO/SB/47, Rev 03-02 or more recent) attached. Use of a Customer Number is required.

2. For printing on the patent front page, list
   (1) the names of up to 3 registered patent attorneys or agents OR, alternatively,
   (2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

   PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

   (A) NAME OF ASSIGNEE

   HUMAX Co., Ltd.

   Gyeonggi-Do, Korea

   Please check the appropriate assignee category or categories (will not be printed on the patent): □ Individual  ☑ Corporation or other private group entity  □ Government

4a. The following fee(s) are submitted:
   □ Issue Fee
   □ Publication Fee (No small entity discount permitted)
   □ Advance Order - # of Copies

   4b. Payment of fee(s): (Please first reapply any previously paid issue fee shown above)
   □ A check is enclosed.  ☑  Payment by credit card: Form PTO-213 is attached.
   ☑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number 16-0607 (enclose an extra copy of this form).

5. Change in Entity Status (from status indicated above)
   ☑ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27.
   □ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

   NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

   Authorized Signature  

   Date  06/26/2012  

   Typed or printed name  David C. Oren  

   Registration No.  38,694

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

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PTOL-85 (Rev. 02/11) Approved for use through 08/31/2013.  
OMB 0651-0033 U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
**Electronic Patent Application Fee Transmittal**

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**Title of Invention:**

TUNER SELECTION IN DIGITAL BROADCASTING RECEIVER HAVING MULTIPLE TUNERS

**First Named Inventor/Applicant Name:**

Ho Yi

**Filer:**

David Carlton Oren/Kathy Humphries

**Attorney Docket Number:**

EZ-0005

Filed as Large Entity

**Utility under 35 USC 111(a) Filing Fees**

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**Warnings:**

**Information:**

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

**New Applications Under 35 U.S.C. 111**

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

**National Stage of an International Application under 35 U.S.C. 371**

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

**New International Application Filed with the USPTO as a Receiving Office**

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

**Total Files Size (in bytes):** 135333
NOTICE OF ALLOWANCE AND FEE(S) DUE

KED & ASSOCIATES, LLP
P.O. Box 8638
Reston, VA 20195

34610 7590 03/29/2012
EXAMINER
DUBASKY, GIOVANNI
ART UNIT 2421
PAPER NUMBER

APPLICATION NO. FILING DATE FIRST NAMED INVENTOR ATTORNEY DOCKET NO. CONFIRMATION NO.
11/872,282 10/15/2007 Ho YI EZ-0005 8550

TITLE OF INVENTION: TUNER SELECTION IN DIGITAL BROADCASTING RECEIVER HAVING MULTIPLE TUNERS

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THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

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HOW TO REPLY TO THIS NOTICE:

I. Review the SMALL ENTITY status shown above.

If the SMALL ENTITY is shown as YES, verify your current SMALL ENTITY status:
A. If the status is the same, pay the TOTAL FEE(S) DUE shown above.
B. If the status above is to be removed, check box 5b on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and twice the amount of the ISSUE FEE shown above, or If the SMALL ENTITY is shown as NO:
A. Pay TOTAL FEE(S) DUE shown above, or
B. If applicant claimed SMALL ENTITY status before, or is now claiming SMALL ENTITY status, check box 5a on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and 1/2 the ISSUE FEE shown above.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

PTOL-85 (Rev. 02/11)
**PART B - FEE(S) TRANSMITTAL**

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**Mail**  
Mail Stop ISSUE FEE  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
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**CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)**

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KED & ASSOCIATES, LLP  
P.O. Box 8638  
Reston, VA 20195

**APPLICATION NO.** 11/872,282  
**FILING DATE** 10/15/2007  
**FIRST NAMED INVENTOR** Ho YI  
**ATTORNEY DOCKET NO.** EZ-0005  
**CONFIRMATION NO.** 8550

**TITLE OF INVENTION:** TUNER SELECTION IN DIGITAL BROADCASTING RECEIVER HAVING MULTIPLE TUNERS

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1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).  
   - Change of correspondence address (or Change of Correspondence Address form PT O/SB/122) attached.  
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3. **ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT** (print or type)  
   **PLEASE NOTE:** Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

   (A) NAME OF ASSIGNEE  
   (B) RESIDENCE: (CITY and STATE OR COUNTRY)

   Please check the appropriate assignee category or categories (will not be printed on the patent):  
   - Individual  
   - Corporation or other private group entity  
   - Government

4a. The following fee(s) are submitted:  
   - Issue Fee  
   - Publication Fee (No small entity discount permitted)  
   - Advance Order - # of Copies

4b. Payment of Fee(s): (Please first reapply any previously paid issue fee shown above)  
   - A check is enclosed.  
   - Payment by credit card. Form PTO-2038 is attached.  
   - The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number __________ (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)  
   - a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27.  
   - b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

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Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.
Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment to date is 1005 day(s). If the issue fee is paid on the date that is three months after the mailing date of this notice and the patent issues on the Tuesday before the date that is 28 weeks (six and a half months) after the mailing date of this notice, the Patent Term Adjustment will be 1005 day(s).

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.
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The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
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5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.
**Examiner-Initiated Interview Summary**

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Examiner

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All participants (applicant, applicant’s representative, PTO personnel):

1. **GIGI L. DUBASKY.**
2. **DAVID OREN**

Date of Interview: **06 March 2012.**

| Type: | Telephonic | Video Conference | Personal [copy given to: □ applicant □ applicant’s representative] |

Exhibit shown or demonstration conducted: □ Yes □ No.

If Yes, brief description: ___.

Issues Discussed □ 101 □ 112 □ 102 □ 103 □ Others

(For each of the checked box(es) above, please describe below the issue and detailed description of the discussion)

Claim(s) discussed: **13-19.**

Identification of prior art discussed: ___.

Substance of Interview

(For each issue discussed, provide a detailed description and indicate if agreement was reached. Some topics may include: identification or clarification of a reference or a portion thereof, claim interpretation, proposed amendments, arguments of any applied references etc.)

*Discussed the cancellation of claims 13-19 to put the application under allowability.*

---

**Applicant recordation instructions:** It is not necessary for applicant to provide a separate record of the substance of interview.

**Examiner recordation instructions:** Examiners must summarize the substance of any interview of record. A complete and proper recordation of the substance of an interview should include the items listed in MPEP 713.04 for complete and proper recordation including the identification of the general thrust of each argument or issue discussed, a general indication of any other pertinent matters discussed regarding patentability and the general results or outcome of the interview, to include an indication as to whether or not agreement was reached on the issues raised.

□ Attachment

/KRISTINE KINCAID/ Supervisory Patent Examiner, Art Unit 2421
**Notice of Allowability**

**Application No.**

11/872,282

**Applicant(s)**

YI, HO

**Examiner**

GI GI L. DUBASKY

**Art Unit**

2421

--- The MAILING DATE of this communication appears on the cover sheet with the correspondence address---

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. This communication is responsive to 12/13/2011.

2. An election was made by the applicant in response to a restriction requirement set forth during the interview on ____:
   - the restriction requirement and election have been incorporated into this action.

3. The allowed claim(s) is/are 1 and 3-12 which have been renumbered as 1-11.

4. Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
   - a) ☒ All  b) ☐ Some*  c) ☐ None
   - 1. ☒ Certified copies of the priority documents have been received.
   - 2. ☐ Certified copies of the priority documents have been received in Application No. ____.
   - 3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the
      International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: ____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.

**THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.**

5. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.

6. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   - (a) ☐ including changes required by the Notice of Draftperson's Patent Drawing Review (PTO-948) attached
   - 1) ☐ hereto or 2) ☐ to Paper No./Mail Date ____.
   - (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of
      Paper No./Mail Date ____.

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

7. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

**Attachment(s)**

1. ☐ Notice of References Cited (PTO-892)
3. ☒ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date ____
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
6. ☒ Interview Summary (PTO-413), Paper No./Mail Date ____
7. ☒ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other ____

/KRISTINE KINCAID/
Supervisory Patent Examiner, Art Unit 2421

U.S. Patent and Trademark Office
PTOL-37 (Rev. 03-11)
EXAMINER’S AMENDMENT

1. An examiner’s amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner’s amendment was given in a telephone interview with DAVID OREN on 03/06/2012.

The application has been amended as follows:

Cancelling claims 13-19.

2. The following is an examiner’s statement of reasons for allowance:

The arts of record either alone or in combination fails to particularly disclose or suggest the claimed limitation of "calculating a tuning completion rate of each tuner; and selecting a tuner to search channels of the satellite by referencing the calculated tuning completion rate of each tuner, wherein selecting a tuner includes selecting a tuner with a highest tuning completion rate from among the multiple tuners, and wherein the tuning completion rate is a total sum of a number of completions for the tuner over all transponders” in combination with other elements recited in the claim 1 as well as in claim 10.
Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled “Comments on Statement of Reasons for Allowance.”

**Conclusion**

Any inquiry concerning this communication or earlier communications from the examiner should be directed to GIGI L. DUBASKY whose telephone number is (571)270-5686. The examiner can normally be reached on Monday through Thursday from 8:00 AM to 5:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner’s supervisor, KRISTINE L. KINCAID can be reached on 571-272-4063. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a
USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

GD

/KRISTINE KINCAID/
Supervisory Patent Examiner, Art Unit 2421
**Search Notes**

Application/Control No. 11872282  
Applicant(s)/Patent Under Reexamination YI, HO

Examiner GIGI L DUBASKY  
Art Unit 2421

**SEARCHED**

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LIST OF ART CITED BY APPLICANT
(PTO-1449)

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OTHER ART (Including Author, Title, Date, Pertinent Pages, Publisher, Place of Publication, Etc.)

European Search Report dated October 21, 2011

/G.D./

EXAMINER
/Gigi Dubasky/

DATE CONSIDERED
03/09/2012

EXAMINER: Initial if reference has been considered, whether or not citation is in conformance with MPEP 609; draw line through citation if not in conformance and not considered. Include copy of this form with next communication to Applicant.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /G.D./
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### Issue Classification

**Application/Control No.:** 11872282  
**Applicant(s)/Patent Under Reexamination:** YI, HO

**Examiner:** GIGI L DUBASKY  
**Art Unit:** 2421

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- **(Assistant Examiner):** GIGI L DUBASKY  
  (Art Unit 2421)  
  (Date): 03/09/2012

- **(Primary Examiner):** KRISTINE KINCAID  
  (Supervisory Patent Examiner 2421)  
  (Date): 03/22/2012

**Total Claims Allowed:** 11

**O.G. Print Claim(s):** 1  
**O.G. Print Figure:** 9

U.S. Patent and Trademark Office  
Part of Paper No. 20120300
**LIST OF ART CITED BY APPLICANT**

(PTO-1449)

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**OTHER ART (Including Author, Title, Date, Pertinent Pages, Publisher, Place of Publication, Etc.)**

European Search Report dated October 21, 2011

**EXAMINER**

**DATE CONSIDERED**

**EXAMINER:** Initial if reference has been considered, whether or not citation is in conformance with MPEP 609; draw line through citation if not in conformance and not considered. Include copy of this form with next communication to Applicant.
# Electronic Acknowledgement Receipt

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<td>TUNER SELECTION IN DIGITAL BROADCASTING RECEIVER HAVING MULTIPLE TUNERS</td>
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<td>First Named Inventor/Applicant Name:</td>
<td>Ho Yi</td>
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**New Applications Under 35 U.S.C. 111**
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

**National Stage of an International Application under 35 U.S.C. 371**
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

**New International Application Filed with the USPTO as a Receiving Office**
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.
IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of Ho Yi

Confirmation No.: 8550

Group Art Unit: 2421

Serial No.: 11/872,282

Examiner: Gigi L. Dubasky

Filed: October 15, 2007

Customer No.: 34610

For: TUNER SELECTION IN DIGITAL BROADCASTING RECEIVER HAVING MULTIPLE TUNERS

INFORMATION DISCLOSURE STATEMENT

U.S. Patent and Trademark Office
Customer Service Window
Randolph Building
401 Dulany Street
Alexandria, Virginia 22314

Sirs:

Pursuant to 37 C.F.R. §1.56, the attention of the Patent and Trademark Office is hereby directed to the references listed on the attached PTO-1449. One copy of each non-U.S. reference is attached. It is respectfully requested that the information be expressly considered during the prosecution of this application, and that the reference(s) be made of record therein and appear among the “References Cited” on any patent to issue therefrom.

Applicants have listed publication dates on the attached PTO-1449 based on information presently available to the undersigned. However, the listed publication dates should not be construed as an admission that the information was actually published on the indicated date. Applicants reserve the right to establish the patentability of the claimed invention over any of the information provided herewith, and/or to prove that this information may not be prior art, and/or to prove that this information may not be enabling for the teachings purportedly offered. This statement should not be construed as a representation that a search has been made, that information cited in the statement is considered to be and/or is material to patentability, or that information more material to the examination of the present patent application does not exist. The Examiner is specifically requested not to rely solely on the material submitted herewith. It is further understood that the Examiner will consider information that was cited or submitted to the U.S. Patent and Trademark Office in a prior application relied on under 35 U.S.C. §120. 1138 OG 37, 38 (May 19, 1992).

☐ 1. This Information Disclosure Statement is being filed (i) within three months of the US. filing date of a U.S. application other than a CPA continued prosecution application under §1.53(d) OR (ii) within three months of the date of entry of the national stage as set forth in §1.491 in an international application OR (iii) before the mailing date of a first Office Action on the merits OR (iv) before the mailing of a first Office Action after the filing of a Request for continued examination under §1.114. No certification or fee is required. 37 C.F.R. §1.97(b).

☒ 2. This Information Disclosure Statement is being filed more than three months after the U.S. filing date AND after the mailing date of the first Office Action on the merits, but before the mailing date of a Final Rejection OR Notice of Allowance OR an action that otherwise closes prosecution in the application. 37 C.F.R. §1.97(c).

☒ a. I hereby state that each item of information contained in this Information Disclosure Statement was first cited in a communication from a foreign patent office in a counterpart foreign application or from the U.S. Patent Office in a related U.S. application, not more than three months prior to the filing of this Information Disclosure Statement. 37 C.F.R. §1.97(e)(1). No fee is required.
b. I hereby state that no item of information in this Information Disclosure Statement was cited in a communication from a foreign patent office in a counterpart foreign application and, to my knowledge after making reasonable inquiry, was known to any individual designated in 37 C.F.R. §1.56(c) more than three months prior to the filing of this Information Disclosure Statement. 37 C.F.R. §1.97(e)(2).

c. Please charge our Credit Card in the amount of $180.00 in payment of the fee under 37 C.F.R. §1.17(p) per the attached PTO 2038 form. Please credit or debit Deposit Account No. 16-0607 as needed to ensure consideration of the disclosed information.

☐ 3. This Information Disclosure Statement is being filed after the mailing date of a Final Rejection OR Notice of Allowance OR an action that otherwise closes prosecution in the application, but on or before payment of the Issue Fee. Please charge our Credit Card in the amount of $180.00 in payment of the fee under 37 C.F.R. §1.17(p) per the attached PTO 2038 form. Please credit or debit Deposit Account No. 16-0607 as needed to ensure consideration of the disclosed information. 37 C.F.R. §1.97(d).

a. I hereby state that each item of information contained in this Information Disclosure Statement was first cited in a communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of this Information Disclosure Statement. 37 C.F.R. §1.97(e)(1).

b. I hereby state that no item of information in this Information Disclosure Statement was cited in a communication from a foreign patent office in a counterpart foreign application or, to my knowledge after making reasonable inquiry, was known to any individual designated in 37 C.F.R. §1.56(c) more than three months prior to the filing of this Information Disclosure Statement. 37 C.F.R. §1.97(e)(2).

☐ 4. The attached European Search Report lists several references that were previously cited in a corresponding foreign application in Search Reports dated December 19, 2008 and February 9, 2009.

☐ 5. To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 16-0607 and please credit any excess fees to such deposit account.

Respectfully Submitted,
KEL & ASSOCIATES, LLP

David C. Oren
Registration No. 38,694

Correspondence Address:
P.O. Box 8638
Reston, VA 20195
Telephone: (703) 766-3777
Date: January 9, 2012
Please direct all correspondence to Customer Number 34610
DCO/sah
AMENDMENT

U.S. Patent and Trademark Office
Customer Window, Mail Stop Amendment
Randolph Building
401 Dulany Street
Alexandria, Virginia 22314

Sir:

In reply to the Office Action dated September 16, 2011, please amend the above-identified application as follows:

Amendments to the Specification are reflected in this paper.

Amendments to the Drawings are reflected in this paper.

Amendments to the Claims are reflected in the listing of claims.

Remarks begin after the listing of the claims.
AMENDMENTS TO THE SPECIFICATION:

Please replace the paragraph on page 10, lines 4-9 with the following amended paragraph:

The transponder data storage 40 stores data of a satellite connected to the digital broadcasting receiver and transponder data of the satellite. The transponder data includes frequencies, symbol rates, FEC values, and polarization of each transponder, and the transponder list and transponder data can be pre-stored in the digital broadcasting receiver, for example, by referencing a website such as www.lyngsat.com or www.sateodx.com, in which updated satellite data can be found.
AMENDMENTS TO THE DRAWINGS:

The attached drawing includes changes to FIG. 1. This sheet, which includes FIG. 1 replaces the original sheet including FIG. 1. FIG. 1 is labeled as "Prior Art" as requested in the Office Action. No new matter is added.

Attachment: Replacement Sheet
AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Currently Amended) A method of selecting a tuner in a digital broadcasting receiver having multiple tuners, comprising:

   tuning each tuner with at least one of transponder data corresponding to a satellite to be searched;

   calculating a tuning completion rate of each tuner; and

   selecting a tuner to search channels of the satellite by referencing the calculated tuning completion rate of each tuner, wherein selecting a tuner includes selecting a tuner with a highest tuning completion rate from among the multiple tuners, and

   wherein the tuning completion rate is a total sum of a number of completions for the tuner over all transponders.

2. (Canceled)

3. (Currently Amended) The method of Claim [[2]]1, wherein[[, if]] when two or more tuners have the same highest tuning completion rate, the selecting further comprises:

   determining whether or not a signal outputted from each of the tuners is identical to each other; and
when the signal output from each of the tuners is identical to each other, selecting a tuner having a higher predetermined priority.

4. (Currently Amended) The method of Claim 3, wherein when the signal output from each of the tuners is not identical to each other, a tuner is selected to correspond to an input signal for tuner selection.

5. (Original) The method of Claim 3, wherein identicalness of the signal outputted from each of the tuners is determined by interpreting PSI/SI data from a transport stream of a transponder.

6. (Currently Amended) The method of Claim 1, wherein each tuner includes tuning each tuner by use of all of the transponder data corresponding to the satellite to be searched.

7. (Currently Amended) The method of Claim 1, wherein the tuning, calculating and the selecting steps are repeated as many times as a number of antennas connected to the digital broadcasting receiver.

8. (Original) The method of Claim 1, wherein an antenna connection state of the digital broadcasting receiver is a separate type.
9. (Original) The method of Claim 1, wherein the transponder data is pre-stored in the digital broadcasting receiver.

10. (Currently Amended) A digital broadcasting receiver comprising:

    a plurality of tuners;

    a transponder data storage, in which at least one of the transponder data of a satellite to be searched is stored; and

    a controller, selecting to select one tuner to search a channel of the satellite from the plurality of tuners by referencing tuning completion rates resulted from tuning the plurality of tuners by use of the transponder data,

    wherein the controller selects a tuner having a highest tuning completion rate, and

    wherein the tuning completion rate is a total sum of a number of completions for the tuner over all transponders.

11. (Currently Amended) The digital broadcasting receiver of Claim 10, wherein the controller selects a tuner having the highest tuning completion rate, if when two or more tuners have the same highest tuning completion rate, the controller determines whether or not output signals from both tuners are identical; and

    selecting the controller selects a tuner having a predetermined higher priority [[if]when the output signals from both tuners are identical, and selecting selects a tuner corresponding to an input signal [[if]when the output signals from both tuners are not identical.
12. (Currently Amended) The digital broadcasting receiver of Claim 10, further comprising a channel data storage, storing channel data of a searched channel [[if]when the channel search by the selected tuner is stopped or completed.

13. (Currently Amended) A method of selecting a tuner in a digital broadcasting receiver having multiple tuners, comprising:

   attempting to tune each tuner by use of any one of transponder data corresponding to a satellite to be searched;

   [[if]when only one tuner completes tuning, searching a channel of the satellite with the tuner; and

   [[if]when two or more tuners complete tuning, selecting one tuner to search the channel according to [[the]] identicalness of output signals from each tuner and searching a channel of the satellite with the selected tuner.

14. (Currently Amended) The method of Claim 13, wherein, according to a result of determining the identicalness of output signals from each tuner in the selecting-step,

   a tuner having a predetermined higher priority is selected [[if]when the output signals from each tuner are identical, and

   a UI (User interface) screen for selecting a tuner to search the channel is displayed if the output signals from each tuner are not identical.
15. (Original) The method of Claim 13, wherein the identicalness of the output signals from each tuner is determined by interpreting PSI/SI data from a transport stream of a transponder.

16. (Currently Amended) A digital broadcasting receiver comprising:

   a plurality of tuners;

   a controller, selecting to select only one tuner to search a channel [if]when the tuner is the only tuner that completes tuning, and selecting the controller to select a tuner by determining whether signals outputted from each tuner are identical [if]when two or more tuners complete tuning, in accordance with a result of attempting to tune each tuner with transponder data corresponding to a satellite to be searched; and

   a user interface, displaying to display a UI (User Interface) screen to receive an input signal for selecting a tuner from the tuners that have completed tuning,

   whereas wherein the controller selects one tuner based on a predetermined priority [if]when signals outputted from the plurality of tuners completing tunings are identical, and the controller selects one tuner based on the input signal [if]when the signals outputted from the plurality of tuners are not identical.

17. (Currently Amended) The digital broadcasting receiver of Claim 16, wherein the identicalness of the signals outputted from each tuner are determined by interpreting PSI/SI data from a transport stream of a transponder according to the transponder data.
18. (Currently Amended) The digital broadcasting receiver of Claim 16, further comprising a channel data storage, storing channel data of a searched channel when the channel search by the selected tuner is stopped or completed.

19. (Currently Amended) The digital broadcasting receiver of Claim 16, wherein the user interface comprises:

   a display, displaying the UI screen; and

   an input device, receiving the input signal.
REMARKS

Claims 1 and 3-19 are pending in this application. By this Amendment, the specification and claims 1, 3, 4, 6, 7, 10-14 and 16-19 are amended and claim 2 is canceled without prejudice or disclaimer. A replacement sheet for FIG. 1 is also provided. Various amendments may be made for clarity and are unrelated to issues of patentability.

The Office Action objects to the specification. The Office Action states that page 10 of the specification contains hyperlinks. In order to further prosecution, applicant has deleted the hyperlinks from the written specification. Applicant maintains that the referenced websites remain as disclosed information. Withdrawal of the objection is respectfully requested.

The Office Action states that FIG. 1 should be labeled as “Prior Art.” The attached replacement sheet labels FIG. 1 as prior art.

The Office Action rejects claims 13 and 15 under 35 U.S.C. §102(e) by U.S. Patent 7,929,062 to Oh. The Office Action also rejects claims 1, 2, 6 and 7 under 35 U.S.C. §103(a) over Oh. The Office Action rejects claims 3-5, 8, 14 and 16-19 under 35 U.S.C. §103(a) over Oh in view of U.S. Patent Publication 2006/0035610 to Potrebic. The Office Action also rejects claims 9, 10 and 12 under 35 U.S.C. §103(a) over Oh in view of U.S. Patent 6,980,529 to Arsenault. Still further, the Office Action rejects claim 11 under 35 U.S.C. §103(a) over Oh in view of Arsenault and Potrebic. The rejections are respectfully traversed with respect to the pending claims.

Independent claim 1 recites tuning each tuner with at least one of transponder data corresponding to a satellite to be searched, and calculating a tuning completion rate of each
tuner. Independent claim 1 also recites selecting a tuner to search channels of the satellite by referencing the calculated tuning completion rate of each tuner, wherein selecting a tuner includes selecting a tuner with a highest tuning completion rate from among the multiple tuners, and wherein the tuning completion rate is a total sum of a number of completions for the tuner over all transponders.

The applied references do not teach or suggest all the features of independent claim 1. More specifically, Oh does not teach or suggest that selecting a tuner includes selecting a tuner with a highest tuning completion rate from among the multiple tuners, and wherein the tuning completion rate is a total sum of a number of completions for the tuner over all transponders. Oh merely discloses that the tuner is continuously selected. This does not suggest the claimed features relating to a tuning completion rate. When discussing previous dependent claim 2, the Office Action cites Oh's col. 10, line 57-col. 11, line 4 and lines 60-67 as teaching selecting a tuner to continuously search channels on the basis of first come, first served as soon as determining which tuner is finished tuning channels first. This does not teach or suggest selecting a tuner with a highest tuning completion rate (from among the multiple tuners), wherein the tuning completion rate is a total sum of a number of completions for the tuner over all transponders, as recited in independent claim 1.

For at least these reasons, Oh does not teach or suggest all the features of independent claim 1. Potrebic and Arsenault do not teach or suggest the missing features of independent claim 1. Independent claim 1 therefore defines patentable subject matter.
Independent claim 10 recites a plurality of tuners, a transponder data storage to store transponder data of satellite to be searched, and a controller to select one tuner to search a channel of the satellite from the plurality of tuners by referencing tuning completion rates resulted from tuning the plurality of tuners by use of the transponder data. Independent claim 10 also recites that the controller selects a tuner having a highest tuning completion rate, and wherein the tuning completion rate is a total sum of a number of completions for the tuner over all transponders.

For at least similar reasons as set forth above, the applied references do not teach or suggest all the features of independent claim 10. More specifically, Oh, Potrebic and Arsenault do not teach or suggest a controller to select one tuner by referencing tuning completion rates, and that the controller selects a tuner having a highest tuning completion rate, and wherein the tuning completion rate is a total sum of a number of completions for the tuner over all transponders, as recited in independent claim 10. Accordingly, independent claim 10 defines patentable subject matter.

Independent claim 13 recites attempting to tune each tuner by use of transponder data corresponding to a satellite to be searched. Independent claim 13 also recites that when only one tuner completes tuning, searching a channel of the satellite with the tuner. Independent claim 13 also recites that when two or more tuners complete tuning, selecting one tuner to search the channel according to identicalness of output signals from each tuner and searching a channel of the satellite with the selected tuner.
For at least similar reasons as set forth above, the applied references do not teach or suggest all the features of independent claim 13. More specifically, Oh does not teach or suggest when only one tuner completes tuning, searching a channel of the satellite with the tuner, and when two or more tuners complete tuning, selecting one tuner to search the channel according to identicalness of output signals from each tuner and searching a channel of the satellite with the selected tuner, as recited in independent claim 13. Oh relates to using a plurality of tuners in parallel, by assuming that all tuners are already tuned.

The Office Action (on page 4) states that Oh’s col. 11, line 62-col. 12, line 3 discloses selecting one tuner to continue searching channel on a first come-first served basis as soon as two or more tuners finish the scanning according to output signals from each tuner. The Office Action interprets that output signals indicating empty channel from the tuners are identical. Oh does not teach or suggest that when two or more tuners complete tuning, selecting one tuner to search the channel according to identicalness of output signals from each tuner and searching a channel of the satellite with the selected tuner, as recited in independent claim 13.

For at least these reasons, Oh does not teach or suggest the features of independent claim 13. Potrebic and Arsenault do not teach or suggest the missing features of independent claim 13. Accordingly, independent claim 13 defines patentable subject matter.

Independent claim 16 recites a plurality of tuners, and a controller to select only one tuner to search a channel when the tuner is the only tuner that completes tuning, and the controller to select a tuner by determining whether signals outputted from each tuner are identical when two or more tuners complete tuning, in accordance with a result of attempting to
tune each tuner with transponder data corresponding to a satellite to be searched. Independent claim 16 also recites a user interface to display a UI (User Interface) screen to receive an input signal for selecting a tuner from the tuners that have completed tuning. Independent claim 16 also recites that the controller selects one tuner based on a predetermined priority when signals outputted from the plurality of tuners completing tunings are identical, and the controller selects one tuner based on the input signal when the signals outputted from the plurality of tuners are not identical.

For at least similar reasons as set forth above, the applied references do not teach or suggest all the features of independent claim 16. More specifically, Oh, Potrebic and Arsenault do not teach or suggest that the controller selects one tuner based on a predetermined priority when signals outputted from the plurality of tuners completing tunings are identical, and the controller selects one tuner based on the input signal when the signals outputted from the plurality of tuners are not identical, as recited in independent claim 16. Accordingly, independent claim 16 defines patentable subject matter.

For at least the reasons set forth above, each of independent claims 1, 10, 13 and 16 defines patentable subject matter. Each of the dependent claims depends from one of the independent claims and therefore defines patentable subject matter at least for this reason. In addition, the dependent claims recite features that further and independently distinguish over the applied references.
CONCLUSION

In view of the foregoing, it is respectfully submitted that the application is in condition for allowance. Favorable consideration and prompt allowance of claims 1 and 3-19 are earnestly solicited. If the Examiner believes that any additional changes would place the application in better condition for allowance, the Examiner is invited to contact the undersigned attorney at the telephone number listed below.

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this, concurrent and future replies, including extension of time fees, to Deposit Account 16-0607 and please credit any excess fees to such deposit account.

Respectfully submitted,
KED & ASSOCIATES, LLP

[Signature]
David C. Oren
Registration No. 38,694

Attachment: Replacement FIG. 1

Correspondence Address:
P.O. Box 8638
Reston, VA 20195
703 766-3777 DCO/kah
Date: December 13, 2011
Please direct all correspondence to Customer Number 34610
FIG. 1
PRIOR ART

START

SET ANTENNA CONNECTION STATE

SET ANTENNA

SELECT TUNER

SEARCH CHANNEL

END
## Electronic Acknowledgement Receipt

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<td>Ho YI</td>
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- Submitted with Payment: no

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This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.
IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of

Ho Yi

Confirmation No.: 8550
Group Art Unit: 2421
Examiner: Gigi L. Dubasky

Serial No: 11/872,282
Customer No.: 34610

Filed: October 15, 2007

For: TUNER SELECTION IN DIGITAL BROADCASTING RECEIVER HAVING MULTIPLE TUNERS

U.S. Patent and Trademark Office
Customer Window, Mail Stop Amendment
Randolph Building
401 Dulany Street
Alexandria, Virginia 22314

Dear Sir:

Transmitted herewith is an Amendment and/or Reply in the above identified application.

[ ] No additional fee is required.
[ ] Also attached: Replacement FIG. 1

The fee has been calculated as shown below:

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If multiple claims newly presented, add $450.00 $0.00
Fee for extension of time $0.00

TOTAL FEE DUE $0.00

[ ] The Commissioner is hereby authorized to charge payment of any fees associated with this communication or credit any overpayment, to Deposit Account No. 16-0607, including any filing fees under 37 C.F.R. 1.16 for presentation of extra claims and any patent application processing fees under 37 C.F.R. 1.17.

Respectfully submitted,

[Signature]
David C. Oren
Registration No. 38,694

Correspondence Address:
P.O. Box 8638
Reston, VA  20195
(703) 766-3777  DCO/ta

Date: December 13, 2011

Please direct all correspondence to Customer Number 34610
**PATENT APPLICATION FEE DETERMINATION RECORD**

**APPLICATION AS FILED – PART I**

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**MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))**

* If the difference in column 1 is less than zero, enter “0” in column 2.

**APPLICATION AS AMENDED – PART II**

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**FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))**

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**CLAIMS REMAINING AFTER AMENDMENT**

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- **PRESENT EXTRA**

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Legal Instrument Examiner: /GAIL WOOTEN/

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* If the entry in column 1 is less than the entry in column 2, write “0” in column 3.
** If the “Highest Number Previously Paid For” in this space is less than 20, enter “20”.
*** If the “Highest Number Previously Paid For” in this space is less than 3, enter “3”.

The “Highest Number Previously Paid For” (Total or Independent) is the highest number found in the appropriate box in column 1.

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.
Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.
Office Action Summary

Application No. 11/872,282

Applicant(s) YI, HO

Examiner GIGI L. DUBASKY

Art Unit 2421

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).

Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) ☒ Responsive to communication(s) filed on 15 October 2007.
2a) ☐ This action is FINAL.
2b) ☒ This action is non-final.
3) ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on ___; the restriction requirement and election have been incorporated into this action.
4) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under Ex parte Quayle, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

5) ☒ Claim(s) 1-19 is/are pending in the application.
5a) ☐ Of the above claim(s) ____ is/are withdrawn from consideration.
6) ☐ Claim(s) ____ is/are allowed.
7) ☐ Claim(s) 1-19 is/are rejected.
8) ☐ Claim(s) ____ is/are objected to.
9) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

10) ☒ The specification is objected to by the Examiner.
11) ☐ The drawing(s) filed on 15 October 2007 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
12) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☒ All  b) ☐ Some  c) ☐ None of:
   1. ☒ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. ____.
   3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

   * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson’s Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08)
   Paper No(s)/Mail Date ____.
4) ☒ Interview Summary (PTO-413)
   Paper No(s)/Mail Date ____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: ____.
DETAILED ACTION

Specification

1. The disclosure is objected to because it contains an embedded hyperlink and/or other form of browser-executable code on page 10. Applicant is required to delete the embedded hyperlink and/or other form of browser-executable code. See MPEP § 608.01.

Drawings

2. Figure 1 should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g). Corrected drawings in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. The replacement sheet(s) should be labeled “Replacement Sheet” in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.
Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

4. Claims 13 and 15 are rejected under 35 U.S.C. 102(e) as being anticipated by Oh (US 7929062).

Regarding claim 13, Oh discloses a method of selecting a tuner in a digital broadcasting receiver having multiple tuners (see Figure 1 for digital broadcast receiver having multiple tuners 10a-c), comprising:

- attempting to tune each tuner by use of any one of transponder data corresponding to a satellite to be searched (Col 1 lines 42-44 for receiving a plurality of broadcast channels from sources such as satellite; Col 11 lines 17-19 and 42-48 for tuning all tuners in a predetermined channel of entire frequency range (as “transponder data” in the case of satellite source) to be searched);

- if only one tuner completes tuning, searching a channel of the satellite with the tuner (Col 11 lines 62-67 for selecting a tuner to continue searching channel on a first come first served basis as soon as one of them finishes the scanning); and
if two or more tuners complete tuning, selecting one tuner to search the channel according to the identicalness of output signals from each tuner (Col 11 line 62 through Col 12 line 3 for selecting one tuner to continue searching channel on a first come first served basis as soon as two or more tuners finish the scanning according to output signals from each tuner determining that whether the channel is empty. By reading the limitation in a broadest reasonable sense, the output signals indicating empty channel from the tuners are identical).

Regarding claim 15, Oh discloses the method as discussed in the rejection of claim 13. The combined system further discloses identicalness of the signal outputted from each of the tuners is determined by interpreting PSI/SI data from a transport stream of a transponder (Col 9 lines 10-50).

**Claim Rejections - 35 USC § 103**

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

   (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negativized by the manner in which the invention was made.

6. Claims 1-2 and 6-7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Oh (US 7929062).
Regarding claim 1, Oh discloses method of selecting a tuner in a digital broadcasting receiver having multiple tuners (see Figure 1 for digital broadcast receiver having multiple tuners 10a-c), comprising:
tuning each tuner with at least one of transponder data corresponding to a satellite to be searched (Col 1 lines 42-44 for receiving a plurality of broadcast channels from sources such as satellite; Col 7 lines 53-61 (first embodiment) and Col 9 lines 62-64 (second embodiment) for tuning each of tuners in a predetermined channel of whole frequency range or respective sub frequency ranges (as “transponder data” in the case of satellite source) to be searched).

Oh’s first or second embodiment does not explicitly disclose calculating a tuning completion rate of each tuner and selecting a tuner to search channels of the satellite referencing the tuning completion rate of each tuner.

However, by reading the limitations in a broadest reasonable sense, in the fourth embodiment, Oh teaches the above limitations as follows: Oh discloses selecting a tuner to continuously search or scan channels on the basis of first come, first served as soon as determining that the tuning channel(s) finishing (completion) of each tuner (Col 11 lines 60-67). One ordinary skill in the art would obviously recognize that Oh’s system in the fourth embodiment enables to determine or calculate tuning completion rate of each tuner and to select a tuner to search channels based on the determination.

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention was made to modify the Oh’s first or second embodiment with the teaching of selecting a tuner to search channels based on the determination of tuning
completion or finishing rate of each tuner as taught in Oh's fourth embodiment, so to accurately and quickly select a fast tuner among a plurality of tuners to search channels or to do other subsequent functions in an automatic manner in order to fulfill user's satisfaction.

Regarding claim 2, Oh discloses the method as discussed in the rejection of claim 1. Oh further discloses a tuner with the highest tuning completion rate is selected from the multiple tuners (Col 10 line 57 through Col 11 line 4 and Col 11 lines 60-67 for selecting a tuner to continuously search channels on the basis of first come, first served as soon as determining that which of tuner is finished tuning channels first).

Regarding claim 6, Oh discloses the method as discussed in the rejection of claim 1. Oh further discloses the tuning tunes each tuner by use of all of the transponder data corresponding to the satellite to be searched (Col 12 lines 8-10).

Regarding claim 7, Oh discloses the method as discussed in the rejection of claim 1. Oh further discloses the tuning to selecting steps are repeated as many times as the number of antennas connected to the digital broadcasting receiver (see Figures 4, 8 and 10-11 for repeating the tuning to selecting steps as many times as number of tuners and number of channels in entire frequency ranges; see Figure 2 for connecting antenna 11 to a pair of tuner 10a and demodulator 20a to receive a plurality of broadcast signals; and Col 5 lines 57-60 for also applying the same operation of tuner
10a to tuners 10b and 10c. It is obvious that Oh’s broadcast receiver is connected to
number of antennas 11 corresponding to number of tuners 10).

7. Claims 3-5, 8, 14 and 16-19 are rejected under 35 U.S.C. 103(a) as being
unpatentable over Oh (US 7929062) in view of Potrebic (US 2006/0035610).

    Regarding claim 3, Oh discloses the method as discussed in the rejection of
claim 2. Oh further discloses each tuner may spend different amount of time to scan a
channel in either case of empty channel or case of channel containing data (Col 8 lines
1-16).

    When tuners are identical in type and capacity, there will be a case that those
identical tuners spend the same amount of time to scan a channel (which means that
they have “the same tuning completion rate”). It is obvious to modify Oh system with
some tuners that are identical, so to provide an enhanced system having a plurality of
tuners but also being capable of handling both different and same types of tuners in a
flexible manner.

    Oh discloses each tuner detects program association table (PAT) in the scanning
channel to output a signal determining whether or not channel is empty (Col 8 lines 36-
42 and Col 9 lines 10-43), which means that the same signal indicating empty channel
is outputted from each of tuners when there is no detection of PAT in scanning channel.
By reading the limitation in a broadest reasonable sense, Oh discloses the limitation of
“determining whether or not a signal outputted from each of the tuners is identical to
each other”.

Oh fails to disclose selecting a tuner having a higher predetermined priority.

Potrebic discloses a broadcast receiver having a plurality of tuners (Figures 2-3). Potrebic discloses tuners are prioritized and assigned or selected a task according to their higher predetermined priorities (¶ [0030] and ¶ [0058]-[0066]).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention was made to modify Oh’s system with the teaching of Potrebic about prioritizing tuners and selecting a tuner for a task according to its higher predetermined priority, so to provide an enhanced system with a better and more organized selection of tuners for a task in a priority manner.

Regarding claim 4, Oh in view of Potrebic discloses the method as discussed in the rejection of claim 3. The combined system further discloses if the signal is not identical to each other, a tuner is selected to correspond to an input signal for tuner selection (taught by Potrebic; ¶ [0118] and ¶ [0125]).

Regarding claim 5, Oh in view of Potrebic discloses the method as discussed in the rejection of claim 3. The combined system further discloses identicalness of the signal outputted from each of the tuners is determined by interpreting PSI/SI data from a transport stream of a transponder (taught by Oh; Col 9 lines 10-50).
Regarding claim 8, Oh discloses the method as discussed in the rejection of claim 1. Oh does not explicitly disclose an antenna connection state of the digital broadcasting receiver is a separate type.

Potrebic discloses a broadcast receiver having a plurality of tuners which are connected to number of antennas to receive broadcast signals from multiple sources such as over the air, satellite, cable... (Figures 2-3). The antenna for receiving signals over the air 102 and the antenna for receiving signals from satellite 108 are separate type to receiving signals from two separate sources.

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention was made to modify Oh’s antenna system with the Potrebic's separate typed antennas system, so to enhance the broadcast receiver with the ability of receiving broadcast signals from a plurality of different sources.

Regarding claim 14, Oh discloses the method as discussed in the rejection of claim 13. Oh further discloses each tuner detects program association table (PAT) in the scanning channel to output a signal determining whether or not channel is empty (Col 8 lines 36-42 and Col 9 lines 10-43), which means that the same signal indicating empty channel is outputted from each of tuners when there is no detection of PAT in scanning channel. By reading the limitation in a broadest reasonable sense, Oh discloses the limitation of “determining the identicalness of output signals from each tuner”.
Oh fails to disclose a tuner having a predetermined higher priority is selected and a UI (User interface) screen for selecting a tuner to search the channel is displayed if the output signals are not identical.

Potrebic discloses a broadcast receiver having a plurality of tuners (Figures 2-3). Potrebic discloses that tuners are prioritized and assigned or selected a task according to their higher predetermined priorities (¶ [0030] and ¶ [0058]-[0066]). Potrebic also discloses if the signal outputted from both tuners are different about access quality, selecting a tuner corresponding to a user input signal selection through a user interface (¶ [0098], ¶ [0118] and ¶ [0125]).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention was made to modify the system of Oh with the teaching of Potrebic about prioritizing tuners and selecting a tuner for a task according to its higher predetermined priority or according to user's selection, so to provide an enhanced system which not only automatically select a tuner for a task based on its priority but also allows user to choose a tuner for a task on his or her own choice.

Regarding claim 16, Oh discloses a digital broadcasting receiver (Figure 1) comprising:
a plurality of tuners (tuners 10a-10c);
a controller (CPU 90), selecting only one tuner to search a channel if the tuner is the only tuner that completes tuning (Col 11 lines 62-67 for selecting a tuner to continue searching channel on a first come first served basis as soon as one of them finishes the
scanning), and selecting a tuner by determining whether signals outputted from each tuner are identical if two or more tuners complete tuning (Col 11 line 62 through Col 12 line 3 for selecting one tuner to continue searching channel on a first come first served basis as soon as two or more tuners finish the scanning according to output signals from each tuner determining that whether the channel is empty. By reading the limitation in a broadest reasonable sense, the output signals indicating empty channel from the tuners are identical), in accordance with a result of attempting to tune each tuner with transponder data corresponding to a satellite to be searched (Col 1 lines 42-44 for receiving a plurality of broadcast channels from sources such as satellite; Col 11 lines 17-19 and 42-48 for tuning all tuners in a predetermined channel of entire frequency range (as “transponder data” in the case of satellite source) to be searched).

Oh further discloses each tuner detects program association table (PAT) in the scanning channel to output a signal determining whether or not channel is empty (Col 8 lines 36-42 and Col 9 lines 10-43), which means that the same signal indicating empty channel is outputted from each of tuners when there is no detection of PAT in scanning channel. By reading the limitation in a broadest reasonable sense, Oh discloses the limitation of “determining whether signals outputted from each tuner are identical”.

Oh fails to disclose a tuner having a predetermined higher priority is selected and a user interface, displaying a UI (User Interface) screen, to receive an input signal for selecting a tuner to search the channel is displayed if the output signals are not identical.
Potrebic discloses a broadcast receiver having a plurality of tuners (Figures 2-3). Potrebic discloses tuners are prioritized and assigned or selected a task according to their higher predetermined priorities (¶ [0030] and ¶ [0058]-[0066]). Potrebic also discloses if the signal outputted from both tuners are different about access quality, selecting a tuner corresponding to a user input signal selection through a user interface (¶ [0098], ¶ [0118] and ¶ [0125]).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention was made to modify the system of Oh with the teaching of Potrebic about prioritizing tuners and selecting a tuner for a task according to its higher predetermined priority or according to user's selection, so to provide an enhanced system which not only automatically select a tuner for a task based on its priority but also allows user to choose a tuner for a task on his or her own choice.

Regarding claim 17, Oh in view of Potrebic discloses the method as discussed in the rejection of claim 16. The combined system further discloses identicalness of the signal outputted from each of the tuners is determined by interpreting PSI/SI data from a transport stream of a transponder (taught by Oh; Col 9 lines 10-50).

Regarding claim 18, Oh in view of Potrebic discloses the digital broadcast receiver as discussed in the claim 16. The combined system further discloses a channel data storage, storing channel data of a searched channel if the channel search by the
selected tuner is stopped or completed (taught by Oh; Col 8 lines 43-48, Col 10 lines 19-24 and lines 51-56).

Regarding claim 19, Oh in view of Potrebic discloses the digital broadcast receiver as discussed in the claim 16. The combined system, Potrebic per se, further discloses the user interface comprises: a display (display 891 in Figure 8), displaying the UI screen; and an input device (elements 861 and 862 in Figure 8), receiving the input signal.

8. Claims 9-10 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Oh (US 7929062) in view of Arsenault (US 6980529).

Regarding claim 9, Oh discloses the method as discussed in the rejection of claim 1. Oh does not explicitly disclose the transponder data is pre-stored in the digital broadcasting receiver.

Arsenault discloses a digital broadcast receiver (Figure 3) pre-stores data such as network IDs and polarities of satellite frequencies (as “transponders”) (Col 6 lines 14-26).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention was made to modify Oh’s broadcast receiver with the teaching of pre-storing transponder data in the broadcast receiver as taught by Arsenault, so to enhance the broadcast receiver with the capability of more efficiently searching channel data of only transponders whose information are pre-stored in the broadcast receiver.
Regarding claim 10, Oh discloses a digital broadcasting receiver (Figure 1) comprising:

a plurality of tuners (tuners 10a-10c); and

a controller (CPU 90), selecting one tuner to search a channel of the satellite from the plurality of tuners by referencing tuning completion rates resulted from tuning the plurality of tuners by use of the transponder data (Col 11 lines 42-67 for tuning tuners in to the same first channel of entire frequency range and selecting a tuner to continuously search or scan channels on the basis of first come, first served as soon as determining that the tuning channel(s) finishing (completion) of each tuner).

Oh does not explicitly disclose a transponder data storage, in which at least one of transponder data of satellite to be searched is stored.

Arsenault discloses a digital broadcast receiver (Figure 3) stores in a memory the data such as network IDs and polarities associated with satellite frequencies (as “transponders”) to be retrieved and searched (Col 6 lines 14-26).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention was made to modify Oh’s broadcast receiver with the teaching of storing transponder data in the broadcast receiver as taught by Arsenault, so to enhance the broadcast receiver with the capability of more efficiently searching channel data of only transponders whose information are stored in the broadcast receiver.
Regarding claim 12, Oh in view of Arsenault discloses the digital broadcast receiver as discussed in the claim 10. The combined system further discloses a channel data storage, storing channel data of a searched channel if the channel search by the selected tuner is stopped or completed (taught by Oh; Col 8 lines 43-48, Col 10 lines 19-24 and lines 51-56).

9. Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Oh (US 7929062) in view of Arsenault (US 6980529) and further in view of Potrebic (US 2006/0035610).

Regarding claim 11, Oh in view of Arsenault discloses the digital broadcast receiver as discussed in claim 10. Oh in view of Arsenault further discloses the controller (CPU 90 in Oh’s Figure 1):

selects a tuner having the highest tuning completion rate (taught by Oh; Col 10 line 57 through Col 11 line 4 and Col 11 lines 60-67 for selecting a tuner to continuously search channels on the basis of first come first served as soon as determining that which tuner is finished tuning channels first);

if two or more tuners have the same highest tuning completion rate, determines whether or not output signals from both tuner are identical (Oh further discloses each tuner may spend different amount of time to scan a channel which is empty or contains channel data (Col 8 lines 1-16). Obviously, there will be a case that two or more tuners spend the same amount of time to scan a channel which means that they have the same tuning completion rate. Oh discloses each tuner detects program association table
(PAT) in the scanning channel to output a signal determining whether or not channel is empty (Col 8 lines 36-42 and Col 9 lines 10-43), which means that the same signal indicating empty channel is outputted from each of tuners when there is no detection of PAT in scanning channel. By reading the limitation in a broadest reasonable sense, Oh discloses the limitation of “determining whether or not output signals from both tuners are identical”).

Oh in view of Arsenaught does not disclose selecting a tuner having a predetermined higher priority, and selecting a tuner corresponding to an input signal if the output signals are not identical.

Potrebic discloses a broadcast receiver having a plurality of tuners (Figures 2-3). Potrebic discloses tuners are prioritized and assigned or selected a task according to their higher predetermined priorities (¶ [0030] and ¶ [0058]-[0066]). Potrebic also discloses if the signal outputted from both tuners are different about access quality, selecting a tuner corresponding to a user input signal selection through a user interface (¶ [0098], ¶ [0118] and ¶ [0125]).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention was made to modify the system of Oh in view of Arsenaught with the teaching of Potrebic about prioritizing tuners and selecting a tuner for a task according to its higher predetermined priority or according to user’s selection, so to provide an enhanced system which not only automatically select a tuner for a task based on its priority but also allows user to choose a tuner for a task on his or her own choice.
Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to GIGI L. DUBASKY whose telephone number is (571)270-5686. The examiner can normally be reached on Monday through Thursday from 8:00 AM to 5:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner’s supervisor, KRISTINE L. KINCAID can be reached on 571-272-4063. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

GD
/KRISTINE KINCAID/
Supervisory Patent Examiner, Art Unit 2421
### U.S. PATENT DOCUMENTS

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* A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)

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# Index of Claims

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- **Rejected**
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- **Non-Elected**
- **Interference**
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- **Objected**

- **Claims renumbered in the same order as presented by applicant**
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(PTO-1449)

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European Search Report dated February 9, 2009

EXAMINER /Gigi Dubasky/   DATE CONSIDERED 08/15/2011

EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 600; draw line through citation if not in conformance and not considered. Include copy of this form with next communication to Applicant.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /G.D./
**BIB DATA SHEET**

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**APPLICANTS**
Ho Yi, Seongnam-si, KOREA, REPUBLIC OF;

**CONTINUING DATA**

**FOREIGN APPLICATIONS**

**IF REQUIRED, FOREIGN FILING LICENSE GRANTED**
10/30/2007

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**ADDRESS**
KED & ASSOCIATES, LLP
P.O. Box 8638
Reston, VA 20195
UNITED STATES

**TITLE**
TUNER SELECTION IN DIGITAL BROADCASTING RECEIVER HAVING MULTIPLE TUNERS

**FILING FEE RECEIVED**
1370

FEES: Authority has been given in Paper No.________ to charge/credit DEPOSIT ACCOUNT No.________ for following:

- All Fees
- 1.16 Fees (Filing)
- 1.17 Fees (Processing Ext. of time)
- 1.18 Fees (Issue)
- Other __________
- Credit

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**(PTO-1449)**

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**U.S. PATENT APPLICATIONS**

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**OTHER ART (Including Author, Title, Date, Pertinent Pages, Publisher, Place of Publication, Etc.)**


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**EXAMINER**

/Gigi Dubasky/

**DATE CONSIDERED**

08/15/2011

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**EXAMINER** Initial if reference considered, whether or not citation is in conformance with MPEP 609; draw line through citation if not in conformance and not considered. Include copy of this form with next communication to Applicant.

**ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /G.D./**
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<td>(each tuner or plurality near 2 tuner) same (tun $3) with (transponder or TP)</td>
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<td>(plurality near 2 tuner) same (transponder or TP) same satellite</td>
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<td>46</td>
<td>(plurality near 2 tuner) and (transponder or TP) and (auto or automatic $4) with (tun $3 or channel near 2 scan $4 or channel set $3 up)</td>
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<td>(detect $3 or determin $3) with tune $3 with (complet $3 or finish $3 or success $6) with (ratio or rate or speed or time)</td>
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<td>2</td>
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<td>(select$3 or choos$3) with fast near3 tuner with (search$3 or tun$3 or scan$4) with channel</td>
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<td>S64</td>
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<td>(select$3 or choos$3) with fast with tuner with (search$3 or tun$3 or scan$4)</td>
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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of Ho YI Serial No.: 11/872,282
Confirmation No.: 8550
Group Art Unit: 2622
Examiner: David L. Ometz

Customer No.: 34610
Filed: 10/15/2007

For: TUNER SELECTION IN DIGITAL BROADCASTING RECEIVER HAVING MULTIPLE TUNERS

INFORMATION DISCLOSURE STATEMENT

U.S. Patent and Trademark Office
Customer Service Window
Randolph Building
401 Dulany Street
Alexandria, Virginia 22314

Sir:

Pursuant to 37 C.F.R. §1.56, the attention of the Patent and Trademark Office is hereby directed to the references listed on the attached PTO-1449. One copy of each non-U.S. reference is attached. It is respectfully requested that the information be expressly considered during the prosecution of this application, and that the references be made of record therein and appear among the "References Cited" on any patent to issue therefrom.

Applicants have listed publication dates on the attached PTO-1449 based on information presently available to the undersigned. However, the listed publication dates should not be construed as an admission that the information was actually published on the indicated date. Applicant reserves the right to establish the patentability of the claimed invention over any of the information provided herewith, and/or to prove that this information may not be prior art, and/or to prove that this information may not be enabling for the teachings purportedly offered. This statement should not be construed as a representation that a search has been made, that information cited in the statement is considered to be and/or is material to patentability, or that information more material to the examination of the present patent application does not exist. The Examiner is specifically requested not to rely solely on the material submitted herewith. It is further understood that the Examiner will consider information that was cited or submitted to the U.S. Patent and Trademark Office in a prior application relied on under 35 U.S.C. §120. 1138 OG 37, 38 (May 19, 1992).

☒ 1. This Information Disclosure Statement is being filed (i) within three months of the U.S. filing date of a U.S. application other than a CPA continued prosecution application under §1.53(d) OR (ii) within three months of the date of entry of the national stage as set forth in §1.491 in an international application OR (iii) before the mailing date of a first Office Action on the merits OR (iv) before the mailing of a first Office Action after the filing of a Request for continued examination under §1.114. No certification or fee is required. 37 C.F.R. §1.97(b).

☐ 2. This Information Disclosure Statement is being filed more than three months after the U.S. filing date AND after the mailing date of the first Office Action on the merits, but before the mailing date of a Final Rejection OR Notice of Allowance OR an action that otherwise closes prosecution in the application. 37 C.F.R. §1.97(c).

☐ a. I hereby state that each item of information contained in this Information Disclosure Statement was first cited in a communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of this Information Disclosure Statement. 37 C.F.R. 1.97(e)(1).
b. I hereby state that no item of information in this Information Disclosure Statement was cited in a communication from a foreign patent office in a counterpart foreign application and, to my knowledge after making reasonable inquiry, was known to any individual designated in 37 C.F.R. §1.56(c) more than three months prior to the filing of this Information Disclosure Statement. 37 C.F.R. 1.97(e)(2). No fee is required.

c. Attached is our check no. _____ in the amount of $180.00 in payment of the fee under 37 C.F.R. 1.17(p). Please credit or debit Deposit Account No. 16-0607 as needed to ensure consideration of the disclosed information.

3. This Information Disclosure Statement is being filed after the mailing date of a Final Rejection OR Notice of Allowance OR an action that otherwise closes prosecution in the application, but on or before payment of the Issue Fee. Attached is our check no. _____ in the amount of $180.00 in payment of the fee under 37 C.F.R. 1.17(p). Please credit or debit Deposit Account No. 16-0607 as needed to ensure consideration of the disclosed information. 37 C.F.R. §1.97(d).

a. I hereby state that each item of information contained in this Information Disclosure Statement was first cited in a communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of this Information Disclosure Statement. 37 C.F.R. 1.97(e)(1).

b. I hereby state that no item of information in this Information Disclosure Statement was cited in a communication from a foreign patent office in a counterpart foreign application or, to my knowledge after making reasonable inquiry, was known to any individual designated in 37 C.F.R. §1.56(c) more than three months prior to the filing of this Information Disclosure Statement. 37 C.F.R. 1.97(e)(2).

4. The references were cited in a corresponding foreign application in a Search Report dated February 9, 2009.

5. To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 16-0607 and please credit any excess fees to such deposit account.

Respectfully submitted,
KED & ASSOCIATES, LLP

David C. Oren
Registration No. 38,694

Correspondence Address:
P.O. Box 221200
Chantilly, VA 20153-1200
Telephone: (703) 766-3777
Date: May 11, 2009
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<th>*ISSUE DATE</th>
<th>*INVENTOR NAME</th>
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<td></td>
<td>5,757,441</td>
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**OTHER ART (Including Author, Title, Date, Pertinent Pages, Publisher, Place of Publication, Etc.)**

European Search Report dated February 9, 2009

EXAMINER

DATE CONSIDERED

**EXAMINER:** Initial if reference considered, whether or not citation is in conformance with MPEP 609; draw line through citation if not in conformance and not considered. Include copy of this form with next communication to Applicant.
(54) System for transmission and reception of radio programmes carrying a prefixed code, allowing the automatic search of these programmes, irrespective of the transmitter which broadcasts these programmes: programme link system

(57) This is a system for transmitting, receiving and listening to a program/piece prefixed and identified by a code, whatever the station which transmits that program/piece may be, provided that it has to be preceded by the broadcast of the identification code of the program itself. As this code can be transmitted together with the actual FDS/PAD signal by adding only some bit in the end, the following description is, in short, based on the variations of the project, which the radioreceivers need to make use of this additional code for the automatic search of the program/piece.

BLOCK DIAGRAM ENCLOSED WITH AN APPLICATION FOR A PATENT ENTITLED:
SYSTEM FOR TRANSMISSION AND RECEPTION OF RADIO PROGRAMMES/Pieces JOINED TO A PREFIXED CODE WHICH ALLOWS THE AUTOMATIC SEARCH OF THIS PROGRAM/Piece, QUITE APART FROM THE TRANSMITTER: PROGRAM LINK SYSTEM (PLS
This is a system for transmitting, receiving and listening to a program/piece which is prefixed and identified by a code. One can achieve it whatever the station which transmits that program/piece may be, provided that it has to be preceded by the broadcast of the identification code of the program/piece itself.

You can transmit the code making use of the actual criterion for the transmission of the RDS/PAD signal adding, immediately afterwards, the identifying code of the transmitter (which we will call RDSE/PADE), a further code for the identification of the program/piece (which we will call RDSP/PADP), which will be present in the transmitted signal for all the duration of the program/piece itself (or a little more, if you want some spot to go before or after).

Therefore, the transmission of the identifying code of the program/piece doesn’t require substantial alterations in the RDS/PAD system which in use at the moment. But it is necessary to link the beginning of a prefixed program/piece to the insertion of its code after the RDS/PAD signal.

This code can have two or more digits according to as many programs as you want to put in the list of the programs which can be preset.

The transmitters which are interested in this project will have, obviously, to agree on and draw up a CODES / PROGRAMS / PIECES list which, then, the common communications channels used by the press specialized in radio programs will circulate to the users.

Concerning the reception, on the contrary, it is necessary to provide the radio receiver set with appropriate circuits which allow the correct use of the system.

The block diagram in the picture 1 reports, in a very schematic way, those which are the basic elements of a radio receiver today: a tuner (1), a decoder of the RDS/PAD signal which, in turn, controls the tuner (1), a medium frequency amplifier, a discriminator for the audio signal revelation and, therefore, the low frequency preamplification and amplification phases which control the loudspeaker. There is, obviously, a luminous display which visualizes the current information.

The same picture, in the dotted square, reports the more blocks required to receive and use the RDSP/PADP system with the relative interconnections: a second tuner (2), a decoder of the RDS/PAD signal (which will be able to decodify the RDSP/PADP signal), a code selector with its memory and a counter, a comparator and a tuner selector.

When you turn the apparatus on, the tuner selector is in a stand by position and allows the signal which is tuned by the tuner 1 to pass toward the medium frequency and the listening circuits (and it allows the indications toward the luminous display too), as it normally happens in actual radio receivers. At the same time, the Tuner 2 starts its automatic search and begins to explore all the frequencies of the selected band.

At every received frequency, the system decodifies the RDS/PAD signal, separates the RDSP/PADP signal and presents it to a comparator which compares it with that coming from the preset programs/pieces selector. This comparison happens, obviously, for every frequency tuned during the automatic search of the Tuner 2. Only if the two signals coincide the comparator activates a MATCH signal which, in turn, sets the following functions:

1. It cuts the automatic search of the Tuner 2 off, jamming it on the frequency which contains, in RDS/PAD, the preset RDSP/PADP code; this frequency can concern, obviously, any transmitter, quite apart from what you are listening to by means of the Tuner 1;

2. It makes the tuner selector switch over in order to present to the luminous display the information concerning the Tuner 2 and to the MF and audio circuits the program/piece received by the Tuner 2, which corresponds to the program/piece prefixed by the user and selected through the program/piece selector in order to allow you to listen to it in loudspeaker.

At the end of the program/piece, the transmitter stops transmitting the RDSP/PADP signal, so the comparator switches the MATCH signal off. Because of this:

1. The tuner selector doesn’t work any more and so the data and the program/piece the user was previously listening to will appear on the display and in the loudspeaker again;

2. The Tuner 2 releases itself so that it can start the automatic search again;

3. The counter of the program/piece selector goes on in order to present to the comparator the second program/piece selected by the user.

At this point the process will happen again (as we have already described) until a selected program/piece is present on the comparator.
[0009] Obviously if there aren’t selected programs/pieces everything works like a normal receiver tuned to the transmitter defined by the Tuner 1; on the contrary, the Tuner 2 will explore all the band of frequencies continuously; but in the comparator there isn’t any preset code, so the MATCH signal will never be activated and everything remains standing in this form.

[0010] So, as a consequence of the market range in which the receiver goes and takes position, the number of the presetable programs/pieces changes. If this number increases you have also to increase the memory size of the programs/pieces selector and, consequently, the maximum range of the counter.

[0011] As these codes can be transmitted and received in the form of digital signals, you have to remember that you can get 4 codes with 2 bit, 8 codes with 3 bit and so on, according to the following formula:

\[ C = 2^n \]

with:

- \( C \) = number of codes
- \( n \) = number of bit

[0012] So the counter has to have a number of bit equivalent to \( n \), whereas the selector memory has to have a size equivalent to \( C \times n \) bit, organized in \( C \) words, each one being \( n \) bit long.

[0013] You can practically carry out the preselection of the codes concerning the programs/pieces you want to listen to by means of keys which are already available in the majority of the radio receivers present on the market and equipped with the RDS/PAD system.

[0014] In fact, there is a MODE key to which you can add a further electronic position which lets the receiver acquire preset codes and store these codes in memory using the keys which are already available to tune in the most frequent listening transmitters (there are usually 6 or more keys).

[0015] An only additional control is necessary to clear the memory contents of the preset programs/pieces codes (RESET key); you have to use this control in the two following cases:

1. The user doesn’t want to preset programs/pieces, but he means to use the receiver in standard conditions;

2. The user is listening to a preset program/piece, but he wants, for any reason, to come back to the standard working without waiting for the program/piece end.

In both cases, the RESET key activation cancels the memory, clears the counter and switches the MATCH signal off, so the receiver returns to the standard condition, as we have previously described.

[0016] In short, the system, apart from allowing the normal use of a radio receiver set, that is the tuning in any transmitter of the selected band (manually or by means of the automatic search), also permits to tune in any broadcasting station which is transmitting a desired program/piece preset by means of a prefixed code, which is transmitted by the transmitter together with the RDS/PAD signal and which identifies the program/piece itself unequivocally. Obviously, in this last case, the tuning can be only automatic, as the broadcasting station which transmits the desired program/piece is a priori unknown.

Naturally the system is not addressed only to the mobile receivers for which the RDS/PAD concept has been introduced, but it can be extended to the fixed installations too, so it allows to benefit by an automatic search concerning programs/pieces rather than frequencies.

[0017] Obviously, in relation to the market range to which the receiver is directed, the PLS function can be activated even if the user is using other sound sources (c.d., cassettes) or if the apparatus is in a stand-by condition.

[0018] Note that you have not to associate or mix PLS up with the PTY system, which already exists, as the latter is based on the search of a kind of program selected by a defined list, which is in the radio itself; this list according to the producers, contains a restricted number of preset generic programs, so that the user can make a very restricted choice and the transmitters can’t carry the desired combinations to make their programs personal out at all.

EXAMPLES OF SUBJECTS CODIFIED IN PTY

- SPORT - VARIED - NEWS - POP M. - DRAMA - EDUCATION -

[0019] On the contrary, the PLS function, is based on the search of a numerical code in which you have previously keyed; you can use:
A type codes, objectively combined for the selection of programs and pieces on all the transmitters; B types codes, differently combined by the single transmitters to select and make specific programs and pieces personal;

<table>
<thead>
<tr>
<th>A TYPE CODES</th>
<th>B TYPE CODES</th>
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<tbody>
<tr>
<td>THE TOP TWENTY ALBUMS IN ITALY</td>
<td>PROGRAMS OF RADIORAI 1 OF THE 25th OF FEBRUARY</td>
</tr>
<tr>
<td>1) Zucchero 331</td>
<td>At 06.16 a.m. All'ordine del giorno 1531</td>
</tr>
<tr>
<td>2) Fiorella Mannoia 332</td>
<td>At 08.21 a.m. Settimocielo 1652</td>
</tr>
<tr>
<td>3) Blagio Antonacci 333</td>
<td>At 06.30 a.m. Italia istruzioni per l' uso 1642</td>
</tr>
<tr>
<td>4) Roberto Vecchioni 334</td>
<td>At 07.33 a.m. Questione di soldi 1611</td>
</tr>
<tr>
<td>5) Mina/Celantano 335</td>
<td>At 08.43 a.m. Golem 1211</td>
</tr>
<tr>
<td>6) U 2 336</td>
<td>At 09.00 a.m. GR 1 Cultura 1666</td>
</tr>
<tr>
<td>7) Cher 441</td>
<td>At 09.05 a.m. Radio arch'io 1555</td>
</tr>
<tr>
<td>5) Laura Pausini 442</td>
<td>At 10.00 a.m. Millevoci lettere 1613</td>
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<td>9) Sfive 443</td>
<td>At 10.13 a.m. GR 1 Cultura 1666</td>
</tr>
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<td>10) Mariah Carey 444</td>
<td>At 11.00 a.m. GR 1 Scienza 1667</td>
</tr>
<tr>
<td>7) Backstreet Boys 445</td>
<td>At 11.17 a.m. Radioacolori 1254</td>
</tr>
<tr>
<td>12) Nek 446</td>
<td>At 12.05 a.m. Come vanno gli affari 1264</td>
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[0020] Actually, by means of PTY, you can only search for musical genres (jazz, country) or types of programs (sport, drama, education). In practice, the limit of PTY system is that if the user means to listen to the football match of the Italian national team transmitted by Radiorai 1, he has to select "sport" in the PTY list; the radio begins to search and if just in that moment several transmitters are transmitting a basketball match and / or a program about boxing apart from the football match the radio the radio will pick up these too and so it is very probably that if the transmitter which broadcasts the basketball match or the boxing match is before Radiorai 1, the football match will be neglected, just as according to the PTY system, "sport" means not only the football match but also the basketball match or the program about boxing.

[0021] On the contrary, with the PLS system, since the transmitter would assign to the football match of that day that preset identifying code, the tuner would linger only over the football match leaving out the other sports.

[0022] The same thing happens for a program like "Alto gradimento" transmitted by Radiorai 2.

By means of the PTY system you can identify it only as a type of VARIED program, so that the tuner will pick up also other programs of that kind;

On the contrary, by means of the PLS system, you can achieve a punctual and sure tuning.

[0023] One could go on giving an example of a record company which means to launch a new record of an artist in three months time and to let listen to only a piece for the first time; you can achieve that by means of the PLS system.

[0024] One could give also the example of the pieces of the San Remo Festival or Festivalbar to which you can associate identifying codes, and the extension of the PLS system to the service of Rai "Cis viaggiare informati" too, giving a specific permanent code to it.

[0025] Concerning marketing aspects, the PTY function appears vague and not flexible, as it regards codes prefixed by the producer, which one can't bring up to date at all; therefore the PTY system doesn't manage to involve the interest and the active participation of the transmitters, of the other media and of all the firms that mean to advertise their goods.

By means of the PLS system, on the contrary, you can involve:

1) the interest of those who mean to advertise their goods, as they can choose to put in some jingles of theirs (which last not many seconds) before the beginning of the preselected piece and / or program so the selector user is subjected to listen to the advertising;

2) the interest of the transmitters, which will earn by means of the jingles assigned to pieces or programs;

3) the interest of mass-media (the best music magazines and radio-televisión programs, Internet), involved in making the codes or any others initiatives concerning the PLS system known;

4) the interest of the record companies which if they would, could manage a part of the codes concerning the promotional launch of a new record or singer;
EP 0 967 749 A2

[0026] Besides note that many radio networks transmit on frequencies which are different for towns or reception areas, so the user is forced to search for the transmitter concerning his own town. In fact some transmitters advertising themselves in the most important newspapers in the country indicate explicitly to search for the frequency either on the web site or even by calling a phone free. Other transmitters, on the contrary, compile the "boring" list. The PLS system solves the above mentioned problems considerably, as it simplifies both the advertising matters of the frequencies and the searching matters of the users.

In fact, this system, associates an identifying code (A type) to every transmitter, for example "Radio x" (PLS 7), "Radio y" (PLS 8), etc. so if the user is in Milan or Palermo he will be able to listen to "Radio x" keying simply 7 in his own radio and so he needn't know the frequency concerning that town at all costs.

If a user who comes from Milan and has tuned "Radio x" in the button 5 on his own car radio turns by chance the car radio on in Palermo, he will note that the button 5 doesn't correspond to "Radio x" any more but perhaps to another transmitter or even to anything.

The RDS system in this case, is not useful as the car radio should be on for the duration of the whole journey so as to allow the automatic frequency passages according to the area;

On the contrary by means of the PLS system, you have only to key in 7 and in few seconds the car radio tunes itself automatically in the frequency of "Radio x" concerning the city of Palermo.

[0027] So, by means of the PLS system, you will get to all the networks easily so as to solve the problem of the variety of the frequencies at last creating a system of identification which is "only" for every single transmitter concerning the whole area, quit apart from the reception area.

[0028] Besides you have to note that a considerable percentage of car accidents happens because of absent-mindedness mistakes and among these there is searching for a favourite transmitter, program or piece. Undoubtedly, by means of the PLS system and thanks to the flexibility of the search you can avoid absent-mindedness mistakes (which might be fatal) after you have set the programs you want out.

[0029] In short, you can maintain that the PLS system can be defined as an "interactive system" thanks to which the transmitters and the users are able to communicate among themselves more easily.

Claims

1. Concept of transmission/reception of a specific radio program/piece to which has been associated a code which can be combined differently and continually by the single transmitters. This code identifies a radio program/piece not in its typology but in its specific quality and singularity; it is transmitted together with the RDS/PAD signal, allowing the automatic search of the particular program/piece itself, using a double Tuner system chosen by a signal which, in turn, is the result of a comparison between the transmitted code and that preset by the user.

2. The same concept mentioned above, which also uses the conventional RDS/PAD signal in order to search the most suitable transmitter for the reception of the selected program/piece.

3. The same concept expressed by the points 1 and 2, but with the selection of the Tuner you have to listen to manually made by the user.

4. The same concept expressed by the points 1, 2 and 3, but realized with the two Tuners integrated in a single Integrated Circuit (chip).

5. The same concept expressed by the points 1, 2 and 3, but realized with all the parts in a single Integrated Circuit.

6. The same concept expressed by the points 1, 2 and 3, but realized with all the additional parts (compared to a traditional radio receiver) integrated in an only Integrated Circuit.

7. The same concept expressed by the previous points, but realized setting the additional parts up (compared to a traditional radio receiver) in a shape which is discreet or integrated (also partially) on one or more cards which you have to use like "ADD-ON" in the radio receivers which are already on the market.
BLOCK DIAGRAM ENCLODED WITH AN APPLICATION FOR A PATENT ENTITLED:
SYSTEM FOR TRANSMISSION AND RECEPTION OF RADIO PROGRAMS/PIECES JOINED TO A PREFIXED CODE WHICH ALLOWS
THE AUTOMATIC SEARCH OF THIS PROGRAM/PIECE, QUITE APART FROM THE TRANSMITTER: PROGRAM LINK SYSTEM (PLS

Diagram:

- TUNER 1
  - RDS/PAD DECODER
    - M. F. AMPLIFIER
      - DISCRIMINATOR
        - AUDIO AMPLIFIER
  - TUNER SELECTOR
    - TUNER 2
      - RDS/PAD DECODER
        - RDS/PADP DECODER
          - MATCH
            - COMPARATOR
              - CODES MEMORY
                - CODES SELECTOR
              - COUNTER
                - RESET
System for transmission and reception of radio programmes carrying a prefixed code, allowing the automatic search of these programmes, irrespective of the transmitter which broadcasts these programmes: programme link system

This is a system for transmitting, receiving and listening to a program/piece prefixed and identified by a code, whatever the station which transmits that program/piece may be, provided that it has to be preceded by the broadcast of the identification code of the program itself. As this code can be transmitted together with the actual RDS/PAD signal by adding only some bit in the end, the following description is, in short, based on the variations of the project, which the radio-receivers need to make use of this additional code for the automatic search of the program/piece.

BLOCK DIAGRAM ENCLOSED WITH AN APPLICATION FOR A PATENT ENTITLED: SYSTEM FOR TRANSMISSION AND RECEIPTION OF RADIO PROGRAMS/PIECES JOYNED TO A PREFIXED CODE WHICH ALLOWS THE AUTOMATIC SEARCH OF THIS PROGRAM/PIECE, QUITE APART FROM THE TRANSMITTER: PROGRAM LINK SYSTEM (PLS)
### DOCUMENTS CONSIDERED TO BE RELEVANT

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The present search report has been drawn up for all claims

Place of search: THE HAGUE  Date of completion of the search: 10 July 2001  Examiner: Pantelakis, P
This Annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

10-07-2001

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For more details about this annex: see Official Journal of the European Patent Office, No. 12/82
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### Information:
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**New Applications Under 35 U.S.C. 111**
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

**National Stage of an International Application under 35 U.S.C. 371**
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

**New International Application Filed with the USPTO as a Receiving Office**
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.
IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of
Ho YI
Serial No.: 11/872,282
Filed: 10/15/2007

For: TUNER SELECTION IN DIGITAL BROADCASTING RECEIVER HAVING MULTIPLE TUNERS

INFORMATION DISCLOSURE STATEMENT

U.S. Patent and Trademark Office
Customer Service Window
Randolph Building
401 Dulany Street
Alexandria, Virginia 22314

Sir:

Pursuant to 37 C.F.R. §1.56, the attention of the Patent and Trademark Office is hereby directed to the references listed on the attached PTO-1449. One copy of each non-U.S. reference is attached. It is respectfully requested that the information be expressly considered during the prosecution of this application, and that the references be made of record therein and appear among the "References Cited" on any patent to issue therefrom.

Applicants have listed publication dates on the attached PTO-1449 based on information presently available to the undersigned. However, the listed publication dates should not be construed as an admission that the information was actually published on the indicated date. Applicant reserves the right to establish the patentability of the claimed invention over any of the information provided herewith, and/or to prove that this information may not be prior art, and/or to prove that this information may not be enabling for the teachings purportedly offered. This statement should not be construed as a representation that a search has been made, that information cited in the statement is considered to be and/or is material to patentability, or that information more material to the examination of the present patent application does not exist. The Examiner is specifically requested not to rely solely on the material submitted herewith. It is further understood that the Examiner will consider information that was cited or submitted to the U.S. Patent and Trademark Office in a prior application relied on under 35 U.S.C. §120. 1138 OG 37, 38 (May 19, 1992).

1. This Information Disclosure Statement is being filed (i) within three months of the U.S. filing date of a U.S. application other than a CPA continued prosecution application under §1.53(d) OR (ii) within three months of the date of entry of the national stage as set forth in §1.491 in an international application OR (iii) before the mailing date of a first Office Action on the merits OR (iv) before the mailing of a first Office Action after the filing of a Request for continued examination under §1.114. No certification or fee is required. 37 C.F.R. §1.97(b).

☐ 2. This Information Disclosure Statement is being filed more than three months after the U.S. filing date AND after the mailing date of the first Office Action on the merits, but before the mailing date of a Final Rejection OR Notice of Allowance OR an action that otherwise closes prosecution in the application. 37 C.F.R. §1.97(c).

☐ a. I hereby state that each item of information contained in this Information Disclosure Statement was first cited in a communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of this Information Disclosure Statement. 37 C.F.R. 1.97(c)(1).
b. I hereby state that no item of information in this Information Disclosure Statement was cited in a communication from a foreign patent office in a counterpart foreign application and, to my knowledge after making reasonable inquiry, was known to any individual designated in 37 C.F.R. §1.56(c) more than three months prior to the filing of this Information Disclosure Statement. 37 C.F.R. 1.97(e)(2). No fee is required.

c. Attached is our check no. _____ in the amount of $180.00 in payment of the fee under 37 C.F.R. 1.17(p). Please credit or debit Deposit Account No. 16-0607 as needed to ensure consideration of the disclosed information.

3. This Information Disclosure Statement is being filed after the mailing date of a Final Rejection OR Notice of Allowance OR an action that otherwise closes prosecution in the application, but on or before payment of the Issue Fee. Attached is our check no. _____ in the amount of $180.00 in payment of the fee under 37 C.F.R. 1.17(p). Please credit or debit Deposit Account No. 16-0607 as needed to ensure consideration of the disclosed information. 37 C.F.R. §1.97(d).

4. The references were cited in a corresponding foreign application in a Search Report dated December 19, 2008.

5. To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 16-0607 and please credit any excess fees to such deposit account.

Respectfully submitted,
KED & ASSOCIATES, LLP

David C. Oren
Registration No. 38,694

Correspondence Address:
P.O. Box 221200
Chantilly, VA 20153-1200
Telephone: (703) 766-3777
Date: February 2, 2009

DCO/kah
# List of Art Cited by Applicant

**Applicant (PTO-1449)**

**Ho Yi**

**Filing Date:** October 15, 2007

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### Other Art (Including Author, Title, Date, Pertinent Pages, Publisher, Place of Publication, Etc.)

European Search Report dated December 19, 2008

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**Examiner**

**Date Considered**

---

**Examiner:** Initial if reference considered, whether or not citation is in conformance with MPEP 609; draw line through citation if not in conformance and not considered. Include copy of this form with next communication to Applicant.
Communication

The partial European search report (R. 64 EPC) is enclosed.

The applicant is informed that if the European search report is also to cover inventions other than the invention(s) already searched and for which a meaningful search can be carried out, a further search fee must be paid for each of these inventions, in the present instance

1 search fees

within one month after notification of this communication.

The amount payable for each further search is EUR 1050,- (OJ EPO 2008, 5).

If applicable, a European search opinion covering those invention(s) for which a search fee has been paid will then be sent together with the European search report.

Copies of documents cited in the European search report are attached.

☑ 2 additional set(s) of copies of such documents is (are) enclosed as well.

The following have been approved:

☑ Abstract
☑ Title

☐ The Abstract was modified and the definitive text is attached to this communication.

The following figure(s) will be published together with the abstract: 9

Note to the users of the automatic debiting procedure

Unless the EPO receives prior instructions to the contrary, the fee(s) will be debited on the last day of the period for payment. For earlier payment(s) another method of payment must be used. For further details see the Arrangements for the automatic debiting procedure (see Supplement to OJ EPO 10/2007).
### DOCUMENTS CONSIDERED TO BE RELEVANT

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### LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

The present partial European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims.
The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1-12

   method and apparatus for automatically selecting a tuner in a multiple tuners receiver using the tuning completion rate of each tuner.

2. claims: 13-19

   method and apparatus for selecting a tuner in a multiple tuners receiver, in which the user manually select the tuner when the output signals of each tuner are different.
This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on. The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

27-11-2008

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

A radio receiver such that even though the variations of elements are large, the receiving condition can be set the same irrespective of the antenna input level. In the receiver, a high-frequency cut-off circuit (30) removes a high-frequency band included in a composite signal according to a high-frequency cut-off factor and according to the voltage applied to an HCC terminal (30a). The main signal and the sub-signal which are included in the composite signal are demodulated respectively by main demodulation and sub-demodulation circuits (32, 34). In the sub-demodulation circuit (34), based on the voltage applied to an SPC terminal (34a), the demodulation level of the sub-signal is changed from 0 to 100 % according to its separation characteristic to control the separation. From the demodulation main signal and sub-signal, a matrix circuit (36) reproduces L and R signals and outputs them. A signal meter output voltage from an FM detection IC (12) is inputted to a microcomputer (20). In an operation part (24), based on the signal meter output reference voltage and a control reference voltage which are stored in an EEPROM (18), the intrinsic signal meter output voltage of the receiver is corrected, and the SPC and HCC voltages, which have no variation due to differences in antenna input level even though the antenna input level changes are calculated to be applied to the HCC and SPC terminals (30a, 34a).
Field of the Invention

The present invention relates to a radio receiver equipped with an FM and/or AM receiving function. More particularly, the present invention relates to a radio receiver equipped with functions such as a high frequency cutoff function, a stereo separation adjustment function, an automatic receiving frequency seek function, an automatic mono/stereo selector function, or an automatic wide/narrow selector function for selecting a band with.

Background of the Invention

When operating an FM receiver, the problem exists of the characteristic FM noise when the signal is weak and the antenna input level is low. The drop in the S/N ratio consequent on a weak signal is much greater for a stereo signal than for a monaural signal, and it is known for the stereo drop to be 20 dB or more compared with the monaural drop.

A conventional response to this problem is to vary the stereo separation when the signal is weak, to increase the S/N ratio. For example, as shown in Fig. 4, based on a composite signal from an FM detector IC 12, an FM multiplexer IC 14, which regenerates left and right signals, demodulates the subsidiary signal in this composite signal. At this point, by varying the demodulation level of this subsidiary signal it is possible to control the stereo separation for a weak signal.

On the other hand, for monaural broadcasts, the drop in the S/N ratio for a weak signal can be counteracted by implementing a high frequency cutoff function, reducing the level of high frequencies, and improving the subjective S/N ratio. The FM multiplexer IC 14 of Fig. 4 has a built-in high frequency cutoff function. The high frequency cutoff function and elements relating to it are hereafter referred to by the abbreviation HCC (for "High Cut Control"), and the stereo separation control function similarly by the abbreviation SPC ("Separation Control").

The FM multiplexer IC 14 has an HCC pin 30a and an SPC pin 34a. The signal meter output voltage from the FM detector IC 12, representing the strength of the signal, is divided by resistors R1 and R2, and the resulting HCC and SPC voltages are applied to the pins 30a and 34a respectively.

In a conventional system as described above, the high frequency cutoff and stereo separation control functions are adjusted by means of the variable resistor R2 connected to the pins 30a and 34a. Not only, however, does this require troublesome manual operations, but it is also often extremely difficult to make adjustments for the desired characteristics. This is because of the inevitable variations in the many components of an FM receiver, which cause the signal meter output to vary from unit to unit. Because of the variability of the output from the signal meter, in many cases the whole unit has to be rejected because the adjustment is not possible within the adjustment range of the variable resistor R2, and this causes production problems.

Moreover, in a two-tuner diversity receiving system, in which two tuners are used, and the tuner with the higher antenna input level is selected, the following erroneous operation occurs. Namely, if the signal meter output voltages from the two tuners are different when the same antenna levels are input, although the tuner with the higher signal meter output voltage is selected, in fact this results in selecting the tuner with the lower antenna input level. Therefore, it is in fact necessary for the two tuner components when using this method to be selected to have substantially the same characteristics.

Moreover, there are also variability problems when using a seek function, which automatically scans through the broadcast frequencies and selects a station with a high receiving sensitivity. The condition for the seek is that the output from a station detector (SD) goes high. At the manufacturing stage, an operation is needed, for example using a trimmer or a variable resistor, to adjust the point at which this station detector output goes high. For example, in the manufacturing adjustment stage, a trimmer or a variable resistor may be set so that the station detector output goes high when the antenna input level is 20 ± 3 dB\text{u}. It is, however, very difficult to achieve this ± 3 dB\text{u} adjustment tolerance, and except for an accomplished expert this adjustment takes a long time. If, for example, the tolerance is widened to ±5 dB\text{u}, on some units the seek will stop when the antenna input is at least 15 dB\text{u}, while on other units the seek will stop when the antenna input is at least 26 dB\text{u}. This results in considerable problems of variability from unit to unit.

Thus, conventionally the variability of component characteristics leads to variation in the receiving conditions of different units. Attempting to resolve this reflection of variability in components as variability in performance of the finished product by adjustment at the manufacturing stage results in extensive time requirements for the adjustment, or in a need for highly expert workers. Furthermore, the variability in components sometimes exceeds the limits of such adjustments, leading to a failure to meet the specification demanded by customers.

In view of the above, the present invention has as its objective the provision of a radio receiver
which, even when there is variability in components, allows the receiving conditions to be adjusted easily or requires no adjustment, and has reduced variability among units of the receiving conditions.

Another objective of the present invention is the provision of a radio receiver which, even when there is variability in components, allows the receiving conditions to be adjusted easily, reduces the proportion of cases in which the adjustment is not possible to almost zero, and has uniform high frequency cutoff control and stereo separation control characteristics from unit to unit.

Yet another objective of the present invention is the provision of a radio receiver which, in a diversity receiving system, even if there is variability in component characteristics between tuners allows the tuner with the highest antenna input level to be selected without erroneous operation.

Yet another objective of the present invention is the provision of a radio receiver which, while allowing the conditions for a seek to stop to be adjusted easily or to require no adjustment, is able to attain uniform seek function characteristics.

Yet another objective of the present invention is the provision of a radio receiver in which component systems for automatic mono/stereo selection, automatic wide/narrow selection, and automatic high frequency cutoff ratio 0%/100% selection operate uniformly when a certain level of antenna input signal is input, regardless of variability in components.

Summary of the Invention

The radio receiver of the present invention comprises a radio frequency amplifier circuit which amplifies an antenna input signal; a frequency conversion circuit which converts said amplified antenna input signal to an intermediate frequency signal; an intermediate frequency amplifier circuit which amplifies and outputs this intermediate frequency signal, and is provided with a signal meter which detects the level of said amplified intermediate frequency signal; a detector circuit which detects an AM signal or FM signal from said amplified intermediate frequency signal; a nonvolatile memory which stores the output of said signal meter, subject to component variability from unit to unit, when a predetermined reference level of said antenna input signal is input in an adjustment stage of manufacture, as a reference voltage value; and a control means which, based on said signal meter output reference voltage value stored in said nonvolatile memory, sets and controls receiving conditions when different levels of said antenna input signal are input in such a way as to be appropriate to said different levels of said antenna input signal with low variability from unit to unit.

According to the present invention, in an adjustment stage of manufacture, a signal meter output when an antenna input signal of a reference level is input is stored in nonvolatile memory as a reference voltage value. This reference value is affected by the variability in electrical characteristics of the various components of the radio receiver, and varies from unit to unit.

When an arbitrary level of antenna input signal is actually input to the radio receiver, the corresponding signal meter output is detected, and by comparing it with the reference value stored in nonvolatile memory, the real antenna input signal level can be determined. Therefore, the receiving conditions can be set according to the antenna input level in a uniform way, even when there is variability in the electrical characteristics of the various components of the radio receiver which thus vary from unit to unit.

As receiving conditions can be cited varying characteristics for the subsidiary signal demodulation level for AM stereo and FM stereo.

In this case, control means may include a stereo separation control voltage generating means, which, based on said signal meter output reference voltage value stored in said nonvolatile memory, computes a correction to said signal meter output corresponding to the actually input antenna input level and generates said stereo separation control voltage.

In another aspect of the invention, in said nonvolatile memory is further stored a stereo separation control reference voltage value for setting a subsidiary signal demodulation level appropriate to the antenna input signal when an antenna input signal of said reference level is input. In this case, said stereo separation control voltage generating means, based on said signal meter output reference voltage value and said stereo separation control reference voltage value stored in said nonvolatile memory, computes a correction to said signal meter output corresponding to the actually input antenna input level and generates the stereo separation control voltage.

In yet another aspect of the invention, in said nonvolatile memory can be stored a plurality of signal meter output reference voltage values measured respectively when an antenna input level corresponding to a monaural point with a subsidiary signal demodulation level of 0% and one or a plurality of antenna input levels corresponding to a stereo separation variation region in which the antenna input level is higher than at said monaural point are input, and respective stereo separation control reference voltage values to obtain stereo separation characteristics corresponding to this plurality of signal meter output reference voltage lev-
els. In this case, said stereo separation control voltage generating means, based on said plurality of signal meter output reference voltage values and stereo separation control reference voltage values, when an antenna input signal of any level is input computes a stereo separation control voltage corresponding to said antenna input signal level by linear interpolation.

As receiving conditions can be cited varying characteristics for the high frequency cutoff ratio for a weak broadcast signal for AM and FM reception.

In this case, said control means includes a high frequency cutoff control voltage generating means which, based on said signal meter output reference voltage value stored in said nonvolatile memory, computes a correction to said signal meter output corresponding to the actually input antenna input level and generates the high frequency cutoff control voltage.

In another aspect of the invention, in said nonvolatile memory is further stored a high frequency cutoff control reference voltage value for setting a high frequency cutoff ratio appropriate to the antenna input signal when an antenna input signal of said reference level is input. In this case, said high frequency cutoff control voltage generating means, based on said signal meter output reference voltage value and said high frequency cutoff control reference voltage value stored in said nonvolatile memory, computes a correction to said signal meter output corresponding to the actually input antenna input level and generates the high frequency cutoff control voltage.

In yet another aspect of the invention, said nonvolatile memory stores a plurality of signal meter output reference voltage values measured respectively when an antenna input level corresponding to a monaural point with a subsidiary signal demodulation level of 0% and one or a plurality of antenna input levels corresponding to a high frequency cutoff region in which the antenna input level is lower than at said monaural point are input, and respective high frequency cutoff control reference voltage values to obtain high frequency cutoff characteristics corresponding to this plurality of signal meter output reference voltage levels. In this case, said high frequency cutoff control voltage generating means, based on said plurality of signal meter output reference voltage values and high frequency cutoff control reference voltage values, when an antenna input signal of any level is input computes a high frequency cutoff control voltage corresponding to said antenna input signal level by linear interpolation.

In yet another aspect, the invention can be applied to a radio receiver having a high frequency cutoff circuit which reduces the high frequency components in said composite signal at a high frequency cutoff ratio of selectively two values, 0% or 100%. In this case, in said nonvolatile memory is further stored the output of said signal meter when an antenna input signal corresponding to a weak broadcast signal is input, as a reference voltage value, and when a comparator detects said signal meter output to be lower than said signal meter output reference voltage value, said control means outputs the high frequency cutoff control voltage to set said high frequency cutoff ratio to 100%.

As receiving conditions can be cited sensitivity conditions for which, on carrying out an automatic scan of receiving frequencies, the scan is ceased at a frequency of high sensitivity.

In this case, said intermediate frequency amplifier circuit is provided with a station detector which, based on said signal meter output, outputs a station detection signal. Furthermore, said nonvolatile memory stores said signal meter output when an antenna input signal is input of a level close to or greater than or equal to the upper limit of a predetermined range determined such that said station detection signal is output from the station detector, as said reference voltage value. Yet further, said control means includes a seek control means which carries out an automatic scan of receiving frequencies, and causes a stop to the scan at a frequency of high sensitivity. This seek control means is constructed to include: an intermediate frequency counter which counts the output from said buffer for counting said intermediate frequency when said station detection signal is input from said station detector; and a comparator which compares said signal meter output reference voltage level stored in said nonvolatile memory with said signal meter output when said antenna input signal is input at an arbitrary level. Moreover, this seek control means, when said intermediate frequency counter counts a predetermined intermediate frequency and said comparator detects said signal meter output to be higher than said signal meter output reference voltage level, stops said automatic scan.

As receiving conditions can be cited sensitivity conditions for switching automatically according to the antenna input level between a wide mode for high fidelity reception and a narrow mode for high selectivity reception.

In this case, in said nonvolatile memory is stored the signal meter output when an antenna input signal corresponding to a strong broadcast signal is input, as a reference voltage value. Moreover, said control means includes a second mode setting means which controls the enablement of a high bandwidth receiving mode (wide mode) for high fidelity or a low bandwidth receiving mode.
(narrow mode) for high selectivity. This second
mode setting means has a comparator which com-
pares said signal meter output reference voltage
level stored in said nonvolatile memory with said
signal meter output when said antenna input signal
is input at an arbitrary level, and when said com-
parator detects said signal meter output to be
higher than said signal meter output reference volt-
age level, controls the enablement of said high
bandwidth receiving mode.

As receiving conditions can be cited sensitivity
conditions for automatic mono/stereo switching. In
this case, in said nonvolatile memory is stored the
output of said signal meter when an antenna input
signal corresponding to a monaural point is input,
as a reference voltage value. Moreover, said con-
trol means includes a comparator which compares
said signal meter output reference voltage level
stored in said nonvolatile memory with said signal
meter output when said antenna input signal is
input at an arbitrary level, and when said compara-
tor detects said signal meter output to be higher
than said signal meter output reference voltage
level, outputs said stereo separation control voltage
to set said subsidiary signal demodulation level to
100%.

The present invention can further be applied to
a radio receiver employing the diversity reception
method, selecting with a first switch a tuner for
reception from a plurality of tuners, each compris-
ing a receiving circuit including elements from an
antenna to a detector circuit. In this case, said
nonvolatile memory stores the output of said signal
meter, subject to variability from tuner to tuner,
when a predetermined reference level of said an-
tenna input signal is input in an adjustment stage of
manufacture, for each of said tuners as corre-
sponding reference voltage values. Moreover, said
control means includes: a calculation means which,
based on said signal meter output reference volt-
age values stored in said nonvolatile memory, com-
putes a correction to said signal meter output from
each of said tuners corresponding to arbitrary lev-
els of said antenna input signals, to compute ac-
curate level comparison values for said antenna
input signal levels, and a comparator for comparing
said level comparison values for each of said tun-
ers; and controls the operation of said first switch
to select the tuner for which said level comparison
value is highest.

Brief Description of the Drawings

Fig. 1 is a block diagram of the FM multiplexer
IC and microprocessor of one embodiment of the
present invention.

Fig. 2 is a block diagram of the overall con-
struction of one embodiment of the present inven-
tion.

Fig. 3 is a schematic block diagram showing a
variant method of obtaining an HCC voltage and an
SPC voltage by means of a voltage divider.

Fig. 4 is a schematic block diagram showing
the application of voltages to an SPC pin and an
HCC pin in a conventional device.

Fig. 5 is a block diagram of the overall con-
struction of an embodiment of the present invention
applied to the two-tuner diversity receiving method.

Fig. 6 is a block diagram showing details of the
microprocessor 50 in Fig. 5.

Fig. 7 is a characteristics graph showing the
relationship between an antenna input level and an
output level.

Fig. 8 is a characteristics graph showing the
relationship between a stereo separation control
voltage and a subsidiary signal demodulation level.

Fig. 9 is a characteristics graph showing the
relationship between a high frequency cutoff con-
trol voltage and a high frequency cutoff ratio.

Fig. 10 is a characteristics graph showing vari-
ability of a signal meter output voltage against an
antenna input level.

Fig. 11 is a characteristics graph showing the
relationship between signal meter output voltages
for different units and output levels.

Fig. 12 is a schematic diagram illustrating the
principle for linear interpolation of the stereo sepa-
ration control voltage from the signal meter output
voltage.

Fig. 13 is a graph showing the result of linear
interpolation of the high frequency cutoff ratio and
stereo separation characteristics.

Fig. 14 is a block diagram of a variant of the
present invention applied to seek control.

Fig. 15 is a block diagram illustrating details of
the seek control in Fig. 14.

Fig. 16 is a block diagram of a radio receiver
with a local/distance function.

Fig. 17 is a flowchart illustrating the seek op-
eration of the device shown in Fig. 14.

Fig. 18 is a block diagram showing essential
parts of a radio receiver equipped with an auto-
matic wide/narrow selector function.

Fig. 19 is a flowchart illustrating the automatic
wide/narrow selector function of the device shown
in Fig. 18.

Fig. 20 is a flowchart illustrating an automatic
mono/stereo selector function.

Fig. 21 is a flowchart illustrating an automatic
0%-100% high frequency cutoff ratio selector func-
tion.

Detailed Description of the Preferred Embodiments

The present invention is now described in
terms of a number of preferred embodiments, with
reference to the drawings.

First Embodiment

Fig. 2 illustrates the overall construction of one embodiment of the present invention applied to an FM receiver. A radio frequency signal is input from an antenna 2 to an FM front end 4. This FM front end 4 comprises a radio frequency amplifier circuit 6, a voltage-controlled oscillator (VCO) 8, and a frequency mixer circuit 10, and converts the radio frequency signal to an intermediate frequency signal. The voltage-controlled oscillator 8 and frequency mixer circuit 10 together constitute a frequency conversion circuit. The output of the FM front end 4 is input to an FM detector IC 12, which functions as an intermediate frequency amplifier and FM detector. The composite signal resulting from this FM detection includes a principal signal corresponding to the sum of the two channels (L + R), a subsidiary signal amplitude modulated at 38 kHz corresponding to the difference (L - R), and a pilot signal. This composite signal is input to an FM multiplexer IC 14, which acts as a stereo demodulation circuit, and signals for the left and right channels are regenerated. This FM multiplexer IC 14 has an HCC pin 30a and an SPC pin 34a.

From a first pin 120a on the FM detector IC 12 is output a signal meter output voltage, and this signal meter output voltage is input to a microprocessor 20.

The characteristics of this signal meter output voltage are subject to variability from unit to unit, because of the variability of component parts.

The microprocessor 20 corrects this variability in the signal meter output voltage, and computes SPC and HCC voltages which depend on the antena input level in a way which does not vary from unit to unit; these voltages are then applied to the HCC pin 30a and SPC pin 34a of the FM multiplexer IC 14. It should be noted that the second and third pins 122a and 124a of the FM detector IC 12 will be described below.

The FM multiplexer IC 14 and microprocessor 20 will now be described with reference to Fig. 1.

The FM multiplexer IC 14 has as its principal components a high frequency cutoff circuit 30, a principal signal demodulation circuit 32, a subsidiary signal demodulation circuit 34, a matrix circuit 36 and a phase-locked loop 38.

The high frequency cutoff circuit 30 eliminates high-frequencies, that is to say, FM noise present in a weak composite signal, for example in a band from 7 kHz upward, based on the input voltage to the HCC pin 30a, at a cutoff ratio derived in a predetermined way from the antenna input level. The relation between the HCC voltage and the cutoff ratio is shown in Fig. 9, and the cutoff ratio is higher when the HCC voltage is lower.

The principal signal demodulation circuit 32 and subsidiary signal demodulation circuit 34 respectively demodulate the principal signal and subsidiary signal in the composite signal. In particular, the subsidiary signal demodulation circuit 34 also has a stereo separation control function, which varies the demodulation level of the subsidiary signal from 0 to 100%, based on the input voltage to the SPC pin 34a, according to predetermined characteristics depending on the antenna input level. The relationship between the SPC voltage and subsidiary signal demodulation level is shown in Fig. 8. As will be seen from the figure, the subsidiary signal demodulation level approaches 100% as the SPC voltage increases.

Based on the signals output from the principal and subsidiary signal demodulation circuits 32 and 34, the matrix circuit 36 uses the computation:

\[
(L - R) + (L + R) = 2L \\
(R - L) + (L + R) = 2R
\]

to regenerate the left and right channel signals. In this regeneration, the necessary 38 kHz signal is obtained from the composite signal through the phase-locked loop 38.

The output level (dB) of the matrix circuit 36 when the antenna input level (dBu) from the antenna 2 varies is shown in Fig. 7. As shown in this figure, if the antenna input level is for example 20 dBu, this is the monaural point M at which the separation is 0%, and as the input level increases from the monaural point M there is a separation variation region in which the separation (%) increases, and when the broadcast signal is strong the separation reaches 100%. On the other hand, in the region where the broadcast signal becomes weaker from the monaural point M, there is a high frequency cutoff region in which the characteristic FM noise is smoothly attenuated. The high frequency cutoff region may be extended to include input level values higher than the monaural point M.

To obtain the high frequency cutoff characteristics and stereo separation control characteristics shown in Fig. 7, it is necessary for SPC and HCC voltages as shown in Figs. 8 and 9 to be applied to the pins 30a and 34a. The relation between the SPC voltage shown in Fig. 8 and the antenna input level is shown by the solid line S1 in Fig. 10. As shown by the solid line S1 in this figure, when the antenna input level is 20 dBu, the SPC voltage is B1, and by the application of this SPC voltage B1 the characteristics of the monaural point M in Fig. 7 are obtained. Similarly, when the antenna input level is 39 dBu, the SPC voltage is A1, and by the application of this SPC voltage A1 a stereo separa-
tion of -12 dB is obtained as shown in Fig. 7.
In a conventional device, meanwhile, as shown in Fig. 4, the signal meter output voltage from the FM detector IC 12 is used to provide SPC and HCC voltages by means of a voltage splitter formed by resistors R1 and R2.

The signal meter output voltage varies from unit to unit independent to a constant antenna input level, because of the variability of the components making up the FM receiver. For example, as shown by the broken lines S2 and S3 in Fig. 10, the signal meter output voltage as a function of the antenna input level is different for different units. For example, the characteristics shown by broken line S2 show a signal meter output voltage b2 (> b1) when the antenna input level is 20 dBu, and a signal meter output voltage a2 (> a1) when the antenna input level is 38 dBu. Therefore, a unit with the characteristics of broken line S2 in Fig. 10 must have the altered characteristics shown by the broken (dot-dot-dash) line T2 in Fig. 11, or it will not be possible to attain the monaural point M with a stereo separation of 0% when the antenna input level is 20 dBu.

The FM multiplexer IC 14 has characteristic T1 in Fig. 11, corresponding to the characteristic S1 shown in Fig. 10. As a result, when the antenna input level is 20 dBu, if the signal meter output voltage b2 of the characteristic S2 is used as the SPC voltage, a characteristic N is obtained which has the stereo separation more advanced than the monaural point M. This means that separation is applied to a signal which is not strong enough to support stereo separation, and as a result the S/N ratio is decreased.

On the other hand, for the characteristic S3 in Fig. 10, because of the voltage b3 applied when the antenna input level is 20 dBu, high frequency cutoff is applied at a ratio L lower than the monaural point M. Similarly, when the antenna input level is 38 dBu, whereas basically a characteristic P of -12 dB should be obtained, in the case of characteristic S2 in Fig. 10 the characteristic of point R with an increased stereo separation (%) is obtained, and in the case of characteristic S3 in Fig. 10 the characteristic of point Q with a stereo separation (%) is reduced from that of point P is obtained.

In this embodiment, to prevent the above problems, the microprocessor 20 which inputs the signal meter output voltage corrects the signal meter output voltage and outputs appropriate control voltages to the HCC pin 30a and SPC pin 34a. This microprocessor 20 comprises an A/D converter 22, a calculation unit 24, and a D/A converter 26. The microprocessor 20 is also connected to a nonvolatile memory such as an EEPROM 18. The microprocessor 20 is also connected through an input/output interface 17 to an operating section 18. The calculation unit 24 inputs the signal meter output voltage in digital form, and based on data stored in the EEPROM 18 computes and outputs an appropriate HCC voltage and SPC voltage.

Next, the data stored in the EEPROM 18 is described.

At the stage of adjustment before the FM receiver is shipped from the factory, an antenna input signal is input from a signal generator to the antenna 2, with an input level of for example 20 dBu. At this point the signal meter output voltage is input to the microprocessor 20 from the FM detector IC 12, and the calculation unit 24 stores this signal meter output voltage in the EEPROM 18. The signal meter output voltage stored in memory is b2 in the case of characteristic S2 in Fig. 10 and b3 in the case of characteristic S3. Moreover, when an antenna input level of 20 dBu is input an external adjustment voltage is applied to the SPC pin 34a, and the adjustment voltage when this stereo separation of 0% is achieved is stored in the EEPROM 18. In the case of both characteristics S2 and characteristic S3 in Fig. 10, this adjustment voltage is b1. In a similar way, the signal meter output voltage (a2 in the case of characteristic S2, or a3 in the case of characteristic S3) when the antenna input level is 38 dBu, and the adjustment voltage to obtain a level separation between the left and right channel signals of -12 dB (a1 for both of characteristics S2 and S3) are stored in the EEPROM 18.

Thereafter, when an arbitrary signal meter output voltage X is input to the microprocessor 20, the computation of the SPC voltage x is carried out by the calculation unit 24 based on the data stored in the EEPROM 18, according to the expression below. For example, taking characteristic S2 in Fig. 11 as an example:

\[ x = a1 - \alpha (a2 - X) \]

where \( \alpha \) is the gradient of the solid line in Fig. 12 given by:

\[ \alpha = (a1 - b1) / (a2 - b2) \]

It may be sufficient to store the gradient \( \alpha \) and voltages a1 and a2 in the EEPROM 18.

The reason for using the above linear interpolation calculation to derive the SPC voltage x from the signal meter output voltage X in this way, is that the signal meter output voltages S2 and S3 produced by particular devices may not be parallel to the reference characteristic S1 shown in Fig. 10, or may not be completely linear, having superimposed undulations. In place of this linear interpolation, in cases where the characteristics S2 and S3
can approximated as parallel to the basic characteristic S1, it may be satisfactory to store in memory only the signal meter output voltage and corresponding SPC voltage at a single point, such as for 20 dBu, and to correct the characteristics S2 and S3 to S1 by a simple shift.

The HCC voltage may be determined in a similar way, but since there is a fixed correlation between the SPC voltage and HCC voltage, as shown in Fig. 3 for example, the control voltage output from the microprocessor 20 may be divided by resistor R1 and resistor R2 to provide the required HCC voltage and SPC voltage. By using such voltage division resistors, it may be sufficient to carry out a correction calculation for only one of the SPC voltage and HCC voltage from the signal meter output voltage.

Thus in this embodiment, even if there is variability in components from one unit to another, the varying signal meter output voltage can be converted by calculation to a control voltage corresponding to the antenna input level with no variability, and it is possible always to obtain the high frequency cutoff and stereo separation characteristics with respect to the antenna input level as shown in Fig. 7. In particular, the troublesome work of adjusting a variable resistor in a conventional system is reduced, and a unit which would have had to be rejected because of a large deviation in a component made the adjustment impossible within the adjustment range of the variable resistor can easily be made good, which increases the yield. It should also be noted that the first embodiment may also be applied to an AM stereo receiver.

Second Embodiment

Next an embodiment of the present invention applied to a two-tuner diversity receiving method is described with reference to Figs. 5 and 6. The device of this embodiment has two tuners 40 and 42, having respective separate components from the antennas to the FM detector ICs, a first switch 44 switching selectively the outputs of the first and second FM detectors 12a and 12b of the tuners 40 and 42, an FM multiplexer IC 14 receiving the FM detector output and regenerating the left and right channel signals, and a microprocessor 50 receiving the signal meter output voltages from the first and second FM detectors IC 12a and 12b, and applying an HCC voltage and SPC voltage to pins 30a and 34a of the FM multiplexer IC 14 appropriately depending on the tuners 40 and 42.

The construction of the microprocessor 50 is shown in Fig. 6. This microprocessor 50 comprises an A/D converter 52, a calculation unit 54, a comparator 56, second and third switches 58a and 58b, a D/A converter 60, and a switch selector 62. The microprocessor 50 is connected to an EEPROM 55. The EEPROM 55 stores the same data for the two tuners 40 and 42 as the EEPROM 18 in Fig. 1. The calculation unit 54 receives the signal meter output voltages for the two tuners through the A/D converter 52, and based on data stored in the EEPROM 55 computes and outputs appropriate respective HCC voltages and SPC voltages for the two tuners 40 and 42. The comparator 56 compares the corresponding levels, for example the SPC voltages, output from the calculation unit 54 for the two tuners. The second and third switches 58a and 58b selectively output the HCC voltage and SPC voltage for one only of the two tuners 40 and 42, and whichever of these voltages are passed through the D/A converter 60 and applied to the pins 30a and 34a of the FM multiplexer IC 14.

The switch selector 62, based on the output from the comparator 56, selects whichever of the tuners 40 and 42 has the higher SPC voltage, by controlling the first switch 44 and second and third switches 58a and 58b appropriately.

In this embodiment, even if for example the one tuner 40 has the characteristic S2 of Fig. 10 for the signal meter output voltage characteristic, while the other tuner has the characteristic S3, the SPC voltages for the tuners 40 and 42 output by the calculation unit 54 of the microprocessor 50 are corrected to the characteristic S1 shown in Fig. 10 to be output. Therefore, if the SPC voltages of the tuners 40 and 42 are the same, it implies that both receive signals of the same antenna input level, or in other words if the SPC voltage for one tuner is higher it implies that the antenna input level to that tuner is higher. The comparator 56 is therefore able, by detecting which of the tuners 40 and 42 has a higher SPC voltage, and controlling the first to third switches 44, 58a and 58b through the switch selector 62 based on that result, to select always the tuner which has the higher antenna input level. Moreover, since the SPC voltage and HCC voltage applied to the pins 30a and 34a of the FM multiplexer IC 14 are corrected to be independent of any variability between the tuners 40 and 42, change in signal strength given when switching between the tuners is greatly reduced.

In a conventional two-tuner diversity receiving method, the signal meter output voltages from the tuners 40 and 42 are input directly to the comparator 56. The tuners are then switched so that the tuner with the higher signal meter output voltage is selected.

In this case, if for example the characteristics of the tuner 40 are as S2 in Fig. 10, and the characteristics of the tuner 42 are as S3 in Fig. 10, then supposing that the signal meter output voltage of the tuner 40 is b1 and the signal meter output
voltage of the tuner 42 is b3, then since b1 > b3 the comparator selects the tuner 40.

However, when the signal meter output voltage is b1, the antenna input level to the tuner 40 is 14.5 dBu, and when the signal meter output voltage is b3, the antenna input level to the tuner 42 is 20 dBu which is higher, regardless of which the tuner with the lower signal strength will be erroneously selected. This results in an unpleasant sound for the listener.

In regard to these points, the embodiment described above will not carry out an erroneous selection of the tuner with a lower antenna input signal level, and moreover eliminates unpleasant sounds which would otherwise be generated when the tuners are switched. This second embodiment may also be applied to an AM stereo receiver.

Fig. 13 is a graph showing characteristics when in the high frequency cutoff circuit 30 shown in Fig. 1, based on a control voltage to be input, the high frequency band of the composite signal is reduced at a high frequency cutoff ratio which varies linearly, and also based on a control voltage to be input, the demodulation level of the subsidiary signal in the subsidiary signal demodulator 34 is varied from 0 to 100% according to separation characteristics which vary linearly.

In the embodiment shown in this figure, the control voltages c1 to c5 for example in Fig. 13 are found by adjustment in the same way as for the embodiment shown in Fig. 1, and these are stored in the EEPROM 18 shown in Fig. 1. Furthermore, at the time of this adjustment, the signal meter output voltages when predetermined antenna input levels are supplied from a signal generator are similarly stored in the EEPROM 18.

Next, based on these data, when voltages other than the signal meter output voltages corresponding to these control voltages c1 to c5, are passed through the A/D converter 22 and read into the calculation unit 24, the calculation unit 24 carries out a linear interpolation in the same way as in Fig. 12 to compute the control voltage corresponding to arbitrary signal meter output voltage.

It should be noted that in the case shown in Fig. 13 the high frequency cutoff region and stereo separation region on either side of the monaural point M are each represented by two straight line segments of different gradients for the high frequency cutoff ratio or stereo separation characteristics, but in each case could equally well be used a single straight line segment or three or more straight line segments. In any case, based on the data stored in the EEPROM 18, when any signal meter output voltage is input, the control voltage can be found by linear interpolation. Furthermore, with regard to points other than the monaural point M, it is sufficient to store the control voltage corresponding to at least two points on each straight line segment of a different gradient.

Moreover, the method shown in Fig. 13 may be applied to the embodiment shown in Fig. 5, and in this case the data should be stored in the EEPROM 55 shown in Fig. 6.

Third Embodiment

Next, an embodiment of the present invention applied to a radio receiver equipped with a seek function able to scan the receiving frequencies, and automatically select a station with a high receiving signal strength, is described with reference to Figs. 14 to 17.

Fig. 14 is a block diagram of a circuit implemented within the microprocessor 20 and FM detector IC 12 shown in Fig. 1 and providing a seek function.

As shown in Fig. 14, the microprocessor 20 has a phase-locked loop (PLL) 80 which carries out electronic tuning. This PLL 80 locks the generated frequency of the voltage-controlled oscillator (VCO) 8 to for example the sum of the receiving radio frequency and the intermediate frequency. This PLL 80 comprises a programmable counter 82, a frequency divider 84, a phase comparator 86 and a low-pass filter (LPF) 88. The frequency divider 84 divides a reference frequency from a reference frequency generating quartz oscillator 90. Within the microprocessor 20 is also provided a seek control system 100. This seek control system 100 sets values corresponding to the station frequencies to be selected in seek operation. When the seek function is selected from the operating section 16 in Fig. 2, the values output by the seek control system 100 are updated for the frequency of each FM broadcasting station. For example, for broadcasting in Japan the value is updated by 100 kHz, in the United States it is updated by 200 kHz, and in Europe it is updated by 50 kHz. Thus, when the seek function is used, the seek control system 100 scans the receiving frequencies for consecutive stations, and when it detects a station with a high signal strength, it stops scanning. To seek out a station with a high signal strength, data from the first to third pins 120a, 122a and 124a of the FM detector IC 12 are input to the seek control system 100. Specifically, within the FM detector IC 12 are provided an IF amplifier 110 which amplifies intermediate frequencies, a detector circuit 112 for FM detection, and also a signal meter 120, a station detector (SD) 122 and IF counter buffer 124. The first pin 120a is connected to the signal meter 120 within the FM detector IC 12. The first pin 120a is an output pin for outputting a signal meter output. The second pin 122a is connected to the station detector (SD) 122 within the FM detector IC 12,
and outputs an SD output which is either high or low. The third pin 124a is connected to the IF counter buffer 124 within the FM detector IC 12, and outputs an intermediate frequency (IF).

Fig. 15 shows the details of the seek control system 100 to which these various items of data are input. As shown in this figure, within the seek control system 100 are provided an IF counter 102, a comparator 104, an A/D converter 106 and an AND gate circuit 108. When a station detection signal is output from the station detector (SD) 122, that is, when the SD output goes high, the IF counter 102 measures the intermediate frequency. When the IF counter 102 measures the intermediate frequency of 10.7 MHz, its output goes high. At the same time, the comparator 104 receives the signal meter output to one of its terminals through the A/D converter 106. To the other terminal of the comparator 104 is input a value previously stored in the EEPROM 18 at a factory adjustment stage. The output of the comparator 104 goes high only when the signal meter output supplied through the A/D converter 106 is higher than the value stored in the EEPROM 18.

The output of the AND gate circuit 108 goes high only when the outputs of both the IF counter 102 and the comparator 104 are high. When the output of the AND gate circuit 108 goes high, a scanning by the seek control system 100 is stopped on the receiving frequency.

In order for the output of the AND gate circuit 108 to go high, the following conditions a) and b) must both hold.

a) Conditions for frequency

The output of the IF counter 102 goes high only when the input intermediate frequency is 10.7 MHz, and this condition represents the case that the frequency conditions are met. The IF counter 102 measures the intermediate frequency only when the output from the station detector (SD) 122 goes high. In this embodiment, the output of the station detector (SD) 122 is set to go high only when the level of the antenna input signal input from the antenna 2 is at least (15 ± 5) dBu. The station detection sensitivity of the station detector (SD) 122 is normally adjustable by means of a resistor 123 connected thereto. In this embodiment, there is a relatively wide range, of (15 ± 5) dBu., for which the output of the station detector (SD) 122 is set to go high. It is therefore possible to achieve the station detection sensitivity of (15 ± 5) dBu within the range of tolerance of the resistor 123. The resistor 123 may therefore be a fixed resistor. Thus, in this embodiment, the range of antenna levels at which the output of the station detector (SD) 122 goes high is set to be relatively wide, and the condition for the IF counter 102 to begin measuring is relaxed.

b) Conditions for signal strength

In the EEPROM 18 is held in digital form the value of the output of the signal meter 120 when a 20 dBu antenna input level is input through the antenna 2 in an adjustment stage during manufacture. Therefore, during a seek operation, by comparing the actual output of the signal meter with the stored value in the EEPROM 18 in the comparator 104, it is possible to determine whether or not the input level to the antenna 2 is at least 20 dBu. Thus the output of the comparator 104 goes high only when the antenna input level input to the antenna 2 is at least 20 dBu.

The seek operation is shown in the flowchart of Fig. 17. As shown in this figure, when a seek operation is started, the seek control system 100 sends a frequency selection order to the programmable counter 82, for example in the case of Japanese broadcasting at 100 kHz intervals, and the receiving frequency scan starts (step 301). Next, depending on the yes/no decision made in step 302, that is, depending on the receiving signal strength, either in step 303 the SD output is set high, or in step 308 the SD output is set low. Because of the variability of the value of the resistor 123, the SD output of the station detector (SD) 122 of the FM detector IC 12 goes high only when the antenna input level is at least (15 ± 5) dBu.

Depending on the individual receiver, therefore, the SD output may go high when the antenna input level is 10 dBu or above, or the SD output may go high when the antenna input level is 20 dBu or above. Thus, there is a variation of up to 10 dBu from receiver to receiver in the antenna input level, but in all cases, as shown in step 304, measuring of the intermediate frequency by the IF counter 102 begins.

The signal input to the station detector (SD) 122 has a so-called S-shaped characteristic extending either side (for example ±50 kHz) of the center frequency. There may, therefore, be cases in which a signal of a frequency intermediate between two station frequencies causes the SD output to go high. In this case, only when the intermediate frequency is 10.7 MHz, that is, only when the broadcasting station is unambiguously confirmed, the output of the IF counter 102 goes high (step 305). Thus, the frequency conditions as specified in a) above are met. If in step 305 a "No" decision is made, control returns to step 301, and the receiving frequency is updated.

In the flowchart of Fig. 17, the decision of step 306, that is, the decision on the sensitivity conditions b), is shown as being carried out after step.
305, but in reality the decision of step 306 is carried out in parallel with steps 304 and 305. That is to say, the comparator 104 compares the actual signal meter output with the signal meter output value corresponding to a 20 dBu antenna input level, which has been previously stored in the EEP ROM 18. The output of the comparator 104 goes high only when the actually input signal meter output is equal to or more than the stored value. Thus it comes about that the sensitivity conditions as specified in b) above are met. Moreover, only in the case that a "Yes" decision is made in both of steps 305 and 306, scanning is stopped in step 307. Even if the frequency conditions are met in step 305, there are cases in which the sensitivity conditions are not met in step 306. This case means either that there is no station on the receiving frequency, or that the signal strength from the station is too low. In both of these cases the decision of step 306 is "No", and control returns to step 301, for the receiving frequency to be set to a frequency corresponding to the next station.

The seek operation as described above is also, as shown in Fig. 16, applicable to the case of a radio receiver having an attenuator 70. The attenuator 70 has a diode 72 and a capacitor 76 connected in series between the signal line and ground. It also has a resistor 74 with one end connected to the junction between the diode 72 and capacitor 76, and with the other end 78 forming a control voltage input terminal. This terminal 78 has a local/distance control voltage applied thereto. Thus, in cases where the station being received is close, when the broadcast signal strength is high, an operation is carried out in the operating section 18 to select local mode, and a low voltage is applied to the terminal 78. As a result, the attenuator 70 functions to attenuate the antenna level, for example attenuating the antenna level by between 16 and 19 dB. When, on the other hand, the station being received is distant, and the broadcast signal strength is low, an operation is carried out in the operating section 16 to select distance mode, and a high voltage is applied to the terminal 78. As a result, the diode 72, acting as a switch, goes open circuit, and the attenuator 70 ceases to function. The attenuation of 16 to 19 dB in the attenuator 70 as described above is subject to variation because of the variability of the resistance value of the diode. In this embodiment, even with variability in the attenuation of the attenuator 70 from unit to unit, by carrying out step 306 in Fig. 17, it is possible to surely stop scanning the receiving frequency, in local mode also, when the antenna input level is at least 20 dBu. In the case where the attenuation amount of the attenuator 70 is taken into consideration. It should be noted that the third embodiment may also be applied to an AM receiver.

Fourth Embodiment

Next an embodiment of the present invention applied to a radio receiver equipped with an automatic wide/narrow selection function is described, with reference to Figs. 18 and 19.

Fig. 18 illustrates the case in which the FM detector IC 12 shown in Fig. 2 has three IF amplifiers 130, 132 and 134. A first bandpass filter 135 is disposed before the first IF amplifier 130. Additionally, between the first and second IF amplifiers 130 and 132 are disposed a bandpass filter 136, comprising for example a ceramic filter, and a switch 138 which switches on and off the effect of this bandpass filter 136. The bandpass filters 135 and 136 and the switch 138 are components external to the IC 12. The bandpass filters 135 and 136 are only the intermediate frequency band, and in the case of FM are 10.7 MHz bandpass filters, and in the case of AM, 450 kHz bandpass filters. In the narrow mode, by turning off the switch 138, the bandpass filter 136 also functions in addition to the bandpass filter 135. In this narrow mode, high selectivity receiving conditions are established. On the other hand, in the wide mode, the switch 138 is turned on, so that the bandpass filter 136 does not function. In this case, conditions for high fidelity reception are established. In this embodiment, the on/off operation of the switch 138 is controlled by an output from the microprocessor 20. For this purpose, the microprocessor 20 has a signal meter 120 and EEP ROM 18 connected. The EEP ROM 18 holds a value of the signal meter output, which is previously stored therein in an adjustment stage during manufacture, corresponding to a high signal level for switching to the wide mode, such as, for example, an antenna input level of 50 dBu. The microprocessor 20 carries out a comparison of the actual signal meter output with the value stored in the EEP ROM 18, and controls the operation of the switch 138 based on this comparison result.

Fig. 19 shows the operation of this automatic wide/narrow selection. More specifically, when there is an antenna input in step 401, the microprocessor 20 makes a decision as to whether or not the signal meter output is at least the stored value (step 402). If the decision result of step 402 is "Yes", then the switch 138 is turned on (step 403), and the bandpass filter 136 does not function, thus increasing the bandwidth, and establishing the conditions for the wide mode (step 404). On the other hand, if the decision result of step 402 is "No", then the switch 138 is turned off (step 405), and the bandpass filter 136 does function, thus reducing the bandwidth, and establishing the conditions for the narrow mode (step 406). By this means,
regardless of component variability from unit to unit, it is possible to select the wide mode only when there is a strong signal of 50 dBu input from the antenna 2. It should be noted that the fourth embodiment may also be applied to an AM receiver.

Fifth Embodiment

Next an embodiment of the present invention applied to a radio receiver equipped with an automatic mono/stereo selection function is described, with reference to Fig. 20.

In the radio receiver to which the fifth embodiment applies, in place of the implementation of a subsidiary signal demodulation level in the subsidiary signal demodulator 34 of Fig. 1 which varies continuously from 0 to 100%, as shown in the first embodiment, there are only two subsidiary signal demodulation levels, that is to say, 0% and 100%. The case where the subsidiary signal demodulation level is 0% is the mono mode, and the case where the subsidiary signal demodulation level is 100% is the stereo mode. In the fifth embodiment it is possible to use the microprocessor 20, signal meter 120 and EEPROM 18 shown in Fig. 18. The EEPROM 18 holds a value of the signal meter output, which is previously stored therein in an adjustment stage during manufacture, corresponding to an antenna input level (corresponding to the monaural point M in Fig. 7) of 20 dBu input to the antenna 2.

The operation of this automatic mono/stereo selection is now described with reference to Fig. 20.

More specifically, when there is an antenna input (step 501), the microprocessor 20 makes a decision as to whether or not the signal meter output is greater than the value stored in the EEPROM 18 (step 502). If the decision result of step 502 is "Yes", then a voltage to establish the stereo mode is applied by the microprocessor 20 to the SPC pin 34a of the subsidiary signal demodulator 34, so that the subsidiary signal demodulation level is 100% (step 503). On the other hand, if the decision result of step 502 is "No", then a voltage to establish the mono mode is output, so that the subsidiary signal demodulation level is 0% (step 504).

Thus in the fifth embodiment, regardless of component variability from unit to unit, it is possible to automatically select the stereo mode only when there is an antenna input level of at least 20 dBu input to the antenna 2. It should be noted that the fifth embodiment may also be applied to AM stereo.

Sixth Embodiment

Next an embodiment of the present invention is described in which two high frequency cutoff ratios, of 0% and 100%, are realized in the high frequency cutoff circuit 30 shown in Fig. 1. In this case also, the microprocessor 20, signal meter 120 and EEPROM 18 shown in Fig. 18 are used, and the EEPROM 18 has previously stored therein a reference value of the signal meter output corresponding to a low antenna input level, for example 10 dBu, to the antenna 2.

The manner of operation of this embodiment is, with reference to Fig. 21, that when there is an antenna input (step 601), the microprocessor 20 makes a decision as to whether or not the signal meter output is greater than or equal to the reference value (step 602). If the decision result of step 602 is "Yes", then a relatively high voltage is applied by the microprocessor 20 to the HCC pin 30a of the high frequency cutoff circuit 30, to establish a high frequency cutoff ratio of 0% (step 603), whereas if the decision result of step 602 is "No", then a relatively low voltage is applied by the microprocessor 20 to the HCC pin 30a of the high frequency cutoff circuit 30, to establish a high frequency cutoff ratio of 100% (step 604). It should be noted that the sixth embodiment may also be applied to an AM receiver.

Claims

1. A radio receiver comprising:
   a radio frequency amplifier circuit which amplifies an antenna input signal;
   a frequency conversion circuit which converts said amplified antenna input signal to an intermediate frequency signal;
   an intermediate frequency amplifier circuit which amplifies and outputs the intermediate frequency signal, and is provided with a signal meter which detects the level of said amplified intermediate frequency signal;
   a detector circuit which detects an AM signal or FM signal from said amplified intermediate frequency signal;
   a nonvolatile memory which stores an output of said signal meter, subject to component variability from unit to unit, when a predetermined reference level of said antenna input signal is input in an adjustment stage of manufacture, as a reference voltage value; and
   a control means which, based on said signal meter output reference voltage value stored in said nonvolatile memory, sets and controls receiving conditions when different levels of said antenna input signal are input in such a way as to be appropriate to said different lev-
els of said antenna input signal with low variability from unit to unit.

2. The radio receiver of claim 1 wherein:
   the detected output of said detector circuit is a composite signal including a left channel signal and a right channel signal;
   a stereo demodulation circuit demodulating said left channel signal and right channel signal is further provided;
   said stereo demodulation circuit has:
   a principal signal demodulation circuit which demodulates a principal signal included in said composite signal;
   a subsidiary signal demodulation circuit which demodulates a subsidiary signal included in said composite signal, and varies the demodulation level of said subsidiary signal from 0 to 100% based on a stereo separation control voltage, according to predetermined stereo separation characteristics set to depend on the antenna input level; and
   a matrix circuit which regenerates the left channel signal and right channel signal from said demodulated principal signal and subsidiary signal; and
   said control means includes a stereo separation control voltage generating means which, based on said signal meter output reference voltage value stored in said nonvolatile memory, computes a correction to said signal meter output corresponding to the actually input antenna input level and generates said stereo separation control voltage.

3. The radio receiver of claim 2 wherein:
   when an antenna input signal of said reference level is input, a stereo separation control reference voltage value is set for setting a subsidiary signal demodulation level appropriate to the antenna input signal is further stored in said nonvolatile memory; and
   said stereo separation control voltage generating means, based on said signal meter output reference voltage value and said stereo separation control reference voltage value stored in said nonvolatile memory, computes a correction to said signal meter output corresponding to the actually input antenna input level and generates said stereo separation control voltage.

4. The radio receiver of claim 3 wherein:
   said nonvolatile memory stores a plurality of signal meter output reference voltage values measured respectively when an antenna input level corresponding to a monaural point with a subsidiary signal demodulation level of 0% and one or a plurality of antenna input levels corresponding to a stereo separation variation region in which the antenna input level is higher than at said monaural point are input, and respective stereo separation control reference voltage values to obtain stereo separation characteristics corresponding to this plurality of signal meter output reference voltage levels; and
   said stereo separation control voltage generating means, based on said plurality of signal meter output reference voltage values and stereo separation control reference voltage values, when an antenna input signal of any level is input computes a stereo separation control voltage corresponding to said antenna input signal level by linear interpolation.

5. The radio receiver of claims 2, 3 or 4 wherein:
   said stereo demodulation circuit is further provided with a high frequency cutoff circuit which, depending on a high frequency cutoff control voltage, reduces the high frequency components in said composite signal at a high frequency cutoff ratio varying in a predetermined manner with the antenna input level; and
   said control means includes a high frequency cutoff control voltage generating means which, based on said signal meter output reference voltage value stored in said nonvolatile memory, computes a correction to said signal meter output corresponding to the actually input antenna input level and generates said high frequency cutoff control voltage.

6. The radio receiver of claim 5 wherein:
   in said nonvolatile memory is further stored a high frequency cutoff control reference voltage value for setting a high frequency cutoff ratio appropriate to the antenna input signal when an antenna input signal of said reference level is input; and
   said high frequency cutoff control voltage generating means, based on said signal meter output reference voltage value and said high frequency cutoff control reference voltage value stored in said nonvolatile memory, computes a correction to said signal meter output corresponding to the actually input antenna input level and generates said high frequency cutoff control voltage.

7. The radio receiver of claim 6 wherein:
   said nonvolatile memory stores a plurality of signal meter output reference voltage values measured respectively when an antenna input level corresponding to a monaural point with a
subsidiary signal demodulation level of 0% and one or a plurality of antenna input levels corresponding to a high cutoff variation region in which the antenna input level is lower than at said monaural point are input, and respective high frequency cutoff control reference voltage values to obtain high frequency cutoff characteristics corresponding to this plurality of signal meter output reference voltage levels; and

said high frequency cutoff control voltage generating means, based on said plurality of signal meter output reference voltage values and high frequency cutoff control reference voltage values, when an antenna input signal of any level is input computes a high frequency cutoff control voltage corresponding to said antenna input signal level by linear interpolation.

8. The radio receiver of claims 2, 3 or 4 further comprising,

a comparator which compares said signal meter output reference voltage level stored in said nonvolatile memory with said signal meter output when said antenna input signal is input at an arbitrary level wherein;

said stereo demodulation circuit is further provided with a high frequency cutoff circuit which, depending on a high frequency cutoff control voltage, reduces the high frequency components in said composite signal at a high frequency cutoff ratio of selectively 0% or 100%;

in said nonvolatile memory is further stored the output of said signal meter when an antenna input signal corresponding to a weak broadcast signal is input, as a reference voltage value; and

when said a comparator detects said signal meter output to be lower than said signal meter output reference voltage value, said control means outputs said high frequency cutoff control voltage to set said high frequency cutoff ratio to 100%.

9. The radio receiver of claim 1 wherein:

said intermediate frequency amplifier circuit has:

a station detector which, based on said signal meter output level outputs a station detection signal when the level of said antenna input signal is within a predetermined range or exceeds the upper limit of said range; and

a buffer for counting said intermediate frequency;

said nonvolatile memory stores said signal meter output when an antenna input signal is input of a level close to or greater than or equal to the upper limit of said predetermined range determined such that said station detection signal is output from said station detector, as said reference voltage value;

said control means includes a seek control means which carries out an automatic scan of receiving frequencies, and causes a stop to the scan at a frequency of high sensitivity; and

this seek control means comprising:

an intermediate frequency counter which counts the output from said buffer for counting said intermediate frequency when said station detection signal is input from said station detector;

a comparator which compares said signal meter output reference voltage level stored in said nonvolatile memory with said signal meter output when said antenna input signal is input at an arbitrary level;

whereby ceasing said automatic scan when said intermediate frequency counter counts a predetermined intermediate frequency and said comparator detects said signal meter output to be higher than said signal meter output reference voltage level.

10. The radio receiver of claim 9 wherein:

at a stage preceding said radio frequency amplifier circuit an attenuator is provided which attenuates high antenna input levels;

a means for specifying a selection of a local mode or a distance mode for said control means is provided; and

said control means includes a first mode setting means which when said local mode is selected controls said attenuator to operate, and when said distance mode is selected controls said attenuator not to operate.

11. The radio receiver of claim 1 wherein:

said intermediate frequency amplifier circuit includes a bandpass filter which passes only the frequency band of said intermediate frequency, and a switching means switching this bandpass filter between functionally operating and non-operating states;

in said nonvolatile memory is stored the signal meter output when an antenna input signal corresponding to a strong broadcast signal is input, as a reference voltage value;

said control means includes a second mode setting means which controls the enablement of a wide bandwidth receiving mode for high fidelity or a narrow bandwidth receiving mode for high selectivity; and

said second mode setting means has a comparator which compares said signal meter
output reference voltage level stored in said nonvolatile memory with said signal meter output when said antenna input signal is input at an arbitrary level, and when said comparator detects said signal meter output to be higher than said signal meter output reference voltage level, controls the enablement of said wide bandwidth receiving mode.

12. The radio receiver of claim 1 wherein:

the detected output of said detector circuit is a composite signal including a left channel signal and a right channel signal;

a stereo demodulation circuit demodulating said left channel signal and right channel signal is further provided;

said stereo demodulation circuit has:

a principal signal demodulation circuit which demodulates a principal signal included in said composite signal;

a subsidiary signal demodulation circuit which demodulates a subsidiary signal included in said composite signal, and changes the demodulation level of said subsidiary signal to 0% or 100% based on a stereo separation control voltage, according to predetermined stereo separation characteristics set to depend on the antenna input level; and

a matrix circuit which regenerates the left channel signal and right channel signal from said demodulated principal signal and subsidiary signal;

in said nonvolatile memory is stored the output of said signal meter when an antenna input signal corresponding to a monaural point is input, as a reference voltage value; and

said control means includes a comparator which compares said signal meter output reference voltage level stored in said nonvolatile memory with said signal meter output when said antenna input signal is input at an arbitrary level, and when said comparator detects said signal meter output to be higher than said signal meter output reference voltage level, outputs said stereo separation control voltage to set said subsidiary signal demodulation level to 100%.

13. A radio receiver selecting a tuner for reception from a plurality of tuners, each comprising a receiving circuit including elements from an antenna to a detector circuit, wherein:

each of said tuners comprises:

a radio frequency amplifier circuit which amplifies an antenna input signal;

a frequency conversion circuit which converts said amplified antenna input signal to an intermediate frequency signal; and an intermediate frequency amplifier circuit which amplifies and outputs the intermediate frequency signal, and is provided with a signal meter which detects the level of said amplified intermediate frequency signal; and

a detector circuit which detects an AM signal or FM signal from said amplified intermediate frequency signal;

further comprising:

a first switch selectively outputting the outputs of said detector circuit of said tuners;

a nonvolatile memory which stores the output of said signal meter, subject to variability from tuner to tuner, when a predetermined reference level of said antenna input signal is input in an adjustment stage of manufacture, for each of said tuners as corresponding reference voltage values; and

a control means which receives the respective signal meter outputs when arbitrary levels of said antenna input signals are input to said tuners, and controls the operation of said first switch to select the tuner with the highest antenna input level; and

said control means includes:

a calculation means which, based on said signal meter output reference voltage values stored in said nonvolatile memory, computes a correction to said signal meter output from each of said tuners corresponding to arbitrary levels of said antenna input signals, to compute accurate level comparison values for said antenna input signal levels,

and a comparator for comparing said level comparison values for each of said tuners; whereby the operation of said first switch is controlled to select the tuner for which said level comparison value is highest.

14. The radio receiver of claim 13 wherein:

the detected output of said detector circuit of each of said tuners is a composite signal including a left channel signal and a right channel signal;

a stereo demodulation circuit demodulating said left channel signal and right channel signal is further provided at a stage following said first switch;

said stereo demodulation circuit has:

a principal signal demodulation circuit which demodulates a principal signal included in said composite signal;

a subsidiary signal demodulation circuit which demodulates a subsidiary signal included in said composite signal, and varies the demodulation level of said subsidiary signal from 0 to 100% based on a stereo separation control voltage, according to predetermined
stereo separation characteristics set to depend on the antenna input level; and

a matrix circuit which regenerates the left channel signal and right channel signal from said demodulated principal signal and subsidiary signal;

said calculation means of said control means, based on said signal meter output reference voltage values stored in said nonvolatile memory, computes a correction to each of said signal meter outputs corresponding to the actually input antenna input level, and then computes a stereo separation control voltage as said level comparison values; and

being further provided with a second switch which outputs the highest stereo separation control voltage for each of said tuners computed by said calculation means to said subsidiary signal demodulation circuit of said stereo demodulation circuit.

15. The radio receiver of claim 14 wherein:

when an antenna input signal of said reference level is input, a stereo separation control reference voltage value which sets a subsidiary signal demodulation level appropriate to said antenna input signal is further stored in said nonvolatile memory for each of said tuners; and

said calculation means of said control means, based on said signal meter output reference voltage values and said stereo separation control reference voltage values stored in said nonvolatile memory, computes a correction to each of said signal meter outputs corresponding to the actually input antenna input level, and generates said stereo separation control voltages.

16. The radio receiver of claim 15 wherein:

in said nonvolatile memory are stored for each of said tuners a plurality of signal meter output reference voltage values measured respectively when an antenna input level corresponding to a monaural point with a subsidiary signal demodulation level of 0% and one or a plurality of antenna input levels corresponding to a stereo separation variation region in which the antenna input level is higher than at said monaural point are input, and respective stereo separation control reference voltage values to obtain stereo separation characteristics corresponding to this plurality of signal meter output reference voltage levels; and

said calculation means of said control means, based on said plurality of signal meter output reference voltage values and said stereo separation control reference voltage values, when an antenna input signal of any level is input computes for each of said tuners a stereo separation control voltage corresponding to said antenna input signal level by linear interpolation.

17. The radio receiver of claims 14, 15 or 16 wherein:

said stereo demodulation circuit is further provided with a high frequency cutoff circuit which, depending on a high frequency cutoff control voltage, reduces the high frequency components in said composite signal at a high frequency cutoff ratio varying in a predetermined manner with the antenna input level;

said control means includes a high frequency cutoff control voltage generating means which, based on said signal meter output reference voltage values stored in said nonvolatile memory for each of said tuners, computes a correction to said signal meter output corresponding to the actually input antenna input level and generates said high frequency cutoff control voltage for each of said tuners; and

being further provided with a third switch which outputs said high frequency cutoff control voltage for the one tuner selected by said comparator among said high frequency cutoff control voltages for each of said tuners to said high frequency cutoff circuit of said stereo demodulation circuit.

18. The radio receiver of claim 17 wherein:

in said nonvolatile memory is further stored for each of said tuners a high frequency cutoff control reference voltage value for setting a high frequency cutoff ratio appropriate to the antenna input signal when an antenna input signal of said reference level is input; and

said high frequency cutoff control voltage generating means, based on said signal meter output reference voltage values and said high frequency cutoff control reference voltage values stored in said nonvolatile memory, computes a correction to said signal meter output corresponding to the actually input antenna input level and generates said high frequency cutoff control voltages.

19. The radio receiver of claim 18 wherein:

said nonvolatile memory stores for each of said tuners a plurality of signal meter output reference voltage values measured respectively when an antenna input level corresponding to a monaural point with a subsidiary signal demodulation level of 0% and one or a plural-
ility of antenna input levels corresponding to a high frequency cutoff region in which the antenna input level is lower than at said monaural point are input, and respective high frequency cutoff control reference voltage values to obtain high frequency cutoff characteristics corresponding to this plurality of signal meter output reference voltage levels; and said high frequency cutoff control voltage generating means, for each of said tuners, based on said plurality of signal meter output reference voltage values and high frequency cutoff control reference voltage values, when an antenna input signal of any level is input computes a high frequency cutoff control voltage corresponding to said antenna input signal level by linear interpolation.
FIG. 7

Output Level

High frequency cutoff region

Stereo separation variation region

12 dB

Separation 100%

dBμ

FIG. 8

Subsidiary signal demodulation level

100%

FIG. 9

High frequency cutoff ratio

100%

HCC voltage
FIG. 12

STEREO SEPARATION CONTROL VOLTAGE

SIGNAL METER OUTPUT VOLTAGE

q1
x
b1
b2
(b3)
x
a2
(a3)
FIG. 13
FIG. 17

SELECT SEEK MODE

SET SD OUTPUT LOW

SCAN RECEIVING FREQUENCIES

IS ANTENNA INPUT LEVEL AT LEAST (15 ± 5) dBµ?

SET SD OUTPUT HIGH

MEASURE INTERMEDIATE FREQUENCY

IF = 10.7 MHz?

SIGNAL METER OUTPUT ≥ REFERENCE VALUE?

CEASE SCANNING
**FIG. 18**

![Circuit Diagram](image)

**FIG. 19**

```
ANTENNA INPUT

SIGNAL METER OUTPUT ≥ REFERENCE VALUE?

YES

SWITCH OFF

SELECT NARROW MODE

NO

SWITCH ON

SELECT WIDE MODE
```
**FIG. 20**

ANTENNA INPUT 501

SIGNAL METER OUTPUT ≥ REFERENCE VALUE?

502

503 YES

SUBSIDIARY SIGNAL DEMODULATION LEVEL 100% (STEREO)

504

SUBSIDIARY SIGNAL DEMODULATION LEVEL 0% (MONO)

**FIG. 21**

ANTENNA INPUT 601

SIGNAL METER OUTPUT ≥ REFERENCE VALUE?

602

603 YES

HIGH FREQUENCY CUTOFF RATIO 0%

604

HIGH FREQUENCY CUTOFF RATIO 100%
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl5 H04B1/10

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Int. Cl5 H04B1/10

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho 1968 - 1994
Kokai Jitsuyo Shinan Koho 1971 - 1994

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category*</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>JP, A, 3-212027 (Mitsubishi Electric Corp.), September 17, 1991 (17. 09. 91), Lines 1 to 8, upper left column, page 3, Fig. 1, (Family: none)</td>
<td>1-19</td>
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<td>A</td>
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<td>A</td>
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Further documents are listed in the continuation of Box C. See patent family annex.

* Special categories of cited documents:
  "A" document defining the general state of the art which is not considered to be of particular relevance
  "E" earlier document but published on or after the international filing date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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  "O" document referred to in an oral disclosure, use, exhibition or other means
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Date of the actual completion of the international search August 2, 1994 (02. 08. 94)

Date of mailing of the international search report August 30, 1994 (30. 08. 94)

Name and mailing address of the ISA

Japanese Patent Office

Telephone No.

Form PCT/ISA/210 (second sheet) (July 1992)
Diversity radio receiver system with two tuners and a Radio Data System (RDS) decoder

An RDS receiver having dual tuners (10,12) and dual antennas operates in two distinct modes, a diversity mode and a non-diversity mode. Diversity mode is when both tuners (10,12) are tuned to a signal with the same program audio content and the audio from both tuners (10,12) is blended together in a manner to minimise the effects of multipath distortion. In non-diversity mode, a forcing circuit (23) isolates the tuner output signals so that one tuner provides the audio output while the other can be returned to any other frequency for purposes of gathering RDS data.
Description

[0001] The present invention relates in general to RDS radios having dual tuners, and more specifically to a dual mode radio for operating in both a diversity and a non-diversity mode to minimize the effects of multipath distortion while maintaining efficient collection of RDS related information, including collecting signal quality data for RDS alternate frequencies.

[0002] Space diversity radio receiver systems can be employed to reduce the effects of multipath distortion in mobile receivers. Multipath distortion is a localized effect resulting from interaction between multiple signals from a single transmitter that have traversed different paths to reach a receiving antenna. By switching between spaced antennas in a diversity radio receiver, specific multipath events can be avoided since the spacing of the antennas helps assure that not both of the antennas will experience the same multipath event at the same time.

[0003] The prior art has also shown that separate tuners may be connected to each antenna and that the tuner output signals can be combined to provide improved diversity reception.

[0004] Separate tuners have also been employed in radio data system (RDS) receivers. In the case of RDS receivers, however, the tuners simultaneously receive at different frequencies. Standard RDS broadcasts transmit auxiliary digital data within the radio signal in order to achieve various automatic functions of the receiver. The data transmitted on a sub-carrier includes alternate frequencies (AFs) at which the identical audio program can be heard. Thus, the receiver can automatically monitor AFs to determine whether a stronger or higher quality signal can be received by switching the tuner to a different frequency (e.g., as a vehicle moves relative to the broadcast transmitters). In an RDS receiver having just a single tuner, AFs can only be checked by briefly switching the tuner to an AF to detect its signal strength and then quickly returning to the original frequency before any detectable break is heard in the reproduction of the original broadcast. In RDS receivers having a second tuner, the second tuner is dedicated to collecting information about AFs (i.e., is not used for audio reproduction) and can monitor any alternate frequencies for as long as desired.

[0005] Based on the AF information which is collected and stored in memory in the receiver, the tuner which is reproducing audio signals can be switched to the strongest AF whenever the currently received signal becomes degraded. However, the response time required to detect signal degradation (such as a multipath event) and then to switch to an AF is too slow to prevent distortion from being heard. Thus, a dual tuner RDS radio system is needed which obtains RDS data gathering while providing improved immunity to multipath distortion.

[0006] The present invention provides a radio architecture and method of operation wherein maximum RDS operational flexibility is achieved in order to optimize RDS performance while obtaining immunity to multipath distortion using diversity reception.

[0007] In a primary aspect of the invention, a radio receiver for a mobile vehicle which is capable of receiving sub-carrier data from broadcasts containing such data operates in either a diversity mode or a non-diversity mode. A first tuner produces a first tuner output signal in response to a broadcast signal at a first selected broadcast frequency. A second tuner produces a second tuner output signal in response to a broadcast signal at a second selected broadcast frequency. A signal mixer produces a mixed tuner output signal in response to the first and second tuner output signals. The signal mixer proportionally combines the tuner output signals when in the diversity mode according to relative measures of signal quality. The signal mixer isolates a selected one of the tuner output signals from the mixed tuner output when in the non-diversity mode. A data demodulator is responsive to either the first tuner output signal, the second tuner output signal, or the mixed tuner output signal to recover the sub-carrier data. A control is coupled to the first and second tuners, the signal mixer, and the data demodulator and selects the diversity mode or the non-diversity mode in response to the signal quality. The control selects the first and second selected broadcast frequencies such that 1) the first and second selected broadcast frequencies each provide a user selected program when in the diversity mode, or 2) the selected one of the first and second tuner signals is searched for alternate frequency information and the other one of the first and second tuner output signals provides the user selected program when in the non-diversity mode.

[0008] The invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a block diagram showing the RDS diversity radio receiver of the present invention;
Figure 2 is a flowchart showing the operation of the receiver of Figure 1;
Figure 3 is a schematic diagram showing the forcing circuit of Figure 1 in greater detail;
Figure 4 is a flowchart showing the detection of multipath as performed by the controller of Figure 1;
Figure 5 is a flowchart showing the detection of worsening reception conditions as performed by the controller of Figure 1;
Figure 6 is a flowchart showing a method for selecting which of the two tuners to use for scanning RDS alternate frequency signal quality and data; and
Figure 7 is a flowchart showing a method for switching a reception frequency from a current frequency to a new alternate frequency.

[0009] The RDS radio receiver shown in Figure 1 operates in a diversity mode or in a non-diversity mode.
diversity mode, a pair of tuners are each tuned to the same user program (i.e., tuned to the same frequency) and their outputs are combined according to their signal strengths and the detection of multipath in order to minimise the effects of multipath distortion. In non-diversity mode, an audio output is reproduced from one tuner while the other tuner is used for scanning alternate frequencies to detect their signal quality and other data.

More specifically, the RDS diversity radio receiver includes a first tuner 10 with an antenna input 11 and a second tuner 12 with an antenna input 13. Antenna inputs 11 and 13 are preferably connected to spaced antennas 14 and 15 which are separated by a distance sufficient to avoid simultaneous multipath conditions at each antenna.

Tuners 10 and 12 are controlled by a microcontroller 16 via a control bus 19. Tuner 10 generates an FM multiplex tuner signal designated FM MPX 1, a signal strength signal SS1, and a noise detection signal ND1. Tuner 12 generates a tuner output signal FM MPX 2, signal strength signal SS2, and noise detection signal ND2. Signals SS1, ND1, SS2, and ND2, are all connected to a mix control circuit 17, microcontroller 16, and a switching and conditioning circuit 18. The FM MPX 1 signal from tuner 10 is provided through a voltage-controlled amplifier 20 to one input of a summer 21. The FM MPX 2 signal from tuner 12 is provided through a voltage-controlled amplifier 22 to a second input of summer 21.

Mix control circuit 17 provides a pair of gain control signals G1 and G2 through a forcing circuit 23 to amplifiers 20 and 22, respectively. Forcing circuit 23 receives a control signal from microcontroller 16 via control bus 19 to select between the diversity and non-diversity modes as will be described below.

The output of summer 21 provides an FM MPX MIX signal to a stereo decoder 24 and to a switching circuit 25. The output from stereo decoder 24 provides left and right decoded stereo signals for reproduction. Switching circuit 25 also receives as inputs the multiplex signals FM MPX 1 and FM MPX 2 from tuners 10 and 12. Switching circuit 25 receives a control signal from control bus 19 which selects the FM MPX 1, FM MPX 2, and FM MPX MIX signals for input to an RDS demodulator 26. RDS data recovered by demodulator 26 is provided to microcontroller 16.

Tuner output signals FM MPX 1 and FM MPX 2 are also provided to an audio correlator 27 which determines whether the audio content is identical on the two tuner output signals. Based on a comparison of the two signals, correlator 27 provides an indicating signal to microcontroller 16 to identify whether the audio content is the same.

In operation, the radio receiver of Figure 1 operates in either a diversity mode or a non-diversity mode under control of microcontroller 16. When in diversity mode, tuners 10 and 12 are preferably tuned to the same frequency to receive the same user selected program from both antennas 14 and 15 so that the received signals can be combined in a manner which avoids multipath distortion. As described in co-pending application serial number (196-0140), which is incorporated herein by reference, mix control circuit 17 is responsive to multipath conditions to provide gain control signals G1 and G2 to mix the relative contribution of the tuner output signals to the final mixed tuner output signal so that the proportion of each individual output signal in the mixed signal is inversely proportional to the likelihood of multipath in that signal. Thus, tuners 10 and 12 each generate a respective signal strength (SS) signal and a respective noise detection (ND) signal. The noise detection signal may be derived, for example, by bandpass filtering the demodulated tuner output signal with a bandpass from about 100 kHz to about 500 kHz (which measures noise and distortion from multipath and other noise sources). Gain control signal G1 as supplied to amplifier 20 tends to increase with increased signal strength SS1 in tuner 10 and tends to decrease with increasing noise content ND1. Likewise, gain control signal G2 increases with increasing signal strength SS2 from tuner 12 and decreases with increasing noise content ND2. When in the diversity mode, forcing circuit 23 directly passes gain control signals G1 and G2 from mix control circuit 17 to amplifiers 20 and 22.

Also when in diversity mode, switching circuit 25 selects the combined output from summer 21 (i.e., the FM MPX MIX signal) for input into RDS modulator 26 to assure the best quality signal for recovering RDS data for the user selected program.

When microcontroller 16 determines that the receiver should be in non-diversity mode, the elements of Figure 1 are reconfigured so that one selected tuner is used to search for predetermined alternate frequency information in the RDS signal (e.g., determining the quality of each available AF or detecting RDS data at each AF) and the other tuner is used to reproduce the user selected program. In non-diversity mode, microcontroller 16 configures forcing circuit 23 in a way which forces one of amplifiers 20 or 22 to have a maximum gain and the other amplifier to have a minimum gain. Thus, the tuner which is selected as the RDS tuner can then be tuned to any other frequency in order to gather RDS data or signal strength or other information at alternate frequencies without this action affecting the audio quality of the other tuner providing the audio output of the receiver. Also while in non-diversity mode, microcontroller 16 configures switching circuit 25 to couple the selected tuner output to RDS demodulator 26. The selection of which tuner to use as the RDS alternate frequency tuner can be arbitrary or may be done according to an optimised method such as the one discussed below in connection with Figure 6.

Switching and conditioning circuit 18 operates in a conventional manner to introduce high-cut and stereo blend in stereo decoder 24 in response to signal strength SS and noise detection ND in tuners 10 and
12. This helps eliminate any residual multipath distortion during diversity mode and improves signal reproduction during any multipath events that occur during non-diversity mode.

[0019] A preferred method for co-ordinating receiver operation between diversity and non-diversity modes is shown in Figure 2. The method begins at block 30 when the radio receiver is either turned on or when it is manually tuned to a new frequency by the user. In step 31, a check is made to determine whether RDS data is present within the currently tuned-in broadcast. If no RDS data is present, then the tuner enters diversity mode in step 40. If the station being listened to is not an RDS broadcast, then the receiver can spend full time in diversity mode.

[0020] If RDS data is present in step 31, then the receiver initially enters non-diversity mode in step 32. While in non-diversity mode, microcontroller 16 gathers RDS data at the selected broadcast frequency including alternate frequencies carrying the same broadcast audio program. Signal quality of the AFs is collected and stored in memory based on signal strength and noise detection at each AF in step 33. After signal quality is gathered for all the AFs, a check is made in step 34 to determine whether the manually selected or current frequency is the best (i.e., strongest) one to receive. If not, then a switch is made to that best AF in step 35.

[0021] In step 36 (while still in non-diversity mode), a check is made to determine whether a multipath event is present by examining signal strength and noise detection signals. If a multipath event is detected in step 36, then the receiver enters diversity mode in step 40. If no multipath event is detected, then additional lower priority RDS data may be collected and monitored in step 37. In step 38, a check is made to determine whether all possible RDS data has been gathered. If not, then a return is made to step 36. Otherwise, the receiver enters diversity mode in step 40. Thus, under good signal conditions (indicated by the tuner SS and ND signals), the receiver can spend as much time as necessary gathering RDS data.

[0022] After entering diversity mode in step 40, the receiver checks for worsening reception quality in step 41. At the point where reception quality worsens to an unacceptable level, a return is made to step 31 which allows the receiver to re-enter non-diversity mode if RDS data is present, thereby allowing a search to be conducted for a better signal at an alternate frequency. If reception quality has not worsened in step 41, then a check is made in step 42 to determine whether a predetermined period of time has passed (e.g., several minutes) in which reception quality of alternate frequencies may have changed and the memory of the receiver should be updated. If the predetermined delay has not expired, then a return is made to step 41 and the receiver remains in diversity mode. If the predetermined delay has passed, then a return is made to step 31.

[0023] Figure 3 shows forcing circuit 23 in greater detail. A pair of multiplexers 45 and 46 receive gain control signals $G_1$ and $G_2$, respectively, from mix control circuit 17. A maximum gain signal $G_{\text{max}}$ and a minimum gain control signal $G_{\text{min}}$ are provided to additional multiplexer inputs as shown. The outputs of multiplexers 45 and 46 provide modified gain control signals $G_1'$ and $G_2'$ as determined by control signals from microcontroller 16. Thus, either gain control signals $G_1$ and $G_2$ are passed unchanged, or $G_1$ is forced to maximum gain while $G_2$ is forced to minimum or no gain, or $G_1$ is forced to minimum gain while $G_2$ is forced to maximum gain depending upon the control signals.

[0024] Figure 4 shows one embodiment for detecting multipath in step 36 of Figure 2. In step 50, signal strength SS (from the tuner being used to provide the audio reproduction) is compared with a predetermined signal strength threshold. If instantaneous signal strength falls below this threshold, then a multipath event is detected. Otherwise, a check is made in step 51 to determine whether the noise detection signal indicates an amount of noise present greater than a predetermined noise threshold. If the threshold is exceeded then multipath is present, otherwise there is no multipath event taking place. Many other ways are known in the art for detecting a multipath event and any may be acceptable for purposes of this invention.

[0025] Figure 5 shows one embodiment of a method for detecting worsening reception quality as used in step 41 of Figure 2. Likewise, many other acceptable methods could be used for determining when reception quality has worsened. In this preferred embodiment, average signal quality (SQ) for a current time period is compared with average SQ for a previous time period. Signal quality as used herein means a determination based upon signal strength SS, noise detection ND, or both. Noise added to a signal may consist of multipath distortion or other noise such as intermodulation or adjacent channel noise. In the preferred embodiment, signal quality is measured in direct proportion to signal strength SS and in inverse proportion to noise detection ND. Signal quality can be determined by counting how many times signal strength SS and noise detection signal ND cross their respective thresholds during a specified time period.

[0026] In step 55, a number of times, $x$, that SS and/or ND are worse than their respective thresholds during a time block #1 is recorded. In step 56, a number of times, $y$, that SS and/or ND are worse than their respective thresholds during a time block #2 is recorded. Time blocks #1 and #2 are of equal time (each on the order of at least several seconds) and are consecutive. The values of $x$ and $y$ are indicators of signal quality $SQ$ wherein the lower the value of $x$ or $y$, the higher the signal quality. A check is made in step 57 to determine whether the count of threshold crossings has increased by 10 percent (i.e., whether $x > 110\%$ of $y$). If so, then the signal quality has unacceptably worsened and a search for a new broadcast frequency can be initiated.
Otherwise, a determination is made that reception quality has not worsened and is still acceptable. It may also be desirable to compare running averages of SS and ND with their respective thresholds to also detect unacceptable or worsened conditions.

In a typical vehicle installation, although tuners 10 and 12 have substantially identical electrical characteristics, antennas 14 and 15 will not have identical electrical properties for a variety of reasons. Aesthetic and styling requirements dictate the kind of antennas used and where they are placed on the vehicle. Commonly used types of antennas include a whip antenna mounted on a vehicle panel or roof, and an on-glass antenna. Since the antennas will most often differ in gain and radiation patterns, the signal strength received by the tuners will vary from each other even when multipath or other noise is not present. Although it may be possible to designate one tuner as a main tuner and the other as a subsidiary tuner, it may not be possible to know in advance which tuner input is likely to be connected to the better antenna. Thus, a further method is provided for selecting which tuner to use as the RDS tuner and which to use as the audio program reception tuner when entering non-diversity mode as shown in Figure 6. In general, under strong signal conditions, it may be desirable to use the strongest signal to perform RDS data gathering since the audio signal from the other tuner is then of good quality. However, whenever medium or weak signal conditions are present, it is generally desirable to use the stronger signal for audio reproduction and use the weaker signal for RDS data gathering. Thus, a check is made in step 60 to determine whether signal strength signals SS1 and SS1 are each greater than a threshold T1. If both are greater than the threshold then a strong signal is detected in step 61 and the RDS tuner is selected as the one with the bigger signal strength signal. Otherwise, a weak signal is detected in step 62 and the RDS tuner is selected as the one with the smaller signal strength signal. Non-diversity mode is entered in step 63 wherein the selected RDS tuner is scanned tuned while the other tuner is tuned to the desired frequency for the selected program.

Yet another advanced feature of the present invention relates to a completely smooth, inaudible transition when switching between alternate frequencies. In prior art receivers, an audible click or transient can often be heard during retuning to the new frequency. In the present invention, the forcing circuit can be modified to provide ramping signals for controlling the gain control signals to smoothly transition reproduction from one tuner to the other. Before performing such a transition, however, the receiver needs to verify that the content at each frequency is the same. Thus, even though the program information (PI) RDS code may indicate that the two frequencies have the same program audio, there are instances where the program audio may in fact be different. Furthermore, in some instances under weak signal conditions, the RDS decoder may have difficulty obtaining the PI code or may take an unacceptably long period of time to obtain the PI code. Thus, audio correlator 27 in Figure 1 is used to verify identical program audio. Audio correlator 27 is a known circuit for indicating whether or not the two multiplex signals have their inputs correlated.

As shown in Figure 7, a check is made in step 64 to determine whether the audio signals are correlated. If the signals are not correlated, then the transitioning between alternate frequencies is skipped. Otherwise, the receiver enters non-diversity mode in step 66. In step 67, the selected RDS tuner is retuned to the new frequency. Then, the amplifier gains are ramped in step 68 such that audio reproduction transitions from the other tuner to the selected RDS tuner. In step 69, the other tuner is retuned to the new frequency and the receiver enters diversity mode in step 70.

Claims

1. A radio receiver for a mobile vehicle wherein said receiver is capable of receiving sub-carrier data from broadcasts containing said data, and wherein said receiver operates in either a diversity mode or a non-diversity mode, said receiver comprising:

a first tuner (10) producing a first tuner output signal in response to a broadcast signal at a first selected broadcast frequency;

a second tuner (12) producing a second tuner output signal in response to a broadcast signal at a second selected broadcast frequency;

a signal mixer (17, 20, 21, 22, 23) producing a mixed tuner output signal in response to said first and second tuner output signals, said signal mixer proportionally combining said first and second tuner output signals when in said diversity mode according to relative measures of signal quality, and said signal mixer isolating a selected one of said first and second tuner output signals from said mixed tuner output when in said non-diversity mode;

a data demodulator (25) responsive to either said first or second tuner output signal or said mixed tuner output signal to recover said sub-carrier data; and

a control (16) coupled to said first and second tuners (10, 12), said signal mixer (17, 20, 21, 22, 23) and said data demodulator (26), said control (16) selecting said diversity mode or said non-diversity mode in response to said signal quality, said control controlling said first and second selected broadcast frequencies such that 1) said first and second selected broadcast frequencies each provide a user selected program when in said diversity mode, or 2) said selected one of said first and
second tuner output signals is searched for predetermined alternate frequency information according to said sub-carrier data and the other one of said first and second tuner output signals provides said user selected program when in said non-diversity mode.

2. A radio receiver as claimed in claim 1, wherein said control (16) includes a quality detector determining said signal strength in response to received signal strength and distortion.

3. A radio receiver as claimed in claim 2, wherein said distortion is comprised of multipath distortion.

4. A radio receiver as claimed in claim 2, wherein said distortion is comprised of noise.

5. A radio receiver as claimed in claim 1, wherein said first and second tuners (10, 12) each includes its own respective external antenna connection.

6. A radio receiver as claimed in claim 1, wherein said first and second tuners (10, 12) provide first and second signal strength signals, respectively, wherein said control (16) includes threshold means for comparing at least one of said signal strength signals with a threshold, wherein said selected one of said first and second tuner output signals is the one having a greater signal strength signal when said comparison indicates a signal strength above said threshold, and wherein said selected one of said first and second tuner output signals is the one having a lesser signal strength signal when said comparison indicates a signal strength below said threshold.

7. A radio receiver as claimed in claim 1, wherein said first and second selected broadcast frequencies are the same during said diversity mode.

8. A radio receiver as claimed in claim 7, wherein said control (16) transitions said receiver from an original broadcast frequency to a new broadcast frequency containing the same user selected program by 1) entering said non-diversity mode, 2) returning said selected one of said first and second tuner output signals to said new broadcast frequency, 3) ramping said mixed tuner output signal from said other one of said first and second tuner output signals to said selected one of said first and second tuner output signals, 4) returning said other one of said first and second tuner output signals to said new broadcast frequency, and 5) entering said diversity mode.

9. A radio receiver as claimed in claim 8, further comprising an audio correlator comparing said first and second tuner output signals and producing an indicating signal when said first and second tuner output signals are verified to contain said same user selected program, wherein said control transitions to said new broadcast frequency only if said indicating signal is present.

10. A method of mobile radio reception in a mobile receiver capable of receiving sub-carrier data from broadcasts containing said data, and wherein said receiver operates in either a diversity mode or a non-diversity mode, said method comprising the steps of:

- producing a first tuner output signal from a first tuner in response to a broadcast signal at a first selected broadcast frequency;
- producing a second tuner output signal from a second tuner in response to a broadcast signal at a second selected broadcast frequency;
- combining said first and second tuner output signals to produce a mixed tuner output signal, wherein said first and second tuner output signals are proportionally combined when in said diversity mode according to relative measures of signal quality, and wherein said mixed tuner output signal is isolated from said first and second tuner output signals in said non-diversity mode;
- recovering said sub-carrier data in response to either said first and second tuner output signals of said mixed tuner output signal to recover said sub-carrier data;
- selecting said diversity mode or said non-diversity mode in response to said signal quality; and
- setting said first and second selected broadcast frequencies such that 1) said first and second selected broadcast frequencies each provide a same user selected program when in said diversity mode, or 2) said selected one of said first and second tuner output signals is searched for predetermined alternate frequency information according to said sub-carrier data and the other one of said first and second tuner output signals provides said user selected program when in said non-diversity mode.
Diversity radio receiver system with two tuners and a Radio Data System (RDS) decoder

An RDS receiver having dual tuners (10,12) and dual antennas operates in two distinct modes, a diversity mode and a non-diversity mode. Diversity mode is when both tuners (10,12) are tuned to a signal with the same program audio content and the audio from both tuners (10,12) is blended together in a manner to minimise the effects of multipath distortion. In non-diversity mode, a forcing circuit (23) isolates the tuner output signals so that one tuner provides the audio output while the other can be retuned to any other frequency for purposes of gathering RDS data.
### DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
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<th>Citation of document with indication, where appropriate, of relevant passages</th>
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**The present search report has been drawn up for all claims**

**Examiner:** van Hoorick, J

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**CATEGORY OF CITED DOCUMENTS**

- **T:** theory or principle underlying the invention
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For more details about this annex: see Official Journal of the European Patent Office, No. 12/92
Distributed tuner allocation and conflict resolution

Systems, methods and computer program products for allocating tuner resources to tuner consumers when a conflict occurs. When the tuner resources of a system or network reside at a central server, the tuners are allocated to requesting consumers according to the priority of the tuner request and the current tuner priorities. A tuner request that has a higher priority than one of the current tuners is granted. The tuner is not taken from the consumer without warning, however. Tuner conflict is also prevented by lowering the respective tuner priorities as appropriate.

Fig. 1
Description

BACKGROUND OF THE INVENTION

The Field of the Invention

[0001] The present invention relates to allocating tuner resources in a distributed system. The present invention further relates to systems, methods, and computer program products for allocating tuner resources in a distributed system where the tuner resources are distributed across the distributed system and more particularly to allocating tuner resources where the tuner resources reside on a central server.

Background and Relevant Art

[0002] One of the advantages of systems, such as satellite and cable television systems, that deliver audio/video (AV) content is the ability to deliver an increasing number of channels and choices to users. Together, digital satellite systems and cable television systems offer hundreds of television channels from which a user may select. In addition to delivering AV content, these systems also deliver other types of content or data that can be stored on a computer or other processing device.

[0003] In order to receive the various types of content, however, the user may be required to tune to an appropriate channel. In fact, much of the content received through satellite and cable systems requires a tuner. Tuners, therefore, are an important resource as they play an integral role in retrieving content from various sources. Viewing live television, for example, requires a tuner. If the user desires to have picture in picture (PIP) capabilities, a second tuner is typically required for the PIP window. Recording a television program is another function that requires a tuner. Other functions, such as retrieving content such as guide data or receiving a software update, may also require a tuner.

[0004] The ability of a user to perform concurrent actions is often limited by the number of tuners that are available to the user. A system that only has one tuner can only tune one program or channel at a time, even though the user may be able to view previously recorded programs. If a system with only one tuner is recording a program, then that tuner cannot be used for another purpose, unless the user terminates the recording. A system with two tuners provides more flexibility to users. In this case, a user can use the first tuner to record one program while using the second tuner to view another program. Alternatively, the user can concurrently record two programs.

[0005] In some systems, the content is received at a gateway or central server and then distributed to various nodes. Because the tuners are often located at the gateway or central server and because the number of tuners is limited, there is a potential for tuner conflict because tuners are heavily used to retrieve content. Tuner conflict or contention among the consumers that require tuners is inevitable.

[0006] From a user's perspective, the following scenarios describe some of the potential conflicts that may arise with respect to tuner usage. In one scenario, a user may desire to either watch a television program or record a television program and there is no tuner available. In this situation, the user will not be able to either watch television or record a television program unless the conflict can be resolved. In another scenario, the user is watching television and either another user or the system requests a tuner. It is undesirable to interrupt the user watching television in order to provide a tuner to the requesting consumer. Thus, there is a need to resolve this conflict.

[0007] Alternatively, the user desires to watch television, but all tuners are being used to tune television channels. However, the system cannot determine whether someone is actually watching the channels being tuned by those tuners. In this case, a tuner may be available, but it is difficult to ascertain. Other scenarios with tuner conflict may occur, but the limiting factor of these systems is that the number of tuner consumers typically outnumber the tuners that are available in the distributed system. Because these systems rely heavily on the tuner resources, they are a scarce resource and tuner conflict needs to be predictably resolved.

SUMMARY OF THE INVENTION

[0008] The present invention recognizes the limitations of the prior art and the need for systems, methods, and computer program products for allocating tuner resources. In a network or system where content from a source is received through a central server and where tuners primarily reside on the central server, the tuners can become a scarce resource and conflict can arise with respect to tuner usage because the number of consumers that require a tuner typically outnumber the tuners that are available on the central server or in the distributed system. The present invention also applies to those situations where the tuners are not all located at the central server, but are distributed throughout the system or network.

[0009] The system or the central server can only guarantee that a certain number of video streams (equal to the number of tuners) can be used simultaneously. Because of the potential tuner conflict, the central server manages the conflict and allocates tuners to consumers with a tuner arbiter that enforces tuner rules and tuner priorities. When a tuner request is received and a tuner conflict occurs, the tuner arbiter predictably resolves the tuner conflict according to those rules and priorities.

[0010] In accordance with the present invention, the following rules and priorities apply. Each live television event requires a tuner even when two users are watching the same program through different set-top boxes. Similarly, each record event also requires a single tuner.
Pause buffers, typically used to temporarily record a live television event, are not shared among users. If a pause buffer were shared, then the ability of one user to watch television when the other user changes channels may be interrupted. Record buffers, used to record a video stream, are shared in limited circumstances that do not present a potential tuner conflict.

When a tuner is requested by a consumer and a tuner is available, the tuner is allocated to the requesting consumer. If there is a conflict, then the conflict is resolved by the tuner arbiter of the distributed system or of the central server. Each tuner has a particular priority that is determined in part by how the tuner is being used. A tuner that is recording a program, for example, has high priority, while an idle tuner has low priority. The resolution of the tuner conflict depends on the relative priorities of the tuners and on the tuner priority associated with the tuner request. In some instances, a consumer may lose a tuner based on the relative priorities.

In addition to allocating tuners based on rules and/or priorities, the present invention resolves conflict by presenting a user with options or choices. When a tuner is unavailable and cannot be allocated based on priority, the user is given the option of altering a current tuner usage. For example, a scheduled event that is currently being recorded may be rescheduled such that the tuner is made available for the requesting user. Other options may also be presented to the user that will free a tuner.

The present invention also attempts to prevent tuner conflict before it occurs. This is performed by actively monitoring tuner priorities and by lowering their priorities when possible. For example, the priority of a tuner used to record a video stream is lowered when the recording is finished. Preventing tuner conflict is thus another aspect of the present invention and is a part of allocating tuner resources to consumers.

Additional features and advantages of the invention will be set forth in the description which follows, and in part will be obvious from the description, or may be learned by the practice of the invention. The features and advantages of the invention may be realized and obtained by means of the instruments and combinations particularly pointed out in the appended claims. These and other features of the present invention will become more fully apparent from the following description and appended claims, or may be learned by the practice of the invention as set forth hereinafter.

**Detailed Description of the Preferred Embodiments**

The present invention relates to allocating tuner resources in a distributed system or network. In these systems or networks, the number of consumers that use or require tuner resources typically outnumber the tuners that are available for allocation, especially when the tuners reside on a central server or set top box. The present invention allocates tuners to the consumers and resolves conflicts that arise with respect to tuner usage and tuner requests. Those tuners are allocated predictably, thus ensuring that a consumer does not lose control of a tuner without forewarning or without being asked to relinquish their tuner. The present invention is scalable and can be adapted to any number of tuners that reside in the system or network.

One of the advantages of the present invention is that when a user has control of a tuner, the tuner will not be taken from the user without forewarning the user or asking the user for the tuner. The present invention also encourages scheduled recordings to occur, for example, by being rescheduled in some instances or by informing the user that the tuner will be unavailable when the tuner is required to record a program. The present invention also attempts to prevent tuner conflict by attempting to determine if a tuner is actually being used by a consumer. Finally, a user cannot force another user to relinquish their tuner.

In the following description, the following terms...
will apply. A consumer refers to entities that use tuner resources and includes, but is not limited to, users, set top boxes, a scheduler, and the like. A tuner or a tuner resource is used to retrieve or receive content or data from a source, which include, but are not limited to, a satellite system, a specific satellite transponder, or a cable system. A pause buffer is used to temporarily store a current event such as a television program. The pause buffer is used for an event that is not being recorded and a tuner associated with a pause buffer is controlled by a user. A record buffer is a buffer for a currently recording event and a tuner associated with a record buffer is controlled by a scheduler. When a user desires to watch a recorded program, no tuner is required. A television window can be a full screen window, a medium screen window, a picture in picture (PIP) window, and the like. A scheduler is a component that maintains and manages events including record events.

Figure 1 illustrates an exemplary environment for implementing the present invention. Figure 1 illustrates a source 100 that is connected with a network 110. Exemplary sources include, but are not limited to, a satellite system 102, a cable system 104 and the Internet 106. The content or data that is available from the source 100 includes, but is not limited to, audio/video data, video streams, text, guide data, services, software updates, advertisements, image data, other data and the like or any combination thereof.

The network 110 illustrated in Figure 1 includes, for example, a central server 120 and one or more node set top boxes 114, 116, and 118. The central server 120 often functions as a gateway between the network 110 and the source 100. Thus, content or data intended for any particular node set top box or for the central server typically passes through the central server 120. In some instances, however, a node set top box may access the source 100 directly. For example, the set top box 114 may have a separate connection with the Internet 106.

A set top box is an exemplary computing environment that is able to receive, send and process content. Exemplary set top boxes include, but are not limited to, digital video recorders (DVRs), satellite receivers, Internet terminals, cable boxes, digital satellite systems (DSS), a computer, and the like and any combination thereof. The central server 120, for example, may also function as a server computer for the network 110. Much of the content or data that is delivered to the node set top boxes 114, 116, and 118 is distributed and delivered by the central server 120.

Figure 2, for example, illustrates some exemplary resources of a central server that are allocated or distributed to the potential consumers or users of those resources. In particular, the central server 120 illustrated in Figure 2 includes tuner resources shown as: tuner 122, tuner 124, and tuner 126. It is understood that the central server 120 may include any number of tuners. These tuners are consolidated at the central server 120 and can be used by any of the node set top boxes illustrated in Figure 1. When a tuner is used by either a node set top box or the central server, the tuner is distributed or allocated to that set top box. This, of course, does not preclude one of the node set top boxes from having their own tuner. In this example, however, the tuner resources of the network 100 (of Figure 1) reside on the central server 120. The present invention can also be applied to those networks where the tuners are located at various set top box boxes across the network 100 in addition to the central server 120.

Figure 2 also illustrates exemplary consumers of the resources of the central server: user 128, user 130, user 132, PIP 134, and a scheduler 140. The users 128, 130, and 132 are users that are using a node set top box for some function that requires a tuner resource. The PIP 134 is a separate window that is displayed to one of the users and also requires a tuner resource. The scheduler 140 is a component that schedules and manages events for the network. In this example, the scheduler 140 is able to record tuned scheduled events. Because this example illustrates three tuners, the scheduler 140 can control three concurrent recording events, illustrated as recording 142, recording 144, and recording 146.

Figure 2 illustrates that the number of potential consumers is greater than the number of tuners at the central server 120. As previously stated, the tuner resources of the central server 120 are used for a wide number of different purposes that include, but are not limited to, retrieving audio/video data for a television program, receiving services from a source (such as movie data, stock quotes, sport scores, etc.), retrieving software updates from a source, receiving advertisements that are displayed to the users (this is often performed at night when the tuners are likely not in use by the users), aligning a dish, and receiving guide data that describes, for example, television programming that can be accessed from the source 100 through the network 110. Some of the functions for which a tuner are required are deferrable events. For example, receiving a software update or receiving new guide data can be deferred in some instances.

Figure 3 illustrates some of exemplary uses or functions of a tuner resource and illustrates the difference between a pause buffer and a record buffer. When a user at a set top box 306 is, for example, watching a live or current television program, the video will be displayed on the display device 306. For a current television program a tuner is required and in this example, the tuner 300 is tuned to the channel and program selected by the user. If the user is recording the program, then a record buffer 304 is used to record the program. During the recording, the tuner 300 is controlled by the scheduler 140 of Figure 2. The recording is stored on either the central server or on a node set top box. If the user is not recording the program, then a pause buffer 302 is used to record the program as well. The pause
buffer is temporary and a new pause buffer begins, for example, each time the user changes channels. When the tuner 300 is using a pause buffer 302, the tuner 300 is controlled by the user.

[0036] Figure 4 illustrates an exemplary tuner priority list 400. The priority list 400 is used to determine a priority level of a particular tuner. The priority list 400 can also be used to identify a priority level associated with a tuner request. The priority list 400 is thus used in allocating a tuner. Tuners with a low priority, for example, may be allocated to tuner requests that are associated with a higher priority. Tuners that are used for recording (401) have the highest priority. The next level of priority is assigned to a tuner that is writing to or associated with a pause buffer (402). In other words, tuners used for watching live television have this level of priority because a pause buffer is being used. In one example, a tuner used for a pause buffer at the central server has a higher priority that a tuner writing to a pause buffer for a node set top box. Alternatively, if more than one pause buffer is present, then the tuner associated with the most recent user input has higher priority.

[0036] Tuners used for data services (403) have the next priority. Data services typically provide a specific type of data to a user and a tuner is required to access and retrieve the data. For example, a movie service may provide movie related data to a user. Other data services include, but are not limited to, software updates, user profile data, and the like. Some of the data services provide real-time data and these services may have a higher priority than other data services. There is no distinction between data service occurring on a node set top box and data services occurring on the central server. As previously mentioned, many data services are deferrable events. However, some events are non-deferrable and take priority even over higher priority events. When a feed is removed from the set top box, for example, a tuner will be taken away by the central server.

[0037] The next level of priority is when a tuner is writing to a pause buffer for a PIP window. In this case, the user has control of two tuners: one for the regular window and one for the PIP window. If a tuner is required for another use, the PIP tuner, because of its relatively low priority in the priority list 400, will be taken. The lowest priority is assigned to an idle tuner (405). Clearly, an idle tuner is available for any request, at which time it will receive a higher priority based on the usage of the tuner.

[0038] When a tuner is requested by a consumer and/or allocated to a consumer, the priority levels of the tuners are determined. The lowest priority tuner is a candidate to be reallocated to the requesting consumer. The tuner, however, is not always reallocated because the priority level of the consumer request and the identity of the requesting consumer (user or system, for example) are also considered.

[0039] Figure 5 is a block diagram illustrating a tuner arbiter that allocates or distributes the tuner resources to the various consumers that may require a tuner resource. The tuner arbiter 500 is responsible for utilizing the rules engine 502 to allocate the tuners 122, 124, and 126 to the various consumers. The rules engine 502 implements rules that enable the tuner arbiter 500 to resolve conflicts over the tuner resources. The rules engine 502 also takes the tuner priority list 400 into account when resolving tuner conflicts.

[0040] Each tuner of the central server 120 has an associated tuner driver. One of skill in the art would recognize that other driver implementations are possible. In this embodiment, the tuner driver 121 controls the tuner 122, the tuner driver 123 controls the tuner 124, and the tuner driver 125 controls the tuner 126 in this example. Each tuner driver typically maintains information including, but not limited to, tuner state (idle, in use, to pause buffer, to record buffer, etc.), channel, recorded by scheduler, and the like. The tuner information can be used to determine the priority level of a tuner, for example, or determine a current tuner usage. The tuner arbiter 500, for example, can determine whether a tuner is being used for recording a program, watching television, receiving data services, or other function. The particular activity of the tuner thus has an impact on other tuner requests from other consumers. Typically, a tuner will not be taken if it has a higher priority than the priority of the tuner request. A tuner used to record a program, for example, is not taken to allow a user to watch live television.

[0041] The rules engine 502 is also based in part upon the following principles or rules and each principle or rule is illustrated with respect to Figure 1 and Figure 4. Resolving tuner requests and allocating tuner resources are performed using the rules discussed below and/or the tuner priorities previously discussed. For each situation discussed below, the tuners have a corresponding priority level as previously described. When a tuner request is received, the system or the central server determines if the tuner request causes a tuner conflict such that a tuner cannot be allocated. If a tuner conflict is determined, then the rules described below are used in resolving the tuner conflict.

[0042] Each live television event or program requires a single tuner. For example, a user is watching a program on the set top box 114 and another user is watching the same program on the set to box 116. Each user is using a separate tuner allocated by the tuner arbiter 500 of the central server 120. This example also assumes that the programs being watched are not previously recorded programs because viewing a previously recorded program does not require a tuner resource. If the tuners are being used for a live television event, then the tuners are writing to a pause buffer and have a corresponding priority level.

[0043] Each record event also requires a single tuner. For example, a user schedules a program to be recorded by a set top box 114. If the program is being recorded and if the user desires to watch that program, then an
additional tuner is required. In other words, if the user is watching the program on the set top box 114, then two of the tuners from the central server are being used. The tuner used to record the program is controlled by the scheduler and the other tuner used to watch live television is controlled by the user. A tuner used for a record event also has a priority level as previously described.

[0044] Record buffers are typically not shared. One exception to this case is when a user tunes to a channel and begins recording that channel. When the user begins to record the channel, then control of the tuner passes from the user to the scheduler. As long as the user continues to view the channel being recorded, the same tuner will be used. If the user desires to change channels, however, a second tuner will be required as the scheduler is controlling the tuner that is used for the recording in this example. And because a recording event has a higher priority that a tuner used to watch live television. If another tuner is not available, then the conflict is resolved by the tuner arbiter with reference to the rules engine 502 and the priority list 400.

[0045] If a user is viewing a program that is being recorded and the user changes channels and then desires to change back to the channel or program that is recording, the user will be able to use the record buffer in this case. If the channel or program is no longer recording, then the user will not use the record buffer, but will use a pause buffer. The user will also have control of the tuner, which was relinquished by the scheduler when the recording finished. If a user on another set top box desires to watch the channel or program being recorded by the first user, that user will not be able to use the record buffer, but will require their own tuner.

[0046] Pause buffers are not shared between users. Two users that tune to the same channel or program on different set top boxes will not share the same pause buffer. One reason for not sharing the pause buffer is related to predictability and control of the tuner. For example, assume that the central server 120 detects that two users on the set top boxes 114 and 116 are viewing the same program. The central server 120 thus decides to have the users share a tuner and a corresponding pause buffer. The relinquished tuner is reallocated to another consumer and the remaining tuner resources of the central server 120 are in use. When the user who is sharing a pause buffer with another user decides to change to another program, a need for an additional tuner is created in order to ensure that the program of both users remains uninterrupted. Because none of the other tuners are currently idle, one of the users will be unable to continue viewing their program. Conflict that occurs as a result of an action by an unknown user is undesirable and should be avoided. For this reason, pause buffers are not shared.

[0047] A recording cannot be stopped or deleted if another user is viewing the recording. However, the recording can be stopped and/or deleted if only one user is watching the recording as it is being recorded.

[0048] When a conflict is detected by the tuner arbiter in response to a consumer tuner request or other event, a broadcast message is sent to the node set top boxes unless the conflict can be resolved without sending a broadcast message. The broadcast message will disappear as soon as a user responds in a manner that frees a tuner. For example, the broadcast message may cause a user to terminate a recording such that the tuner is freed for use by the requesting consumer. If no user responds to the broadcast message, then the system may take the tuner with the lowest priority. These rules and the tuner priority list are used by the rules engine 502 or the tuner arbiter 500 to resolve tuner conflicts.

[0049] When a user loses their tuner due to conflict resolution or for other reasons, the user will typically remain in the same application. For instance, if a user is viewing guide data when the tuner is taken away from the user, the user will remain in the guide data application and a message will appear indicating that no tuners are currently available.

[0050] Usually, a tuner is only taken away from an existing user when the tuner request has a higher priority than the current tuner usage. However, there are instances when a tuner may be reallocated. For example, when a user fails to respond to a broadcast message or when the current tuner usage of a user is for a PIP window, then the tuner may be reallocated to the requesting user. In the case where a tuner is used for a PIP window and the current user desires to capture the pause buffer for a record buffer, then reallocating this tuner may cause the recording to be prematurely terminated. To promote consistency, tuners are typically only reallocated when a user fails to respond to a broadcast message. This approach ensures that the adversely affected user is the user that is not actually using the tuner and that the user from whom the tuner is taken has simply failed to relinquish the tuner.

[0051] Another aspect of determining tuner priority is by preventing or resolving tuner conflict without interrupting or querying any of the users. The present invention therefore attempts to resolve tuner conflicts before they occur by altering tuner priorities in certain circumstances.

[0052] Determining or detecting whether a user still requires a tuner can be difficult. For example, if a user that is watching a television program through a node set top box simply leaves without turning off the set top box, then neither the node set top box nor the central server is aware that the tuner is available. From the perspective of the tuner arbiter or central server, the tuner is still being used by the user even though the user is no longer present.

[0053] Determining whether a consumer or a user is still using a tuner can be accomplished by establishing an idle time. If the set top box has not experienced any user input (no channel changes, etc.) within the idle time, then the state of the tuner can be automatically set to an idle state. The idle time can be user defined. The
set top box can also broadcast a message when the idle time expires to validate that the tuner is not being used. This broadcast message can be specific to the set top box that is using the tuner resource at issue.

[0054] Using the tuner drivers which store the state of the tuners, the tuner arbiter 500 can make a better decision regarding tuner priority. The tuner can be placed in an idle state or relinquished, for example, in the following situations. When a tuner is finished recording, the tuned is placed in an idle state, which has the lowest priority. When a user decides to watch a recorded program, which does not require a tuner, the tuner(s) that the user is using are also placed in an idle state. When the set top box is turned off, the tuner is relinquished and placed in an idle state. Tuners with an idle state are available for use by a consumer. Reducing the priority of a tuner in these and other situations reduces the likelihood of future conflict.

[0055] In a situation where a user is not watching a live television program but is in an application for which a tuner may be required, such as a guide data application, the set top box is capable of entering a screen saver mode. The set top box is typically not capable of the screen saver mode when live television is being displayed. When the set top box enters a screen saver mode, the tuner is relinquished and placed in an idle state if the screen saver mode is not interrupted for a certain time period because it is reasonable to assume that the tuner is not being actively used in the absence of user input. User input, on the other hand, indicates that the user is actively involved in the application and is using the tuner. In these types of situations, the tuner states are set as idle states, which have low priority and are available for consumer tuner requests.

[0056] When a tuner is available, the tuner may be freely allocated to a requesting consumer. Figure 6 illustrates an exemplary method for allocating tuner resources when no tuner is available for a user, which indicates that all tuners are being used for some functionality. Tuner allocation is related to the priority of the tuner usage and conflicts are resolved based in part on the tuner priorities. Tuner unavailability implies that the tuners in use have the same or higher priority than the tuner request. For example, a user request to watch live television will not take a tuner away from another user that is watching live television. However, a tuner request for live television may take a tuner away from a deferrable event or from a tuner usage that has lower priority.

[0057] In this instance, a tuner is not available. When a user begins to use a set top box for a purpose that requires a tuner, such as viewing television, the user is informed that no tuner is currently available (600). The user is presented with a choice to view a recorded program or show (601) or to select other options 602 that may permit the user to obtain a tuner. If the user elects to view a recorded program, no tuner is required and the conflict is resolved.

[0058] If the user selects options 602, the user is first presented with the option to reschedule a currently recording program (604). This option is typically provided if the central server can reschedule to program. In this example, the set top box may search the guide data to determine if the show is shown at another date and time. If the set top box determines, for example, that the program cannot be rescheduled, then the user is presented with the option of canceling the current recording (606). The user's ability to cancel the recording, however, is subject to the rules described previously.

[0059] If these options do not free a tuner or if those options cannot be accomplished, then the user may be presented with the option of actually checking the other set top boxes (608) to determine if a user is actually using the tuners. This is often accomplished by broadcasting a message on the other set top boxes. While checking the other set top boxes, the central server can determine tuner usage based on the tuner state. If the tuner is associated with a record buffer, then the program is being recorded and the tuner has high priority. If the tuner is associated with a pause buffer, then the user, if present, is watching television.

[0060] Broadcasting a message thus determines if the user is actually watching television, an action that cannot be determined from the tuner state. The broadcasted message to the other set top boxes asks if the user is watching television or otherwise using a tuner. The actual message broadcasted to the users is not in the form of "Are you using a tuner?" because the user may not understand the question. Instead, the user is asked, for example, whether they are watching television, which implicitly requires a tuner. Thus, no response to the broadcast message suggests that the user is not present and is not using the tuner even though the tuner may be tuning and writing to a pause buffer. In this situation, control of that tuner that did not receive a user response is given to the user that is requesting the tuner and the conflict is resolved. If no tuners are available, the user is typically advised that no tuner is available. The user may also be advised that the user will be notified when a tuner becomes available.

[0061] Another type of tuner conflict arises when the system requests or requires a tuner. The first example occurs when the scheduler requires a tuner in order to record a scheduled program. A recording tuner has high priority. In this case, the system indicates to the user that their tuner will be unavailable during the scheduled recording and that their current tuner usage will terminate when the scheduler requires the tuner.

[0062] The system also provides the user, however, with some options in this scenario. The user has the ability to either record the program as scheduled, or to reschedule the recording. If reschedule is selected, then the scheduler will no longer require the tuner to record a program, the conflict is removed and the user can continue using the tuner knowing that they will not lose their tuner to the scheduler. If rescheduling the program is not possible, the user is given the option of canceling
the recording, if the user decides to cancel the recording, then the tuner remains available and control of the tuner will not be relinquished to the scheduler. If the user does not cancel or reschedule the recording, then the user may lose the tuner to the scheduler and the scheduler will record the program with the tuner the user is currently controlling (unless another tuner becomes available in the interim).

[0063] Alternatively, the system broadcasts a message to determine if the tuners (or televisions) are in use. If a yes response is received from some users, then those tuners remain unavailable. If no response is received from one of the tuner users, then that tuner is allocated to the requesting consumer. In some instances, the system will require a tuner immediately and will take the lowest priority tuner. For example, when a satellite feed is removed from the back of the box, a tuner is unavailable and will be taken.

[0064] Another situation is where the system wants a tuner for a deferred event. If no tuners are currently available, the system will wait until a tuner becomes available. This ensures that users are not interrupted. In a situation where a user requests a tuner being used for a system deferred event, the system is preempted and the tuner is allocated to the user. However, the priority of the user request is typically higher than a deferred event. For example, assume that two tuners are being used for recording and one tuner is being used for a system deferred event. When a user turns on a television to watch television, the system deferred event is interrupted and the tuner is allocated to the user to watch television. A system deferred event usually has lower priority than a tuner used to watch television.

[0065] Another factor that can be incorporated into determining tuner priority and to allocating tuners is by assigning priorities to various set top boxes of televisions within the network. In a home, for example, the set top box that is primarily used may the highest priority, while the parent's set top box may have the next highest priority. This can be used, for example, to determine which set top boxes receive a broadcast message or to determine which tuner is taken by default when no users respond to the broadcast messages.

[0066] Figure 7 is another example of resolving tuner conflict. At 700, a tuner request is received at a central server. At 702, the central server or the tuner arbiter determines whether a tuner conflict exists. If no conflict is present, a tuner is allocated to the requesting consumer (704). If a conflict is present, the conflict is resolved at 710.

[0067] Resolving a tuner conflict requires the tuner arbiter to identify the current tuner priorities and the associated tuner usages. This information alone is often sufficient to resolve the conflict. For example, a request to watch live television has priority over a tuner used for a PIP window. In this case, the tuner used for the PIP window is allocated to the requesting consumer. If the tuner conflict cannot be resolved using the tuner priorities, then a message is broadcast (716) as previously described. If the conflict is resolved successfully for the requesting consumer, a tuner is allocated to the requesting consumer (718). Otherwise, the requesting consumer must wait until a tuner becomes available.

[0068] The present invention extends to both methods and systems for allocating tuner resources in a distributed system. The embodiments of the present invention may comprise a special-purpose or general-purpose computer including various computer hardware, as discussed in greater detail below. The set top boxes described herein are examples of special-purpose computers.

[0069] Embodiments within the scope of the present invention also include computer-readable media for carrying or having computer-executable instructions or data structures stored thereon. Such computer-readable media can be any available media that can be accessed by a general purpose or special purpose computer. By way of example, and not limitation, such computer-readable media can comprise RAM, ROM, EEPROM, CD-ROM or other optical disk storage, magnetic disk storage or other magnetic storage devices, or any other medium which can be used to carry or store desired program code means in the form of computer-executable instructions or data structures and which can be accessed by a general purpose or special purpose computer. When information is transferred or provided over a network or another communications connection (either hardwired, wireless, or a combination of hardwired or wireless) to a computer, the computer properly views the connection as a computer-readable medium. Thus, any such connection is properly termed a computer-readable medium. Combinations of the above should also be included within the scope of computer-readable media. Computer-executable instructions comprise, for example, instructions and data which cause a special purpose computer, special purpose computer, or special purpose processing device to perform certain function or group of functions.

[0070] Figure 8 and the following discussion are intended to provide a brief, general description of a suitable computing environment in which the invention may be implemented. Although not required, the invention will be described in the general context of computer-executable instructions, such as program modules, being executed by computers in network environments. Generally, program modules include routines, programs, objects, components, data structures, etc. that perform particular tasks or implement particular abstract data types. Computer-executable instructions, associated data structures, and program modules represent examples of the program code means for executing steps of the methods disclosed herein. The particular sequence of such executable instructions or associated data structures represents examples of corresponding acts for implementing the functions described in such steps.

[0071] Those skilled in the art will appreciate that the
Invention may be practiced in network computing environments with many types of computer system configurations, including personal computers, hand-held devices, multi-processor systems, microprocessor-based or programmable consumer electronics, network PCs, minicomputers, mainframe computers, and the like. The invention may also be practiced in distributed computing environments where tasks are performed by local and remote processing devices that are linked (either by hardwired links, wireless links, or by a combination of hardwired or wireless links) through a communications network. In a distributed computing environment, program modules may be located in both local and remote memory storage devices.

With reference to Figure 8, an exemplary system for implementing the invention includes a general purpose computing device in the form of a conventional computer 20, including a processing unit 21, a system memory 22, and a system bus 23 that couples various system components including the system memory 22 to the processing unit 21. The system bus 23 may be any of several types of bus structures including a memory bus or memory controller, a peripheral bus, and a local bus using any of a variety of bus architectures. The system memory includes read only memory (ROM) 24 and random access memory (RAM) 25. A basic input/output system (BIOS) 26, containing the basic routines that help transfer information between elements of the computer 20, such as during start-up, may be stored in ROM 24.

The computer 20 may also include a magnetic hard disk drive 27 for reading from and writing to a magnetic hard disk 39, a magnetic disk drive 28 for reading from or writing to a removable magnetic disk 29, and an optical disk drive 30 for reading from or writing to removable optical disk 31 such as a CD-ROM or other optical media. The magnetic hard disk drive 27, magnetic disk drive 28, and optical disk drive 30 are connected to the system bus 23 by a hard disk drive interface 22, a magnetic disk drive interface 33, and an optical drive interface 34, respectively. The drives and their associated computer-readable media provide nonvolatile storage of computer-executable instructions, data structures, program modules, and other data for the computer 20. Although the exemplary environment described herein employs a magnetic hard disk 39, a removable magnetic disk 29, and a removable optical disk 31, other types of computer-readable media for storing data can be used, including magnetic cassettes, flash memory cards, digital versatile disks, Bernoulli cartridges, RAMs, ROMs, and the like.

Program code means comprising one or more program modules may be stored on the hard disk 39, magnetic disk 29, optical disk 31, ROM 24 or RAM 25, including an operating system 35, one or more application programs 36, other program modules 37, and program data 38. A user may enter commands and information into the computer 20 through keyboard 40, pointing device 42, or other input devices (not shown), such as a microphone, joy stick, game pad, satellite dish, scanner, or the like. These and other input devices are often connected to the processing unit 21 through a serial port interface 46 coupled to system bus 23. Alternatively, the input devices may be connected by other interfaces, such as a parallel port, a game port or a universal serial bus (USB). A monitor 47 or another display device is also connected to system bus 23 via an interface, such as video adapter 48. In addition to the monitor, personal computers typically include other peripheral output devices (not shown), such as speakers and printers.

The computer 20 may operate in a networked environment using logical connections to one or more remote computers, such as remote computers 49a and 49b. Remote computers 49a and 49b may each be another personal computer, a server, a router, a network PC, a peer device or other common network node, and typically include many or all of the elements described above relative to the computer 20, although only memory storage devices 50a and 50b and their associated application programs 38a and 38b have been illustrated in Figure 8. The logical connections depicted in Figure 8 include a local area network (LAN) 51 and a wide area network (WAN) 52 that are presented here by way of example and not limitation. Such networking environments are commonplace in office-wide or enterprise-wide computer networks, intranets and the Internet.

When used in a LAN networking environment, the computer 20 is connected to the local network 51 through a network interface or adapter 53. When used in a WAN networking environment, the computer 20 may include a modem 54, a wireless link, or other means for establishing communications over the wide area network 52, such as the Internet. The modem 54, which may be internal or external, is connected to the system bus 23 via the serial port interface 46. In a networked environment, program modules depicted relative to the computer 20, or portions thereof, may be stored in the remote memory storage device. It will be appreciated that the network connections shown are exemplary and other means of establishing communications over wide area network 52 may be used.

The present invention may be embodied in other specific forms without departing from its spirit or essential characteristics. The described embodiments are to be considered in all respects only as illustrative and not restrictive. The scope of the invention is, therefore, indicated by the appended claims rather than by the foregoing description. All changes which come within the meaning and range of equivalency of the claims are to be embraced within their scope.

Claims

1. In a network where consumers that include one or
more set top boxes use tuners located at a central server, wherein the tuners are required to deliver content from a source to the consumers in the network, a method for allocating a tuner to a consumer, the method comprising:

receiving a tuner request at the central server from a consumer, wherein the tuner request is associated with a tuner priority;

determining if the tuner request causes a tuner conflict such that a tuner cannot be allocated to the requesting consumer, wherein the tuner request is granted if there is not a tuner conflict; and

resolving the tuner request by providing the consumer with a particular tuner that has a priority that is less than the tuner priority associated with the tuner request, wherein the particular tuner is not allocated to the consumer if the priority of the particular tuner is equal or greater than the tuner priority associated with the tuner request.

2. A method as defined in claim 1, wherein receiving a tuner request at the central server further comprises at least one of:

receiving a tuner request to record a program or for a record buffer;

receiving a tuner request to watch a live program or for a pause buffer, wherein a tuner request to record a program has higher priority than a tuner used to watch a live program;

receiving a tuner request to use data services, wherein a tuner request to watch a live program has higher priority than a tuner used for data services; and

receiving a tuner request for a picture in picture window, wherein a tuner request to use data services has higher priority than a tuner used for a picture in picture window.

3. A method as defined in claim 1, wherein determining if the request causes a tuner conflict further comprises determining if all tuners are being used by a consumer, wherein a tuner in an idle state is not being used by a consumer and can be allocated to the requesting consumer.

4. A method as defined in claim 1, wherein resolving the request for the tuner further comprises:

broadcasting a message to other consumers, wherein the broadcast message determines whether a consumer is using a particular tuner; and

allocating the particular tuner to the requesting consumer if no response to the message is received.

5. A method as defined in claim 1, wherein the requesting consumer is a user and a tuner is being used for a system definable event, interrupting the system definable event and allocating the tuner to the requesting consumer.

6. A method as defined in claim 5, wherein resolving the request for the tuner further comprises notifying consumers that their use of a tuner may end because of a scheduled event that has a higher priority than the current priority of the tuner.

7. In a system where consumers including one or more node set top boxes and a central server that distributes content from a source to the node set top boxes, wherein the central server includes one or more tuners that are used by the central server and the one or more node set top boxes, a method for allocating the one or more tuners to the consumers, the method comprising:

receiving a tuner request from a consumer, wherein the tuner request creates a tuner conflict such that there is not a tuner available to allocate to the requesting consumer;

receiving the tuner request by having the consumer select at least one of:

displaying a recorded program to the user, wherein a tuner is not required to display the recorded program and the tuner conflict is resolved; and

changing a scheduled event such that a particular tuner associated with the scheduled event that causes a conflict with the tuner request no longer conflicts with the tuner request; and

allocating the particular tuner to the consumer.

8. A method as defined in claim 7, wherein receiving a tuner from a consumer further comprises at least one of:

receiving a tuner request to record a program or for a record buffer;

receiving a tuner request to watch a live program or for a pause buffer, wherein a tuner request to record a program has higher priority than a tuner used to watch a live program;

receiving a tuner request to use data services, wherein a tuner request to watch a live program has higher priority than a tuner used for data services; and

receiving a tuner request for a picture in picture window, wherein a tuner request to use data services has higher priority than a tuner used
9. A method as defined in claim 7, wherein changing a scheduled event further comprises:
   rescheduling a scheduled event such that the particular tuner used for the scheduled event no longer conflicts with the tuner request; and
canceling a scheduled event such that the particular tuner used for the scheduled event no longer conflicts with the tuner request.

10. A method as defined in claim 7, wherein resolving the tuner request further comprises:
   broadcasting a message to other consumers to determine whether a consumer is using a particular tuner; and
   allocating the particular tuner to the requesting consumer if no response to the message is received.

11. A method as defined in claim 8, wherein resolving the tuner request further comprises allocating a particular tuner to the requesting consumer if the particular tuner has a priority lower than a priority associated with the tuner request.

12. A method as defined in claim 7, wherein resolving the tuner request further comprises preventing the tuner conflict by lowering a priority of a tuner when a particular tuner usage terminates.

13. A method as defined in claim 12, wherein preventing the tuner conflict further comprises placing a particular tuner in an idle state when the tuner usage terminates.

14. A method as defined in claim 13, wherein the tuner usage is one of:
   recording a program;
   not receiving a response to a broadcast message; and
   not receiving a user response when a set top box enters a screensaver mode.

15. In a network where consumers that include one or more set top boxes use tuners located at a central server, wherein the tuners are required to deliver content from a source to the consumers in the network, a computer program product for implementing a method for allocating a tuner to a consumer, the computer program product comprising:
   a computer readable medium having computer executable instructions for performing the method, the method comprising:
   receiving a tuner request at the central server from a consumer, wherein the tuner request is associated with a tuner priority; determining if the tuner request causes a tuner conflict such that a tuner cannot be allocated to the requesting consumer, wherein the tuner request is granted if there is not a tuner conflict; and resolving the request for the tuner by providing the consumer with a particular tuner that has a priority that is less than the tuner priority associated with the tuner request, wherein the particular tuner is not allocated to the consumer if the priority of the particular tuner is equal or greater than the tuner priority associated with the tuner request.

16. A computer program product as defined in claim 15, wherein receiving a tuner request at the central server further comprises at least one of:
   receiving a tuner request to record a program or for a record buffer;
   receiving a tuner request to watch a live program or for a pause buffer, wherein a tuner request to record a program has higher priority than a tuner used to watch a live program;
   receiving a tuner request to use data services, wherein a tuner request to watch a live program has higher priority than a tuner used for data services; and
   receiving a tuner request for a picture in picture window, wherein a tuner request to use data services has higher priority than a tuner used for a picture in picture window.

17. A computer program product as defined in claim 15, wherein determining if the request causes a tuner conflict further comprises determining if all tuners are being used by a consumer, wherein a tuner in an idle state is not being used by a consumer and can be allocated to the requesting consumer.

18. A computer program product as defined in claim 15, wherein resolving the request for the tuner further comprises:
   broadcasting a message to other consumers, wherein the broadcast message determines whether a consumer is using a particular tuner; and
   allocating the particular tuner to the requesting consumer if no response to the message is received.

19. A computer program product as defined in claim 15, wherein the requesting consumer is a user and a tuner is being used for a system deferrable event,
interrupting the system deferrable event and allocating the tuner to the requesting consumer.

20. A computer program product as defined in claim 19, wherein resolving the request for the tuner further comprises notifying consumers that their use of a tuner may end because of a scheduled event that has a higher priority that the current priority of the tuner.

21. In a system where consumers including one or more node set top boxes and a central server that distributes content from a source to the node set top boxes, wherein the central server includes one or more tuners that are used by the central server and the one or more node set top boxes, a computer program product for implementing a method for allocating the one or more tuners to the consumers, the computer program product comprising:

a computer readable medium having computer executable instructions for performing the method, the method comprising:

receiving a tuner request from a consumer, wherein the tuner request creates a tuner conflict such that there is not a tuner available to allocate to the requesting consumer;

resolving the tuner request by having the consumer select at least one of:

displaying a recorded program to the user, wherein a tuner is not required to display the recorded program and the tuner conflict is resolved; and

changing a scheduled event such that a particular tuner associated with the scheduled event that causes a conflict with the tuner request no longer conflicts with the tuner request, and allocating the particular tuner to the consumer.

22. A computer program product as defined in claim 21, wherein receiving a tuner from a consumer further comprises at least one of:

receiving a tuner request to record a program or for a record buffer;

receiving a tuner request to watch a live program or for a pause buffer, wherein a tuner request to record a program has higher priority than a tuner used to watch a live program;

receiving a tuner request to use data services, wherein a tuner request to watch a live program has higher priority than a tuner used for data services; and

receiving a tuner request for a picture in picture window, wherein a tuner request to use data services has higher priority than a tuner used for a picture in picture window.

23. A computer program product as defined in claim 21, wherein changing a scheduled event further comprises:

rescheduling a scheduled event such that the particular tuner used for the scheduled event no longer conflicts with the tuner request; and

canceling a scheduled event such that the particular tuner used for the scheduled event no longer conflicts with the tuner request.

24. A computer program product as defined in claim 21, wherein resolving the tuner request further comprises:

broadcasting a message to other consumers to determine whether a consumer is using a particular tuner; and

allocating the particular tuner to the requesting consumer if no response to the message is received.

25. A computer program product as defined in claim 22, wherein resolving the tuner request further comprises allocating a particular tuner to the requesting consumer if the particular tuner has a priority lower than a priority associated with the tuner request.

26. A computer program product as defined in claim 21, wherein resolving the tuner request further comprises preventing the tuner conflict by lowering a priority of a tuner when a particular tuner usage terminates.

27. A computer program product as defined in claim 26, wherein preventing the tuner conflict further comprises placing a particular tuner in an idle state when the tuner usage terminates.

28. A computer program product as defined in claim 27, wherein the tuner usage is one of:

recording a program;

not receiving a response to a broadcast message; and

not receiving a user response when a set top box enters a screensaver mode.

29. In a network where consumers use tuners that are distributed within the network, wherein the tuners are required to deliver content from a source to the consumers in the network, a method for allocating a tuner to a consumer, the method comprising:
allocating tuners in the network to consumers according to rules that govern tuner usage within the network;
when a consumer makes a tuner request for a tuner from the tuners distributed in the network, determining if the tuner request causes a tuner conflict such that a tuner cannot be allocated to the requesting consumer, wherein the tuner request is granted if there is not a tuner conflict such that a tuner is allocated to the requesting consumer; and resolving the tuner conflict by allocating a particular tuner to the consumer that has a priority that is less than a tuner priority associated with the tuner request, wherein the particular tuner is not allocated to the consumer if the priority of the particular tuner is equal or greater than the tuner priority associated with the tuner request.

30. A method as defined in claim 29, wherein determining if the tuner request causes a tuner conflict such that a tuner cannot be allocated to the requesting consumer further comprises at least one of:

determining if the tuner request is to record a program or for a record buffer;
determining if the tuner request is to watch a live program or for a pause buffer, wherein a tuner request to record a program has higher priority than a tuner used to watch a live program;
determining if the tuner request is to use data services, wherein a tuner request to watch a live program has higher priority than a tuner used for data services; and determining if the tuner request is for a picture in picture window, wherein a tuner request to use data services has higher priority than a tuner used for a picture in picture window.

31. A method as defined in claim 29, determining if the tuner request causes a tuner conflict such that a tuner cannot be allocated to the requesting consumer further comprises determining if all tuners are being used by a consumer, wherein a tuner in an idle state is not being used by a consumer and can be allocated to the requesting consumer.

32. A method as defined in claim 29, wherein resolving the tuner conflict further comprises:

broadcasting a message to other consumers, wherein the broadcast message determines whether a consumer is using a particular tuner; and
allocating the particular tuner to the requesting consumer if no response to the broadcast message is received.

33. A method as defined in claim 29, wherein the requesting consumer is a user and a tuner is being used for a system deferrable event, interrupting the system deferrable event and allocating the tuner to the requesting consumer.

34. A method as defined in claim 33, wherein resolving the tuner conflict further comprises notifying consumers that their use of a tuner may end because of a scheduled event that has a higher priority than the current priority of the tuner.

35. A method as defined in claim 29, wherein each set top box in the network has a priority that determines which tuner is taken by default when no user responds to a broadcast message.

36. A method as defined in claim 29, wherein the rules comprise one or more of:

allocating a separate tuner for each live television event;
allocating a separate tuner for each record event;
allocating a separate tuner for each pause buffer such that consumers do not share a pause buffer;
allocating a separate tuner for each record buffer such that consumers do not share a record buffer;
allowing a consumer who initiates a record event to return to a record buffer for the record event;
preventing a record event from terminating if another consumer is viewing the record event as it records, wherein the record event can be terminated if only a single consumer is watching the record event while it is recording;
broadcasting a message to other consumers to determine if tuners are in use, wherein at least one tuner from the tuners allocated to consumers that do not respond to the message is taken for the requesting consumer;
taking a tuner according to tuner priorities; and informing the requesting consumer that no tuner is available.

37. In a network where consumers use tuners that are distributed within the network, wherein a tuner is required to deliver content from a source to a consumer in the network, a method for allocating tuners according to tuner usage, the method comprising:

determining if a tuner request causes a tuner conflict such that a tuner cannot be allocated to a requesting consumer, wherein a tuner re-
quest is granted if there is not a tuner conflict according to rules administered by a rules engine, wherein the rules comprise:

assigning a separate tuner to each event;
assigning a separate tuner to each pause buffer; and
assigning a separate tuner to each record buffer; and

allocating tuners by a rules engine according to the rules if there is a conflict, wherein no consumer loses a tuner without receiving a broadcast and wherein the consumer that loses a tuner is determined according to tuner priorities.

38. A method as defined in claim 37, wherein a first consumer and a second consumer are viewing the same event using different set top boxes, wherein the rules further comprise assigning a first tuner to the first consumer for a pause buffer and assigning a second tuner to the second consumer for a separate pause buffer.

39. A method as defined in claim 37, wherein the rules further comprise allowing a consumer to use a tuner for recording a live television event and for viewing the live television event, wherein the consumer requires another tuner if the consumer desires to perform another function that requires a tuner.

40. A method as defined in claim 39, wherein the tuner is controlled by a scheduler when the tuner is used for recording an event.

41. A method as defined in claim 37, wherein a recording event cannot be interrupted by another consumer.

42. A method as defined in claim 37, further comprising broadcasting a message in an attempt to acquire a tuner for a requesting consumer.

43. A method as defined in claim 37, further comprising taking a tuner for a requesting consumer according to tuner priorities such that a tuner with the lowest priority is reallocated to the requesting consumer.
FIG. 5

USER TUNER REQUEST RESULTS IN A TUNER CONFLICT

OPTIONS
RESCHEDULE A CURRENTLY RECORDING SHOW
CANCEL CURRENT RECORDING
CHECK SET TOP BOXES

FIG. 6

VIEW RECORDED SHOW

17
FIG. 7

700  RECEIVE A TUNER REQUEST

702  TUNER CONFLICT?

704  PROVIDE TUNER TO REQUESTING CONSUMER

YES

RESOLVE THE TUNER CONFLICT

712  IDENTIFY TUNER PRIORITIES AND ASSOCIATED TUNER USAGE

714  CONSUMER IS A USER OR SYSTEM CONSUMER

716  BROADCAST MESSAGE

718  ALLOCATE TUNER TO REQUESTING CONSUMER
Distributed tuner allocation and conflict resolution

Systems, methods and computer program products for allocating tuner resources to tuner consumers when a tuner conflict occurs. When the tuner resources of a system or network reside at a central server, the tuners are allocated to requesting consumers according to the priority of the tuner request and the current tuner priorities. A tuner request that has a higher priority than one of the current tuners is granted. The tuner is not taken from the consumer without warning, however. Tuner conflict is also prevented by lowering the respective tuner priorities as appropriate.
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The present search report has been drawn up for all claims.

Place of search: THE HAGUE  
Data of completion of the search: 6 April 2004  
Examiner: Van der Zaal, R
ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO. EP 03 00 4273

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are not contained in the European Patent Office EDIP file on The European Patent Office is in no way liable for these part citations which are merely given for the purpose of information.

06-04-2004

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For more details about this annex: see Official Journal of the European Patent Office, No. 12/02
**EUROPEAN PATENT OFFICE**

Patent Abstracts of Japan

**PUBLICATION NUMBER** : 2004064478
**PUBLICATION DATE** : 26-02-04
**APPLICATION DATE** : 30-07-02
**APPLICATION NUMBER** : 2002220909

**APPLICANT** : SONY CORP;
**INVENTOR** : TAKAGI HIROSHI;
**INT.CL.** : H04N 5/44 H04N 5/76
**TITLE** : BROADCAST RECEIVER AND TUNER CONTROL METHOD

**ABSTRACT** : PROBLEM TO BE SOLVED: To improve the usability by a user, and to validly utilize tuner resources.

SOLUTION: In this broadcast receiver having a plurality tuner means and a recording function, a priority order is set in the assignment of the tuner means concerning various functions, and the tuner means are selectively controlled on the basis of the functions (purposes) to be performed and the priority order. Concerning functions (viewing, manual recording, and reserved recording) by the desired operations of a user, the specialization and high priority order of the tuners to be performed is realized. Concerning automatic functions (EPG data acquisition, just clock, and automatic recording), the selection and low priority order of the tuners is realized.

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(57) 【要約】
【課題】ユーザーの使用性の向上及びチューニング源の有効活用
【解決手段】複数のチューニング源を有し録画機能を有する放送受信装置において、各種機能についてのチューニング手段の割り当てに優先順位を設定し、実行する機能（目的）及び優先順位に基づいてチューニング手段を選択的に制御する。ユーザーの希望する操作による機能（視聴、手動録画、予約録画）については実行するチューニングの専用化及び優先順位とする。自動機能（ＥＰＧデータ取得、ジャストクロック、自動録画）についてはチューニングの選択を可能とし、低優先順位とする。
【選択図】

図5
【特許請求の範囲】
【請求項1】
複数のチューナ手段と、
上記複数のチューナ手段のうちの第1のチューナ手段で受信復調された放送信号を視聴用信号として出力することのできる視聴出力手段と、
上記複数のチューナ手段のいずれかで受信復調された放送信号を記録媒体に記録することのできる記録手段と、
上記複数のチューナ手段がそれぞれ実行する受信復調動作について、その受信復調動作の目的の適切な優先順位を設定するとともに、チューナ手段による受信復調動作が必要とする際に、その受信復調動作の目的の種別及び優先順位に基づいて、上記複数のチューナ手段のうちのいずれかのチューナ手段に当該受信復調動作を実行させる制御手段と、
を備えたことを特徴とする放送受信装置。
【請求項2】
上記制御手段は、上記視聴出力手段による視聴用信号の出力を目的とする放送信号の受信復調動作を優先順位の高い動作と設定することとともに、
当該目的の受信復調動作の実行要求が発生した際には、上記第1のチューナ手段において当該目的のための受信復調動作を実行させることを特徴とする請求項1に記載の放送受信装置。
【請求項3】
上記制御手段は、操作に応じて上記記録手段によって放送信号を記録媒体に記録することを目的とする放送信号の受信復調動作を優先順位の高い動作と設定することとともに、
当該目的の受信復調動作の実行要求が発生した際には、上記複数のチューナ手段のうちの第2のチューナ手段において、当該目的のための受信復調動作を実行させることを特徴とする請求項1に記載の放送受信装置。
【請求項4】
上記制御手段は、所定の自動処理を目的とする放送信号の受信復調動作を優先順位の低い動作と設定することにより、
当該目的の受信復調動作の実行要求が発生した際には、上記複数のチューナ手段のうちで動作実行可能な状態のチューナ手段を選択して、当該目的の受信復調動作を実行させることがを特徴とする請求項1に記載の放送受信装置。
【請求項5】
上記所定の自動処理を目的とする放送信号の受信復調動作は、放送信号から特定の情報を抽出するための受信復調動作であることを特徴とする請求項4に記載の放送受信装置。
【請求項6】
上記所定の自動処理を目的とする放送信号の受信復調動作は、自動的に上記記録手段によって放送信号を記録媒体に記録するための放送信号の受信復調動作であることを特徴とする請求項4に記載の放送受信装置。
【請求項7】
上記制御手段は、実行要求に応じた受信復調動作を終了するチューナ手段に実行させようとする際に、そのチューナ手段において優先順位の低い受信復調動作が実行されていた場合には、その優先順位の低い受信復調動作を終了させ、実行要求に応じた受信復調動作を実行させることを特徴とする請求項1に記載の放送受信装置。
【請求項8】
上記制御手段は、実行要求に応じた受信復調動作を終了するチューナ手段に実行させようとする際に、そのチューナ手段において優先順位が同等以上の受信復調動作が実行されていた場合は、上記実行要求をキャンセルすることを特徴とする請求項1に記載の放送受信装置。
【請求項9】
上記複数のチューナ手段がそれぞれ実行する受信復調動作について、その受信復調動作の目的に応じて優先順位を設定するとともに、受信復調動作の予約要求に応じて、その受信
復調動作の目的種別及び優先順位に基づいて、上記複数のチューナ手段のうちのいずれかのチューナ手段に対して、当該受信復調動作の予約を行う予約手段を、更に備えたことを特徴とする請求項1に記載の放送受信装置。

【請求項10】
上記予約手段は、上記視聴出力手段による視聴用信号の出力を目的とする放送信号の受信復調動作を優先順位の高い動作と設定することにより、当該目的の受信復調動作の予約要求が発生した際には、上記第1のチューナ手段に対する予約情報として、当該目的のための受信復調動作の予約を行うことを特徴とする請求項9に記載の放送受信装置。

【請求項11】
上記予約手段は、操作に応じて上記記録手段によって放送信号を記録媒体に記録することを目的とする放送信号の受信復調動作を優先順位の高い動作と設定することにより、当該目的の受信復調動作の予約要求が発生した際には、上記複数のチューナ手段のうちの第2のチューナ手段に対する予約情報として、当該目的のための受信復調動作の予約を行うことを特徴とする請求項9に記載の放送受信装置。

【請求項12】
上記予約手段は、所定の自動処理を目的とする放送信号の受信復調動作を優先順位の低い動作と設定することにより、当該目的の受信復調動作の予約要求が発生した際には、上記複数のチューナ手段のうちで予約可能な状態のチューナ手段を選択して、選択したチューナ手段に対する予約情報として、当該目的の受信復調動作の予約を行うことを特徴とする請求項9に記載の放送受信装置。

【請求項13】
上記所定の自動処理を目的とする放送信号の受信復調動作とは、放送信号から特定の情報を探出すための受信復調動作であることを特徴とする請求項12に記載の放送受信装置。

【請求項14】
上記所定の自動処理を目的とする放送信号の受信復調動作とは、自動的に上記記録手段によって放送信号を記録媒体に記録するための放送信号の受信復調動作であることを特徴とする請求項12に記載の放送受信装置。

【請求項15】
上記予約手段は、予約要求された受信復調動作を各チューナ手段に対して予約しようとする際に、そのチューナ手段に対する同時刻の予約として優先順位の低い受信復調動作が予約されていた場合は、その優先順位の低い受信復調動作の予約を抹消して、予約要求された受信復調動作を予約することを特徴とする請求項9に記載の放送受信装置。

【請求項16】
上記予約手段は、予約要求された受信復調動作を各チューナ手段に対して予約しようとする際に、そのチューナ手段に対する同時刻の予約として優先順位が同等以上の受信復調動作が予約されていた場合は、上記予約要求をキャンセルすることを特徴とする請求項9に記載の放送受信装置。

【請求項17】
複数のチューナ手段がそれぞれ実行する受信復調動作について、その受信復調動作の目的に応じて優先順位を設定することにより、チューナ手段による受信復調動作が必要とする際には、その受信復調動作の目的種別及び優先順位に基づいて、上記複数のチューナ手段のうちのいずれかのチューナ手段に当該受信復調動作を実行させることを特徴とするチューナ制御方法。

【請求項18】
視聴用信号の出力を目的とする放送信号の受信復調動作を優先順位の高い動作と設定することにより、当該目的の受信復調動作の実行要求が発生した際には、上記複数のチューナ手段のうちの
第1のチューナ手段において当該目的のための受信復調動作を実行させることを特徴とする請求項17に記載のチューナ制御方法。
【請求項19】
操作に応じて放送信号を記録媒体に記録することを目的とする放送信号の受信復調動作を優先順位の高い動作と設定するとともに、
当該目的の受信復調動作の実行要求が発生した際には、上記複数のチューナ手段のうちの第2のチューナ手段において、当該目的のための受信復調動作を実行させることを特徴とする請求項17に記載のチューナ制御方法。
【請求項20】
所定の自動処理を目的とする放送信号の受信復調動作を優先順位の低い動作と設定するとともに、
当該目的の受信復調動作の実行要求が発生した際には、上記複数のチューナ手段のうちで動作実行可能な状態のチューナ手段を選択して当該目的の受信復調動作を実行させることを特徴とする請求項17に記載のチューナ制御方法。
【発明の詳細な説明】
【0001】
【発明の属する技術分野】
本発明は、テレビ放送などを受信する放送受信装置であって、複数のチューナを備えた放送受信装置、及びそのチューナ制御方法に関するものである。
【0002】
【従来の技術】
放送衛星や通信衛星等の衛星によって、テレビジョン信号をデジタル信号化して伝送し、例えば各家庭においてこの放送信号を受信して視聴する。デジタル衛星放送システムが普及している。このような放送システムにおいては、例えば150近くあるチャンネルを確保することが可能であるため、例えばこれまでの地上波による放送と比較しても、非常に多くの番組を放送することができる。
【0003】
そこで、デジタル衛星放送システムでは、多くの番組のなかから所望の番組を確実に選択できるようにするために、放送番組についての情報である、電子番組ガイド（Electronic Program Guide）の情報伝送するようにしている。デジタル衛星放送受信装置側では電子番組ガイドのデータに基づいて番組ガイド表を作成して表示出力可能に構成されている。この番組ガイド表は、GUI（Graphic User Interface）として構成されており、例えばユーザは、この番組ガイド表に対する操作を行うことで所望の番組を選択することなどができるようになっている。
【0004】
またEPGには番組のジャンル、例えばニュース、スポーツ、ドラマなどの種別が含まれており、EPGを利用して放送中の番組をジャンル毎にグループ化して管理することができるため、これを利用して大量のチャンネルの中から見たいジャンルの番組を検索することも可能とされている。
【0005】
また近年では、ハードディスクなどの大容量記録媒体を用い、テレビ番組を録画できる記録再生装置が実現されている。例えば放送受信装置にHDD（ハードディスクドライブ）を組み込むことで、その放送受
信頼度を用いることで、ユーザは番組の視聴だけでなく、録画及びその再生を楽しむことができると。

【0006】
【発明書解決する課題】
ところで、このような録画機能を備えた放送受信装置を考慮した場合、番組の手動録画、予約録画、視聴といったユーザーの意志で機器を制御する機能（手動機能）に加えられるのみならず、EPGデータ取得、ジャストクロック機能、自動録画など、装置が自発的に進行機能（自動機能）も同時に実現しなければならない。
そこで、各機能を実現するためにはチューナによる受信復調動作（所定チャンネルの選局及び選局された放送信号の復調）が必要になる。

【0007】
番組の視聴の場合は、当然ユーザーが要求した番組（チャンネル）についての受信復調動作が必要になる。
また、ユーザー録画操作に応じて録画を開始する手動録画、或いはユーザーの予約操作に基づいて予約された時間に実行される予約録画も、その録画する放送の受信復調動作が必要になる。
また、近年では自動録画としてもユーザーが要求しない録画を実行する機能もある。例えば、ユーザが視聴する番組を計画的に記録しており、ユーザが大きく選んだ番組を判別して、ユーザが録画操作又は録画予約を行わなくとも、その番組を自動的に録画してしまう機能である。このような自動録画を行う際も、当然、録画する放送の受信復調動作が必要になる。

【0008】
またEPGデータは、放送信号に重畳されているため、EPGデータを取得する場合には、放送信号の受信復調動作が必要になる。
ジャストクロック機能とは、例えば放送信号における時報音を検出して、装置内部の時計を合わせる機能である。この機能を実行する場合も放送信号の受信復調動作が必要になる。

【0009】
このように視聴、録画、予約録画、自動録画、EPGデータ取得、ジャストクロック等の各機能は、その機能の実行される場合に、それぞれ必要な受信復調動作が実行される。

【0010】
ここで、装置に1つ以上のチューナしか搭載されていない場合を考えると、ある機能のための受信復調動作が実行されているときに、別の機能の受信復調動作が要求されても、それが実行できない。もしくは実行中の機能の受信復調動作を中断させなければならない。例えば、自動録画を実行中にユーザが他のチャンネルの番組を視聴しようとして操作を行った場合は、自動録画を中断させる必要がある。

【0011】
一方、チューナを1つ搭載した構成を考えると、ある程度複数の機能を同時に実行することが可能となる。例えば視聴用チューナと録画用チューナを設けると、ある番組を録画を実行しながら他の番組を視聴することが可能となる。
しかししながら、上記のように多機能が実装されていることに応じて、各機能にそれぞれ専用となるように多数のチューナを設けることは、資源的、機器構成的な無駄が多くなり好ましくない。
このため、複数のチューナを設ける場合において、各チューナをより効率的に活用できるようにすることが求められている。

【0012】
【課題を解決するための手段】
本発明はこのような事情に鑑みて、複数のチューナ手段を備え、また放送信号の記録機能を備えた放送受信装置において、チューナ手段を有効利用して各種機能のための受信復調動作が実行できるようにすることを目的とする。
【0013】
本発明の放送受信装置では、複数のチューナーヘッドと、上記複数のチューナーヘッドのうちの一つで行われる受信復調動作によって出力することができる視聴出力手段と、上記複数のチューナーヘッドのいずれかで受信復調動作を記録媒体に記録することのできる記録手段と、上記複数のチューナーヘッドがそれぞれ実行する受信復調動作について、その受信復調動作の目的に応じて優先順位を設定するとともに、チューナーヘッドによる受信復調動作が必要とされる場合には、その受信復調動作の目的種別及び優先順位に基づいて、上記複数のチューナーヘッドのうちのいずれかのチューナーヘッドに当該受信復調動作を実行させる制御手段とを備える。
また、上記制御手段は、上記視聴出力手段によって出力信号の出力（視聴機能）を目的とする放送信号の受信復調動作を優先順位の高い動作と設定するとともに、当該目的の受信復調動作の実行要求が発生した際には、上記第1のチューナーヘッドにおいて当該目的のための受信復調動作を実行させる。
また上記制御手段は、操作に応じて上記記録手段によって放送信号を記録媒体に記録すること（動体録画機能、予約録画機能）を目的とする放送信号の受信復調動作を優先順位の高い動作と設定するとともに、当該目的の受信復調動作の実行要求が発生した際には、上記複数のチューナーヘッドのうちの第二のチューナーヘッドにおいて、当該目的のための受信復調動作を実行させる。
また上記制御手段は、所定の自動処理を目的とする放送信号の受信復調動作を優先順位の低い動作と設定するとともに、当該目的の受信復調動作の実行要求が発生した際には、上記複数のチューナーヘッドのうちの動作実行可能な状態のチューナーヘッドを選択して、当該目的の受信復調動作を実行させる。
上記所定の自動処理を目的とする放送信号の受信復調動作とは、放送信号から特定の情報（EPGデータや時報情報等）を抽出するための受信復調動作や、自動的に上記記録手段によって放送信号を記録媒体に記録（動体録画機能）するための放送信号の受信復調動作である。
また上記制御手段は、実行要求に応じた受信復調動作を或るチューナーヘッドに実行させようとする際に、そのチューナーヘッドにおいて優先順位の低い受信復調動作が実行されていなければ、その優先順位の低い受信復調動作を終了させて、実行要求に応じた受信復調動作を実行させる。
また上記制御手段は、実行要求に応じた受信復調動作を或るチューナーヘッドに実行させようとする際に、そのチューナーヘッドにおいて優先順位が同等以上の受信復調動作が実行されていなければ、上記実行要求をキャンセルする。
【0014】
またさらに、上記複数のチューナーヘッドがそれぞれ実行する受信復調動作について、その受信復調動作の目的に応じて優先順位を設定するとともに、受信復調動作の予約要求に応じて、その受信復調動作の目的種別及び優先順位に基づいて、上記複数のチューナーヘッドのうちのいずれかのチューナーヘッドに対して、当該受信復調動作の予約を行う予約手段を備えるようにする。
上記予約手段は、上記視聴出力手段によって出力する視聴用信号の出力（視聴機能）を目的とする放送信号の受信復調動作を優先順位の高い動作と設定するとともに、当該目的の受信復調動作の予約要求が発生した際には、上記第1のチューナーヘッドにおける予約情報として、当該目的のための受信復調動作の予約を行う。
また上記予約手段は、操作に応じて上記記録手段によって放送信号を記録媒体に記録すること（動体録画機能、予約録画機能）を目的とする放送信号の受信復調動作を優先順位の高い動作と設定するとともに、当該目的の受信復調動作の予約要求が発生した際には、上記複数のチューナーヘッドのうちの第二のチューナーヘッドに対する予約情報として、当該目的のための受信復調動作の予約を行う。
また上記予約手段は、所定の自動処理を目的とする放送信号の受信復調動作を優先順位の低い動作と設定するとともに、当該目的の受信復調動作の予約要求が発生した際には、上
記複数のチューナ手段のうちで予約可能な状態のチューナ手段を選択して、選択したチューナ手段に対する予約情報として、当該目的の受信復調動作の予約を行う。

上記所定の自動処理を目的とする放送信号の受信復調動作は、放送信号から特定の情報（EPGデータや時報信号等）を抽出するための受信復調動作や、自動的に上記記録手段によって放送信号を記録媒体に記録（自動録画機能）するための放送信号の受信復調動作である。

また上記予約手段は、予約要求された受信復調動作を含むチューナ手段に対して予約しようとする際に、そのチューナ手段に対する同時刻の予約として優先順位の低い受信復調動作が予約されていた場合は、その優先順位の低い受信復調動作の予約を抹消して、予約要求された受信復調動作を予約する。

また上記予約手段は、予約要求された受信復調動作を含むチューナ手段に対して予約しようとする際に、そのチューナ手段に対する同時刻の予約として優先順位が同等以上の受信復調動作が予約されていた場合は、上記予約要求をキャンセルする。

【0015】
本発明のチューナ制御方法は、複数のチューナ手段がそれぞれ実行する受信復調動作について、その受信復調動作の目的に応じて優先順位を設定するとともに、チューナ手段による受信復調動作が必要とされる際には、その受信復調動作の目的種別及び優先順位に基づいて、上記複数のチューナ手段のうちのいずれかのチューナ手段において当該受信復調動作を実行させる。

この場合、視聴用信号の出力（視聴機能）を目的とする放送信号の受信復調動作を優先順位の高い動作と設定するとともに、当該目的の受信復調動作の実行要求が発生した際には、上記複数のチューナ手段のうちの第1のチューナ手段において当該目的のための受信復調動作を実行する。

また操作に応じて放送信号を記録媒体に記録すること（手動録画機能、予約録画機能）を目的とする放送信号の受信復調動作を優先順位の高い動作と設定するとともに、当該目的の受信復調動作の実行要求が発生した際には、上記複数のチューナ手段のうちの第2のチューナ手段において、当該目的のための受信復調動作を実行させる。

また所定の自動処理を目的とする放送信号の受信復調動作を優先順位の低い動作と設定するとともに、当該目的の受信復調動作の実行要求が発生した際には、上記複数のチューナ手段のうちの動作実行可能な状態のチューナ手段を選択して、当該目的の受信復調動作を実行させる。

また更に、上記複数のチューナ手段がそれぞれ実行する受信復調動作について、その受信復調動作の目的に応じて優先順位を設定するとともに、受信復調動作の予約要求に応じて、その受信復調動作の目的種別及び優先順位に基づいて、上記複数のチューナ手段のうちのいずれかのチューナ手段の予約を行う。

【0016】
このような本発明によれば、複数のチューナ手段を有し録画機能を有する放送受信装置において、各種機能についてのチューナー資源の割り当てに優先順位をつけて制御する。

例えばユーザー操作による手動操作に基づく手動録画、予約録画、放送の視聴といった、ユーザーの意志で制御する機能（手動機能）、EPGデータ取得、ジャストクロック機能、自動録画など、ユーザーの意志によりすぐに実行される機能（自動機能）を考えた場合、これらの機能実行時に必要となる受信復調動作について、実行する機能（目的）に優先順位を設定する。そして目的（実行する機能）及び優先順位によってチューナ手段を割り当てる。

【0017】
優先順位については、上記手動機能については優先順位を高くし、上記自動機能についてはは低下する。

又はチューナ手段に、既に低い優先順位の機能が割り当てられているとき、より高い優先順位の機能に対してはチューナを割り当てを可能とする。その際、すでに割り当てられている低い優先度の機能は中断させる。

BNSDOCID: <JP__2004064478A__1>
或るチューナ手段に、重に高い優先順位の機能が割り当てられているとき、より低い優先順位の機能に対してはチューナを割り当てを不可能とする。つまり実行要求をキャンセルする。

複数のチューナ手段のうちの1つ（第1のチューナ手段）は、自動機能および視聴用とする。他の1つ（第2のチューナ手段）は、自動機能及び手動機能での録画（手動録画、予約録画）とする。

つまり手動機能のうち、視聴機能に関しては第1のチューナ手段を専用とする。手動機能のうち、手動録画、予約録画に関しては第2のチューナ手段を専用とする。自動機能（自動録画、EPGデータ取得、ジャストクロック）については、第1、第2のチューナ手段を選択的に使用できるようにする。

また、チューナー利用を予約を可能とする。即ち各チューナ手段に対応して予約を行う。この場合も、機能の種類や優先順位に応じてチューナ手段を選択して予約する。

【0018】
【発明の実施の形態】
以下、本発明の実施の形態によって説明する。なお、本実施の形態の記録再生装置は、デジタル衛星放送受信機に例えればHDDなどによる記録再生部が設けられているものとする。もちろん、本発明の放送受信装置がこのような構成に限定されるものではない。

【0019】
＜放送受信装置の構成＞
図1は、本発明の実施の形態としての放送受信装置1として、デジタル衛星放送受信機に映像記録再生機能が付加された装置の構成例を示している。
例えばここでは図示しない通信衛星又は放送衛星から送信された放送信号、例えばHDDなどによる記録再生部が設けられているものとする。映像記録再生装置1のチューナ部2に供給される。この放送信号には、フォーマットにしたがって電子番組情報データ（E PGデータ）、音声情報データ（Audio Program Guideデータ）などを含まれている。

なお、上記放送信号は、デジタル衛星放送の他に有線放送信号や地上波などの何れも含まれるが、各チューナ部2に供給され、各チューナ部2に供給される各機能回路部の内部構成は図示変更されることがになる。

【0020】
この放送受信装置1には、第1チューナ部2、第2チューナ部3として2つのチューナ部が設けられている。

各チューナ部2、3は、それぞれシステムコントローラ8の制御に従って選局処理を行い、選局して得られたチャンネルに対応するストリームデータを抽出する。また、選局処理で得られたストリームデータには、各チャンネルの番組内容とされる映像、音声情報、EPGデータなどの付加情報も多重化されている。

各チューナ部2、3は、ストリームデータからEPGデータを抽出し、システムコントローラ8に転送する。

【0021】
システムコントローラ8では、転送されたEPGデータに基づいて、例えばRAM10を用い、作業領域として使用し、番組ガイド表としての番組表示用データ（画像データ）を生成可能とされている。番組ガイド表は、番組内容、選局などのためのGUI画面として機能する。

またシステムコントローラ8は、放送中の番組や、後述する記録再生部12に記録された番組についてのユーザーの検索のために、EPGデータを用いた番組管理も行うことができる。

【0022】
システムコントローラ8の処理によって生成された番組表示用データは、管内表示信号作成解析部7に供給される。管内表示信号作成解析部7は、システムコントローラ8から供給された番組表示用データをもとに、表示用画像信号を作成して合成処理部5に供給する。
ようにされている。
【0023】
また、第1、第2各チューナ部0.3では、番組情報抽出したストリームデータから、さらに、番組内容としての映像信号データ及び音声信号データを抽出する。
第1チューナ部は、映像信号データを映像信号処理部4に対して出力し、音声信号データを音声信号処理部6に対して出力する。
デジタル衛星放送システムにおいて、放送として送信される映像／音声信号データは、例えばMPEG2方式により圧縮符号化されている。
そこで、映像信号処理部4は、番組情報抽出部3から入力された映像信号データについて上記MPEG2方式に対応した復調処理等をはじめとする所要の信号処理を施した映像信号を得る。そして、この映像信号を合成処理部5に出力する。
【0024】
合成処理部5は、映像信号処理部4から出力された映像信号と音声信号作成処理部7から出力された音声信号を合成し、その合成した信号を映像出力として、モニタ装置（テレビジョン受像機）4.1に出力するようにされている。
なお、このとき画面表示信号作成処理部7から入力された映像信号が、番組ガイド表としてのものであれば、モニタ装置4.1には、現在受信中の番組映像に重畳されるようにして、番組ガイド表が表示されることになる。
【0025】
音声信号再生処理部8は、番組情報抽出部3から供給された音声信号データについて、例えばMPEG2方式に对应した復調処理をはじめとする所要の信号処理を施すことによって、ここでは最終的にアナログの音声信号を得るようにされている。また、音声信号再生処理部8においては、常に説明した映像信号処理部4から出力された映像信号の出力タイミングに同期した音声信号を得るようにされている。そして、この音声信号をスピーカー4.2に出力する。
【0026】
このように第1チューナ部2からの受信復調動作による映像信号、音声信号は、ユーザの番組視聴のための信号として、モニタ装置4.1やスピーカー4.2に供給され、映像、音声として出力されることになる。
【0027】
記録再生部1.2は、例えばHDD（ハードディスクドライブ）などによる大容量の記録媒体により、大量の映像記録を行うことのある部位とされる。
例えばシステムコントローラ8は、ユーザによる録画予約設定や手動録画操作に応じて記録再生部1.2に映像記録を実行する。
このようなユーザーの操作に基づく番組録画、即ち手動録画機能のためには、第2チューナ部9が受信復調動作を行うものとされる。
即ち第2チューナ部9では、番組情報信号抽出したストリームデータから、さらに抽出した番組内容としての映像信号データ及び音声信号データを記録再生部1.2に供給し、記録再生部1.2においてハードディスクへの録画を実行させる。
【0028】
また本例では、録画動作として自動録画も行われる。自動録画は、ユーザの操作に基づかないでシステムコントローラ8が自動的に録画を実行させる機能である。例えばシステムコントローラ8は、常に、ユーザが視聴した番組（チャンネルや時間帯）を数計的に記憶していくことで、ユーザが好みの番組を判別できるようになる。このようなデータに基づくことでユーザの見たいと思われる番組を予測することができるため、それを自動的に録画する機能である。
このような自動録画を実行する際には、システムコントローラ8の制御により、第1チューナ部2、第2チューナ部3のどちらかが選択的に受信復調動作を実行する。
即ち、第1チューナ部2、第2チューナ部3のいずれかの受信復調処理で得られた映像信号データ及び音声信号データが記録再生部1.2に供給され、記録再生部1.2において何
ハードディスクへの録画が実行される。
【0029】
またユーザー操作により録画した番組の再生が指示された場合は、システムコントローラ8は記録再生部12に所定の映像信号データ（及び音声信号データ）の再生を実行させる。再生された映像信号データ及び音声信号データは、映像信号処理部4、音声信号処理部6に供給され、上記と同様に再調理処理等が行わせてモニタ装置41、スピーカ42から出力される。
【0030】
また各チューナ部2、3は、ストリームデータから抽出する音声情報において、時報音を検出すことができ、その時報タイミングをシステムコントローラ8に通知できる。システムコントローラ8は、内部に時計を備え、例えば予約録画の実行制御などに利用するが、その計時器の時刻を各チューナ部2、3から通知された時間タイミングと合わせることができる。ジャストクロック機能である。
【0031】
システムコントローラ8は、例えばCPU（Central Processing Unit）を備え、当該放送受信装置1の動作制御を実行する。この場合、システムコントローラ8に対しては、ROM9、RAM10、フラッシュメモリ13等が備えられる。ROM9には、システムコントローラ8が各種動作機能を実現するために実行すべきプログラムが記憶される。また、デバイス設定情報なども格納される。
特に、本実施の形態においては、ROM9内にチューナ部2、3の動作のためのプログラムが記憶される。
【0032】
RAM10は、システムコントローラ8が各種制御処理を実行する場合の作業領域であり、システムコントローラ8が実行する処理に応じて、適宣、各種のデータが保持される。フラッシュメモリ13には、各種処理係数、設定値などが記憶される。なお、チューナ部2、3の動作に関する予約、例えば予約録画や、自動機能（EPGデータ取得、ジャストクロック、自動録画）についてのチューナ部の予約について後述するが、これらの予約情報はフラッシュメモリ13に格納するようにしても良い。なお、予約情報は記録再生部12においてハードディスクの所定領域において記憶しても良い。
【0033】
また、本実施の形態の放送受信装置1に対しては、リモートコントローラ20が付属されている。ユーザは、リモートコントローラ20に対する操作を行うことで、放送受信装置1にて所望の動作が実行されるようにコントロールすることができる。リモートコントローラ20に対して操作が行われることに応じて、その操作に応じた操作情報信号が、例えば紫外線信号や電流などにより無線の形態で送信出力される。このようにして送信された操作情報信号は受信部11にて受信される。
受信部11では、受信した操作情報信号をシステムコントローラ8が処理可能なコマンドに変換し、システムコントローラ8に対して転送する。システムコントローラ8では、入力したコマンドに応答した所要の制御処理を実行する。これにより、放送受信装置1では、ユーザ操作に応じた動作が行われることになる。なお、もちろん放送受信装置1の本体に対して各種操作子を設け、この操作子に対する操作に対応するコマンドに応じて、システムコントローラ8が所要の制御処理を実行するように構成しても良い。
【0034】
＜チューナ制御方式＞
続いて、本例の放送受信装置1において行われるチューナ部2、3に対する制御方式について説明する。
【0035】
チューナ部2、3による受信操作動作としては、図2に示す各機能のための受信操作動作が行われる。
【0036】
・視聴
ユーザーがチャンネル操作に応じてユーザーの求める番組を、モニタ装置41及びスピーカ42から出力するための、通常のテレビジョン放送受信機能である。本例の場合、この視聴機能のための受信復動動作は、第1チューナ部2が実行するものとなる。

【0037】
・ユーザー録画
ユーザーの操作に基づいて所定の放送番組を記録再生部12においてハードディスクに録画する機能である。このユーザー録画としては、ユーザーの録画操作に応じて録画を開始する「手動録画」と、ユーザーが録画予約を行うことにより、予約登録された時刻において指定されたチャンネルの放送番組を録画する「予約録画」がある。本例の場合、このユーザー録画（手動録画、予約録画）のための受信復動動作は、第2チューナ部3が実行する。

【0038】
・EPGデータ取得
システムコントローラ8は必要な時点で第1チューナ部2又昇第2チューナ部3に指示して放送信号からEPGデータを抽出させ、それを取得する。

【0039】
・ジャンストクロック
システムコントローラ8は必要な時点で第1チューナ部2又昇第2チューナ部3に指示して放送信号から時報音を抽出させ、時報タイミングを得て内部時計の時刻合わせを行う。

【0040】
・自動録画
上述のようにシステムコントローラ8がユーザーの操作によりず、所定の放送番組を記録再生部12においてハードディスクに録画する機能である。システムコントローラ8は自動録画を実行する時点で第1チューナ部2又昇第2チューナ部3に指示して所定のチャンネルの受信復動動作を実行させ、放送信号を記録再生部12に供給させる。

【0041】
これらの機能として、視聴及びユーザー録画はユーザーの操作に基づく動作機能であり、これらの機能のための受信復動動作についてチューナ部2、3がそれぞれ専用化される。一方、EPGデータ取得及びジャンストクロック、自動録画の各機能の実行時の受信復動動作については、システムコントローラ8が機能実行時にチューナ部2、3を選択する。

【0042】
またシステムコントローラ8は、チューナ部2、3の制御に関し、優先機能を非優先機能を設定している。手動機能、即ちユーザー操作に基づく視聴、ユーザー録画については、優先順位の高い優先機能としている。
一方、自動機能であるEPGデータ取得、ジャンストクロック、自動録画については、優先順位の低い非優先機能としている。

【0043】
図3によりチューナ制御のための機能ブロックを示す。これらはシステムコントローラ8においてソフトウエアにより構成される機能ブロックである。
機能ブロックとして、第1チューナ制御部51、第2チューナ制御部52、視聴制御部53、ユーザー録画制御部54、自動機能制御部55、予約制御部56、第1予約テーブル57、第2予約テーブル58が設けられる。
これら各機能ブロックは、全体が1つのチューナ制御プログラムによる処理として実現されたり、或いはそれぞれが互いに連携処理を行うプログラムモジュールとして形成される。

【0044】
第1チューナ制御部51は、第1チューナ部2に対して選局チャンネルを指示し、受信復
調動作を実行させる制御処理を行う。
第2チューナ制御部52は、第2チューナ部3に対して選局チャンネルを指示し、受信復調動作を実行させる制御処理を行う。

【0045】
視聴制御部53は、ユーザーのチャンネル操作等の検出、及びその操作に基づいて、ユーザーが視聴しようとしているチャンネルの受信復調動作の指示を出す。上述のように視聴機能については、第1チューナ部2が専用的に行うものとするため、視聴制御部53は第1チューナ制御部51にて指示を出力し、第1チューナ制御部51が、指示に従って第1チューナ部2の選局制御を実行する。これによって第1チューナ部2で受信復調された送信信号が、モニタ装置41やスピーカ42から出力される動作が実行される。

【0046】
ユーザー録画制御部54は、手動録画、予約録画に関する制御、管理を行う。ユーザー録画に関しては、第2チューナ部3が専用的に受信復調動作を行うものとしている。そのため、ユーザーが手動録画の操作を行った場合には、ユーザー録画制御部54は第2チューナ制御部52に対して、録画すべき放送チャンネルの指示を出し、第2チューナ制御部52はこの指示に関して第2チューナ部3の選局制御を実行する。これによって第2チューナ部3で受信復調された送信信号が、記録再生部12に供給される録画される動作が実行される。
また、ユーザーが録画予約の操作を行った場合、ユーザー録画制御部54は予約制御部56に対して予約登録の要求を行う。また登録された予約録画の時刻に達した後、ユーザー録画制御部54は第2チューナ制御部52に対して、録画すべき放送チャンネルの指示を出し、第2チューナ制御部52はこの指示に基づって第2チューナ部3の選局制御を実行する。これによって第2チューナ部3で受信復調された送信信号が、記録再生部12に供給され予約録画動作が実行される。

【0047】
自動機能制御部55は、自動機能、即ち自動録画、EPGデータ取得、ジャストクロックの処理についての制御を行う。これらの処理を行う場合、自動機能制御部55は第1チューナ制御部51、又は第2チューナ制御部52のいずれかに、機能実行のための選局指示を出す。時刻検出された第1チューナ制御部51、又は第2チューナ制御部52は、指示に応じて担当するチューナ部（2, 3）の受信復調動作を実行する。
また自動機能については、実行する時刻を予約することができる。この場合、自動機能制御部55は予約制御部56に対して自動機能の予約を要求する。また自動機能制御部55は登録された予約時刻に、第1チューナ制御部51、又は第2チューナ制御部52のいずれかに、機能実行のための選局指示を出す。

【0048】
第1チューナ制御部51に対しては、視聴制御部53からの指示、及び自動機能制御部55からの指示が発生する。第1チューナ制御部51は、自動機能制御部55からの指示よりも、視聴制御部53からの指示の方が優先順位が高いものとして扱う。
例えば、自動機能制御部55からの指示による選局制御の実行中に視聴制御部53からの指示が発生した場合には、第1チューナ部2で実行中の受信復調動作を中断させて視聴制御部53からの指示による受信復調動作の制御を行い、逆に視聴制御部53からの指示に従った選局制御による受信復調動作の実行中に自動機能制御部55からの指示が発生した場合には、その自動機能制御部55からの指示をキャンセルする。

【0049】
第2チューナ制御部52に対しては、ユーザー録画制御部54からの指示、及び自動機能制御部55からの指示が発生する。第2チューナ制御部52は、自動機能制御部55からの指示よりも、ユーザー録画制御部54からの指示の方が優先順位が高いものとして扱う。
例えば、自動機能制御部55からの指示による選局制御の実行中にユーザー録画制御部54からの指示が発生した場合には、第2チューナ部3で実行中の受信復調動作を中断させて、
ユーザーア録画制御部54からの指示による受信復調動作の制御を行なう。逆にユーザーア録画制御部54からの指示による選局制御の実行中に自動機能制御部55からの指示が発生した場合は、その自動機能制御部55からの指示をキャンセルする。

【0050】
予約制御部56は、ユーザーア録画制御部54又は自動機能制御部55からの要求に応じて予約登録を行い、また予約動作を管理する。
予約登録のためには第1予約テーブル57と第2予約テーブル58が用意され、予約制御部56は、第1チューナ部2の動作として予約する事項を第1予約テーブル57に登録する。また第2チューナ部3の動作として予約する事項を第2予約テーブル58に登録する。

第1予約テーブル57と第2予約テーブル58は、フラッシュメモリ13、或いは記録再生部12におけるハードディスクの所定領域において、予約登録情報をおとすテーブルとして設けられる。

【0051】
また予約制御部56は、現在時刻と予約登録内容をチェックしており、或る予約登録された動作の開始時刻となった段、その情報をおとる録画制御部54又は自動機能制御部55に通知し、予約登録にかかわる動作制御を実行する。
予約内容としては、予約録画と、自動機能としての自動録画、EPGデータ取得、ジャストクロックの各動作の予約が可能である。

【0052】
上述の通り、予約録画のための受信復調動作は第2チューナ部3で行われる。そして第1予約テーブル58は第1チューナ部2の動作に関するものであるため、第1予約テーブル58には自動機能に関する内容（時刻やチャンネル）が登録されるものなる。
一方、第2予約テーブル57は第2チューナ部3の動作に関するものであるため、ユーザーオペレーションによる予約録画の内容（時刻やチャンネル）が登録され、また自動機能に関する内容（時刻やチャンネル）も登録される。

【0053】
予約制御部56は、予約処理に関しユーザーア録画制御部54と自動機能制御部55からの予約要求が発生するが、自動機能制御部55からの指示よりも、ユーザーア録画制御部54からの要求の方が優先順位が高いものとして扱う。例えば第1予約テーブル57には予約録画と自動機能の予約が登録されるが、或る時刻の予約として予約録画の予約要求があった際に、その時刻において既に自動機能の予約がなされていたら、当該自動機能の予約を抹消して予約録画の予約登録を行う。
逆に或る時刻の予約として自動機能の予約要求があった際に、その時刻において既に予約録画の予約がなされていたら、当該自動機能の予約をキャンセルする。

【0054】
このような図3の制御機能によって行われる制御動作をまとめてと、以下のようになる。

【0055】
実行させるチューナー資源の割り当てとしては、視聴機能、ユーザーア録画（手動録画、予約録画）が自動機能（自動録画、EPGデータ取得、ジャストクロック）より優先され、第1チューナ部2は、視聴機能および自動機能用とする。
第2チューナ部3は、ユーザーア録画機能および自動機能用とする。

【0056】
そして或る機能Aの実行要求があった場合、
その機能Aのために使用しようとするチューナ部が空いているならば、そのチューナ部を利用し、その機能を実行させる。
その機能Aのために使用しようとするチューナ部が、優先順位の低い機能Bに利用されていた場合、機能Bを中断し、チューナ部に機能Aを割り当て、機能Aを実行させる。
その機能Aのために使用しようとするチューナ部が、優先順位の高い機能Bに利用される
ていた場合、機能Aは実行させない。
・その機能Aのために使用しようとするチューナ部が、優先順位の同じ機能Bに利用されていた場合、機能Aは実行させない。
【0057】
・予約の割り当てとしても、視聴機能、ユーザーレコード（手動録画、予約録画）が自動機能（自動録画、EPGデータ取得、ジャストクロック）より優先される。・第1予約テーブル57は、自動機能用とする。
・第2予約テーブル58は、予約録画機能および自動機能用とする。
【0058】
そして第2機能Aの予約要求があった場合、
・その機能Aのために使用しようとするチューナ部について予約が空いていれば、そのチューナ部に対応する予約テーブルに予約登録を行う。
・その機能Aのために使用しようとするチューナ部について、優先順位の低い機能Bの予約が行われていた場合、機能Bの予約を抹消し、機能Aの予約登録を行う。
・その機能Aのために使用しようとするチューナ部について、優先順位の高い機能Bの予約が行われていた場合、機能Aは予約させない。
・その機能Aのために使用しようとするチューナ部について、優先順位の同じ機能Bの予約が行われていた場合、機能Aは予約させない。
【0059】
＜チューナ制御処理＞
図3のようなチューナ制御のための機能ブロックが設けられるシステムコンポーテッドクール8によるチューナ制御処理例を図4に示す。
ステップF101として、ユーザーの操作又は自動処理によって、チューナ制御をもとめる機能Aの実行要求が発生すると、システムコンポーネント8の処理はステップF102に進み、当該機能Aが優先機能であるか否かを判断する。機能Aが優先機能、即ち視聴機能又は手動録画機能であった場合は、ステップF103に進み、その機能に応じた専用チューナ部の動作確認を行う。
つまり視聴機能の要求であった場合は、第1チューナ部2が現在、他の機能による受信復調動作中であるか否かを判断する。
手動録画機能であった場合は、第2チューナ部3が現在、他の機能による受信復調動作中であるか否かを判断する。
【0060】
機能Aについて専用とされるチューナ部が動作実行中であるなければ、ステップF104からF107に進んで、要求された機能Aのための受信復調動作を、そのチューナ部（2又は3）で実行させる。
一方、機能Aについて専用とされるチューナ部が、他の機能のための受信復調動作を実行中であった場合、ステップF104からF105に進み、現在実行中の機能が、要求された機能Aと比べて優先順位が同等以上であるか否かを確認する。
もし、優先順位の低い機能のための受信復調動作が実行されていたのであれば、ステップF106に進み、その実行中の動作を終了（中止）させて、ステップF107に進み、要求された機能Aのための受信復調動作を、そのチューナ部（2又は3）で実行させる。
また、優先順位の同等以上の機能のための受信復調動作が実行されていたのであれば、ステップF105からF112に進み、機能Aの実行要求をキャンセルする。
【0061】
このステップF103〜F107、F112の処理により、例えば以下の制御が行われる。
・視聴要求があった場合に、第1チューニング部2があいていれば、第1チューニング部2で要求された視聴機能のための受信復調動作を実行させる。
・視聴要求があった場合に、第1チューニング部2で自動機能のための受信復調動作（優先順序が低い動作）が実行されていたのでは第1チューニング部2の動作を中断させて、要求を
れた視聴機能のための受信復調動作を実行させる。
・手動録画要求があった場合に、第2チューナ部３があるとすれば、第2チューナ部３で
要求された手動録画機能のための受信復調動作を実行させる。
・手動録画要求があった場合に、第2チューナ部３で自動機能のある受信復調動作（優
先順位が低い動作）が実行されている、その第2チューナ部３の動作を中断させて、要
求された手動録画機能のための受信復調動作を実行させる。
・手動録画要求があった場合に、第2チューナ部３で予約録画機能のための受信復調動作
（優先順位が同様以上の動作）が実行されていれば、手動録画の要求をキャンセルする。

【0062】
ステップF１０１で実行要求された機能Aが、非優先機能、つまり自動録画、ＥＰＧデー
タ取得、ジャストクリックのいずれかであったり場合は、ステップF１０２からF１０３に
進む。
ステップF１０３では第1、第2チューナ部２、３の動作を確認する。つまり両チューナ
部２、３が空いているが、あるいは一方向のチューナ部が動作中であるか、あるいは両方のチューナ
部２、３が動作中であるかを確認する。

【0063】
両方のチューナ部２、３が動作中である場合は、どちらのチューナ部２、３も優先順位が
同等以上の動作が実行されていることになるため、ステップF１０９かF１１２に進み
機能Aの実行要求をキャンセルする。
両方又は一方のチューナ部が空いている場合は、ステップF１０９かF１１０に進み、
チューナ選択を行う。一方のチューナ部が空いている場合は、その空いているチューナ部
を選択する。また両方のチューナ部が空いている場合は、どちらか一方を選択する。
そしてステップF１１１で、選択したチューナ部によって、要求された機能Aのための受
信復調動作を実行させる。

【0064】
このステップF１０８～F１１２の処理により、例えば以下の制御が行われる。
・自動録画、ＥＰＧデータ取得、ジャストクリックのいずれか（自動機能）の要求があっ
た場合に、第1、第2チューナ部２、３の両方があいているが、第1、第2チューナ部２
、３のいずれかで、要求された自動機能のための受信復調動作を実行させる。
・上記自動機能の要求があった場合に、第1チューナ部２のみがあいているが、第1チューナ
部２で、要求された自動機能のための受信復調動作を実行させる。また第2チューナ
部３のみがあいているが、第2チューナ部３で、要求された自動機能のための受信復調動作
を実行させる。
・上記自動機能の要求があった場合に、第1、第2チューナ部２、３が動作実行中であれ
ば、その動作は、今回要求された機能よりも優先順位が高いか、あるいは同等のものである
ため、今回の機能の実行要求をキャンセルする。

【0065】
以上の図4の処理により、ユーザの意志にかかわる手動機能（視聴、手動録画）について
は、ユーザの望んだ際に実行できるものとする。また自動機能については使用可能なチ
ューナ部を選択的に用いて実行できるため、優先順位が低くても実行可能な機会は増加する。
従って、２つのチューナ部２、３が効率的に、かつ適切に利用されることになる。

【0066】
＜予約処理＞
次に、図3のようなチューナ制御のための機能ブロックが設けられるシステムコントロー
ラ8による予約処理例を図5で説明する。
ステップF２０１として、ユーザの操作又は自動処理によって、チューナ動作に関する
予約要求、即ち予約録画、又は自動機能（自動録画、ＥＰＧデータ取得、ジャストクリ
ック）についての予約要求が発生すると、システムコントローラ8の処理はステップF２
０２に進み、当該予約要求が優先機能である予約録画のための予約要求であるか否かを判
断する。
【0067】
予約録画についての予約要求があった場合は、スタッフF203に進み、第2予約テーブル58のチェックを行う。予約録画のための受信チューナー動作は第2チューナーデジタル3が割り当てられるものであるため、第2チューナーデジタル3に対応する第2予約テーブル58のチェックを行うものである。
このチェックとしては、予約要求がある時点で、既に第2予約テーブル58に他の予約登録がされているかがないかのチェックとなる。

【0068】
第2予約テーブル58において、予約しようとする時間について予約登録が行われていないければ、スタッフF204からF207に進んで、要求された機能（予約録画機能）のための予約登録を第2予約テーブル58に対して行う。
一方、第2予約テーブル58において、予約しようとする時間について予約登録が行われていた場合、スタッフF204からF205に進み、その予約登録された機能が非優先機能であるか否かを確認する。

もし、優先順位の低い非優先機能のための予約登録であれば、スタッフF206に進み、その予約登録を抹消して、スタッフF207に進み、要求された予約録画機能のための予約登録を第2予約テーブル58に対して行う。
また、優先順位の同等以上の機能のための予約登録がなされていたのであれば、スタッフF205からF212に進み、今回の予約録画のための予約要求をキャンセルする。

【0069】
このスタッフF203～F207、F212の処理により、例えば以下の制御が行われる。
・予約録画のための予約要求があった場合には、第2予約テーブル58において該当時間があるければ、第2予約テーブル58に予約登録する。
・予約録画のための予約要求があった場合には、第2予約テーブル58において該当時間に予約があり、それが非優先機能（自動録画、EPGデータ取得、ジャストクロック）の予約であれば、その予約を抹消して、要求された予約録画のための予約登録を行う。
・予約録画のための予約要求があった場合には、第2予約テーブル58において該当時間に予約があり、それが同等以上の優先機能（過去に登録された他の予約録画）の予約であれば、今回の予約要求をキャンセルする。

【0070】
スタッフF201での予約要求がある、非優先機能、つまり自動録画、EPGデータ取得、ジャストクロックのいずれかについての予約要求であった場合は、スタッフF202からF208に進む。
スタッフF208では第1、第2予約テーブル57、58の予約状況を確認する。つまり両予約テーブル57、58において、予約しようとする時間に予約が既にされているか否かを確認する。

【0071】
該当時間において両方の予約テーブル57、58に予約済みの場合は、どっちも優先順位が同等以上の機能が予約されていることになるため、スタッフF209からF212に進み、今回の予約要求をキャンセルする。
両方又は一方の予約テーブルが空いている場合は、スタッフF209からF210に進み、予約テーブルの選択（予約するチューナー部の選択）を行う。一方の予約テーブルが空いている場合は、その空いている予約テーブルを選択する。両方の予約テーブルが空いている場合は、どちらか一方を選択する。
そしてスタッフF211で、選択した予約テーブルに、今回の予約要求がかかる予約登録を行う。

【0072】
このスタッフF208～F212の処理により、例えば以下の制御が行われる。
・自動録画、EPGデータ取得、ジャストクロックのいずれか（自動機能）の予約要求が
あった場合に、第1、第2予約テーブル57、58の両方があいていれば、第1、第2予約テーブル57、58のいずれかに、要求された自動機能のための予約登録を行う。
・上記自動機能の予約要求があった場合に、第1予約テーブル57のみがあいていければ、第1予約テーブル57に予約登録を行う。また第2予約テーブル58のみがあいていければ、第2予約テーブル58に予約登録を行う。
・上記自動機能の予約要求があった場合に、第1、第2予約テーブル57、58の両方に他の予約がなされていれば、その予約は、今回要求された機能よりも優先順位が高いか、或いは同等の機能についての予約であるため、今回予約要求をキャンセルする。
【0073】
以上の図5の処理により予約された内容については、予約時刻に達した時点で予約された機能の動作が実行される。
即ち図3の予約制御部56が予約内容を管理し、予約内容と予約時刻、現在時刻に応じて、ユーザ録画制御部54又は自動機能制御部55に予約内容の実行指示を出す。そしてユーザ録画制御部54又は自動機能制御部55は、指示に応じて上述の通り制御を行う。
なお、予約動作を開始しようとする時刻において、ユーザーの操作などにより他の処理が行われている場合がある。その場合、予約された動作の実行要求を、図4のスタッフド101での実行要求発生として、図4の処理で優先判断、チューナ選択が行われるようになる。
【0074】
上記図5の処理により、ユーザーの意志にかかわる手動機能（予約録画）については、ユーザの望んだとおりに実行できるものとする。また自動機能については予約可能なチューナ部を選択的に用いて実行できるため、優先順位が低くても実行可能な機能は増加する。従って、2つのチューナ部2.3が効率的に、かつ適切に利用できることになる。
【0075】
＜変形例＞
以上本発明の実施の形態を説明してきましたが、本発明の構成や処理例は、上記と以外に各種変形例が考えられる。
【0076】
例えば図4、図5の処理の変形例として次のようないかが考えられる。
図4のスタッフド106では実行中の非優先機能のための受信復調動作が中断されるが、その場合に、他方のチューナ部が空いている場合は、中止された非優先機能のための受信復調動作を他方のチューナ部において引き続き実行させるようにすることで、よりチューナ資源を有効利用できる。
また、または非優先機能については、スタッフド106の処理も中断されるが何度も連続してその機能が長期にわたって実行できなかった場合は、一時的にその機能を優先機能として、或いは優先機能として予約登録できるようエラーを考慮することも考えられる。
【0077】
図4のスタッフド110のチューナ選択として、両方のチューナ部2.3が使用可能であった場合の選択は、どちらも良いと述べたが、この際予約状況を確認して選択するとより好適である。即ち現在時刻から近い時刻において予約登録が存在する側のチューナ部を避けて他方を選択するとよい。これは、スタッフド111での受信復調動作開始後、その実行中に、他の予約された動作の開始時刻に達してしまった確率を下げるためである。
【0078】
また図5の予約処理におけるスタッフド206では、第2予約テーブル58から非優先機能の予約が抹消されるが、他方の第1予約テーブル57が空いているれば、第1予約テーブルの間に抹消した予約内容を登録するようにすれば、これもチューナ部の有効利用に好適となる。
【0079】
また上記例では優先順位を2段階に設定したが、各種機能について3段階以上の優先順位

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を設定しても良い。
【0080】
また上記例では、チューナ制御処理と予約処理の両方で、機能種別及び優先順位によるチューナ選択が行われるようにしたが、全て予約の割り当ての優先順位制御で行うようにしてもよい。
その場合、視聴機機能や手動録画機能なども、ユーザーの指示があった時点で予約されたものがとして扱い、予約テーブル上で優先判断及びチューナ選択を行う。これにより、予約管理によって上記例と同様にチューナ部2、3の有効利用とユーザーの操作性向上を図ることができる。
【0081】
また上記例では2つのチューナ部2、3を備えるものとしたが、3つ以上のチューナ部を備えた構成においても、本発明は同様に適用可能である。
さらに、上記例のチューナ部2、3はデジタル衛星放送チューナとしたが、アナログ衛星放送チューナ、地上波（アナログ／デジタル）チューナ、ラジオチューナ、その他のあらゆる放送チューナにおいて本発明を適用できる。
【0082】
【発明の効果】
以上の説明から理解されるように本発明によれば、複数のチューナ手段を有し録画機能を有する放送受信用装置において、各種機能についてのチューナー資源の割り当てに優先順位を設定し、実行する機能（目的）及び優先順位に基づいてチューナ手段を選択的に制御することで、ユーザーの希望する操作をいつでも実施可能として、かつ、チューナー機能を有効に利用することが可能となるという効果がある。
【0083】
即ち優先順位については、手動機能については優先順位を高くし、自動機能については低くする。即ち視聴用信号の出力（視聴機能）や、操作に応じて放送信号を記録媒体に記録すること（手動録画機能、予約録画機能）を目的とする放送信号の受信復調動作は優先順位を高くする。一方、所定の自動処理、例えば一定PGデータ取得機能、ジャストクリック機能、自動録画機能を目的とする放送信号の受信復調動作は優先順位を低くする。また視聴機能については第1のチューナ手段を専用とし、手動録画機能、予約録画機能については第2のチューナ手段を専用とし、さらに自動機能については第1、第2のチューナ手段を選択的に使用できるものとしている。これにより、ユーザーの意志にかかわる手動機能については、ユーザーの望んだ際に実行できるものとなる。また自動機能については使用可能なチューナ手段を選択的に用いて実行できるため、優先順位が低くても実行可能な機会は増加される。
これにより、チューナ手段の有効利用及びユーザーの使用性の向上が実現される。
また機能実行のためのチューナ手段の予約についても、同様に機能の種別や優先順位に応じて行うことで、チューナ手段の有効利用が図られると共に、ユーザーの希望する操作をいつでも予約及び実施可能である。
【0084】
また、このように複数のチューナ手段の有効利用が図られる場合には、必要なチューナ手段の数を最小限（例えば2つ）とすり、その時点で構成の複雑化を招かずに高機能処理が可能となる。例えば必要な機能のためそれぞれ専用のチューナ手段が設けられることによりては、構成は簡単となり、また使用機会の少ないチューナ手段が発生するといったこともなくなっとして資源の有効利用が実現される。もちろん、それぞれの機能に専用化した多数のチューナ手段を設けることによりでは、コスト的にも有利となる。
【図面の簡単な説明】
【図1】本発明の実施の形態の放送受信用装置のブロック図である。
【図2】実施の形態の機能の種別及び優先順位の説明図である。
【図3】実施の形態の制御ブロックの説明図である。
【図4】実施の形態のチューナ制御処理のフローチャートである。
【図5】実施の形態の予約処理のフローチャートである。

【符号の説明】
1 放送受信装置、2 第1チューナ部、3 第2チューナ部、4 映像信号処理部、5
合成処理部、6 音声信号処理部、7 管像表示信号生成処理部、8 システムコントローラ、9 ROM、10 RAM、11 受信部、12 記録再生部、13 フラッシュメモリ、20 リモートコントローラ
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If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

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**New International Application Filed with the USPTO as a Receiving Office**

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The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO’s publicly available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently http://www.uspto.gov/patft/.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO’s Office of Public Records. The Office of Public Records can be reached by telephone at (703) 306-9726 or (800) 972-6382, by facsimile at (703) 305-8759, by mail addressed to the United States Patent and Trademark Office, Office of Public Records, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently http://pair.uspto.gov/. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

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Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. If an error is noted on this Filing Receipt, please write to the Office of Initial Patent Examination's Filing Receipt Corrections. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections.

Applicant(s) 
Ho Yi, Seongnam-si, KOREA, REPUBLIC OF;

Power of Attorney: The patent practitioners associated with Customer Number 34610

Domestic Priority data as claimed by applicant

Foreign Applications
REPUBLIC OF KOREA 10-2006-0113200 11/16/2006

If Required, Foreign Filing License Granted: 10/30/2007

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is US 11/872,282

Projected Publication Date: 05/22/2008

Non-Publication Request: No

Early Publication Request: No
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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of Ho Yi

Confirmation No.: 8550

Group Art Unit: 2622

Serial No.: 11/872,282

Examiner: To Be Assigned

Filed: October 15, 2007

Customer No.: 34610

For: TUNER SELECTION IN DIGITAL BROADCASTING RECEIVER HAVING MULTIPLE TUNERS

REPLY TO NOTICE TO FILE MISSING PARTS OF APPLICATION

FILING DATE GRANTED

U.S. Patent and Trademark Office
Customer Service Window, MAIL STOP MISSING PARTS
Randolph Building
401 Dulany Street
Alexandria, VA 22314

Sir:

In reply to the Notice of Missing Parts of Application dated November 2, 2007, submitted herewith are the following documents for filing in the above-referenced application:

☒ Declaration and Power of Attorney.
☐ Filing Fee of $1,030.00.
☒ Additional claim fee of $210.00.
☒ Late filing surcharge of ☒ $130.00 (large entity) ☐ $65.00 (small entity).
☐ Transmittal of certified priority document(s).
☐ Copy of Form PTO-1533 (Notice of Missing Parts).
☒ Authorization to Treat a Reply as Incorporating An Extension of Time under 37 C.F.R. §1.136(a)(3).
☐ A check in the amount of $______ (Check #______ ) is enclosed.

Please charge my Credit Card in the amount of $1,370.00.
☐ Verified English language translation.
☐ Surcharge for filing non-English Specification ☐ $130.00 (large entity) ☐ $65.00 small entity.
☐ Assignment Recordation Coversheet and Assignment.
☐ A check in the amount of $40.00 (Check #   )
Please charge my Credit Card $40.00, representing the recordation fee for the Assignment. (See completed form PTO-2038 enclosed).

It is requested that an Official Filing Receipt showing the data contained herewith now be issued.

Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 16-0607 and please credit any excess fees to such deposit account.

Respectfully submitted,
KED & ASSOCIATES, LLP

Daniel Y.J. Kim
Registration No. 36,186

Correspondence Address:
P.O. Box 221200
Chantilly, VA 20153-1200
703 766-3777  DYK/dak

Date: December 21, 2007
Please direct all correspondence to Customer Number 34610
IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of  

Ho Yi  

Confirmation No.: 8550  

Group Art Unit: 2622  

Serial No.: 11/872,282  

Examiner: To Be Assigned  

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For: TUNER SELECTION IN DIGITAL BROADCASTING RECEIVER HAVING MULTIPLE TUNERS  

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Respectfully submitted,  
KED & ASSOCIATES, LLP

Daniel Y.J. Kim  
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Correspondence Address:  
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703 766-3777  

Date: December 21, 2007  

Please direct all correspondence to Customer Number 34610
Docket No.: EZ-0005

DECLARATION AND POWER OF ATTORNEY

As a below named inventor, I hereby declare that:

My residence, post office and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter claimed and for which a patent is sought on the invention entitled TUNER SELECTION IN DIGITAL BROADCASTING RECEIVER HAVING MULTIPLE TUNERS, the specification of which

☐ is attached hereto  ☑ was filed on October 15, 2007 as Application Serial No. 11/872,282 and was amended on __________________________ (if applicable)

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is known to me to be material to patentability in accordance with Title 37, Code of Federal Regulations, Section 1.56(a).

I hereby claim foreign priority benefits under 35 U.S.C. 119(a)-(d) or 365 (b) of any foreign application(s) for patent or inventor's certificate, or 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or of any PCT international application having a filing date before that of the application on which priority is claimed.

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I hereby claim the benefit under 35 U.S.C. 119(e) of any United States provisional application(s) listed below.

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I hereby claim the benefit under 35 U.S.C. 120 of any United States application(s), or 365(c) of any PCT international application designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT international application in the manner provided by the first paragraph of 35 U.S.C. 112, I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

I hereby appoint the attorney(s) and/or agent(s) associated with Customer Number 34610 to prosecute this application and transact all business in the Patent and Trademark Office.

Direct all correspondence to Customer Number 34610
Full name of sole or first inventor: Ho Yi
Inventor's signature: Date: Nov. 24, 2007
Mailing Address: #103-604 Nakachi Maseul, 77, Gumi-dong, Bungdang-gu, Seongnam-si, Gyeonggi-do 463-500, Republic of Korea
Citizenship: Republic of Korea
Residence Address
(only if different from mailing address):

Full name of joint inventor(s):
Inventor's signature: Date:
Mailing Address:
Citizenship:
Residence Address
(only if different from mailing address):

Full name of joint inventor(s):
Inventor's signature: Date:
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Residence Address
(only if different from mailing address):

Full name of joint inventor(s):
Inventor's signature: Date:
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Filed as Large Entity

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**Title of Invention:**
TUNER SELECTION IN DIGITAL BROADCASTING RECEIVER HAVING MULTIPLE TUNERS

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**Payment information:**
- Submitted with Payment: yes
- Payment Type: Credit Card
- Payment was successfully received in RAM: $1370
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- Deposit Account
- Authorized User

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**Warnings:**

**Information:**

Total Files Size (in bytes): 580460

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

**New Applications Under 35 U.S.C. 111**

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

**National Stage of an International Application under 35 U.S.C. 371**

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

**New International Application Filed with the USPTO as a Receiving Office**

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.
Docket No.: EZ-0005

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
In re Application of Ho YI
Serial No.: 11/872,282
Filed: October 15, 2007
Confirmation No.: 8550
Group Art Unit: 2622
Examiner: To Be Assigned
Customer No.: 34610

For: TUNER SELECTION IN DIGITAL BROADCASTING RECEIVER HAVING MULTIPLE TUNERS

TRANSMITTAL OF CERTIFIED PRIORITY DOCUMENT

U.S. Patent and Trademark Office
Customer Service Window, MAIL STOP MISSING PARTS
Randolph Building
401 Dulany Street
Alexandria, Virginia 22314

Sir:

At the time the above application was filed, priority was claimed based on the following application:


A copy of the priority application listed above is enclosed.

Respectfully submitted,
KED & ASSOCIATES, LLP

Daniel Y.J. Kim
Registration No. 36,186

Correspondence Address:
P.O. Box 221200
Chantilly, VA 20153-1200
703 766-3777  DYK/dak
Date: December 21, 2007
Please direct all correspondence to Customer Number 34610

\FK\4\Documents\2309\2309-005\143580.doc
This is to certify that the following application annexed hereto is a true copy from the records of the Korean Intellectual Property Office.

Application Number: 10-2006-0113200

Filing Date: 2006년 11월 16일

Applicant(s): 주식회사 유맥스

2007년 08월 03일

COMMISSIONER

*This certificate was issued by Korean Intellectual Property Office. Please confirm any forgery or alteration of the contents by an issue number or a barcode of the document below through the KIPOnet- Online Issue of the Certificates' menu of Korean Intellectual Property Office homepage (www.kipo.go.kr). But please notice that the confirmation by the issue number is available only for 90 days.
【서지사항】
【서류명】특허출원서
【권리구분】특허
【수신처】특허청장
【제출일자】2006.11.16
【발명의 국문명칭】복수 개의 튜너가 구비된 디지털 방송 수신기에서의 튜너 지정 방법 및 그 디지털 방송 수신기
【발명의 영문명칭】METHOD FOR TUNER SELECTION IN DIGITAL BROADCASTING RECEIVER HAVING MULTIPLE TUNER AND THE DIGITAL BROADCASTING RECEIVER THEREOF

【출원인】
【명칭】주식회사 휴맥스
【출원인코드】1-1998-000063-1

【대리인】
【성명】이경란
【대리인코드】9-1998-000651-6
【포괄위임등록번호】2004-073908-7

【발명자】
【성명】이호
【성명의 영문표기】Yi, Ho
【주민등록번호】791225-1XXXXXX
【우편번호】463-500
【주소】경기 성남시 분당구 구미동 77번지 까치마을 103동 604호
【국적】KR
【심사청구】청구
【취지】 특허법 제42조의 규정에 의한 출원, 특허법 제60조의 규정에 의한 심사청구를 합니다.

대리인 이경란 (인)

【수수료】
【기본출원료】 0 면 38,000 원
【가산출원료】 34 면 0 원
【우선권주장료】 0 건 0 원
【심사청구료】 19 항 717,000 원
【합계】 755,000 원
【요약서】

【요약】

복수 개의 튜너가 구비된 디지털 방송 수신기에서의 튜너 지정 방법 및 그 디지털 방송 수신기가 개시된다. 본 발명의 일 측면에 따르면, 복수의 튜너가 구비된 디지털 방송 수신기에 연결된 위성의 트랜스폰더 정보를 이용하여 각 튜너에 튜닝을 시도하고, 그 결과에 상응하도록 채널 탐색할 하나의 튜너를 선택하게 된다. 본 발명에 따르면, 트랜스폰더의 입력 과정과 그에 따른 튜너 지정 과정 등을 생략할 수 있어, 튜너 지정 과정이 간소화되는 효과가 있다.

【대표도】

도 9

【색인어】

트랜스폰더, 다이렉트위치, 튜너
【명세서】

【발명의 명칭】

복수 개의 튜너가 구비된 디지털 방송 수신기에서의 튜너 지정 방법 및 그 디지털 방송 수신기 (METHOD FOR TUNER SELECTION IN DIGITAL BROADCASTING RECEIVER HAVING MULTIPLE TUNER AND THE DIGITAL BROADCASTING RECEIVER THEREOF)

【도면의 간단한 설명】

<1> 도 1은 복수 개의 튜너(tuner)가 구비된 디지털 방송 수신기(digital broadcasting receiver)의 일반적인 채널 탑색 과정을 나타낸 순서도.

<2> 도 2 내지 도 4는 디지털 방송 수신기에 연결된 위성 내의 메뉴 목록을 도시한 도면.

<3> 도 5 내지 도 7은 두 개의 튜너를 구비한 디지털 방송 수신기의 안테나 (antenna) 연결 상태를 도시한 구성도.

<4> 도 8은 본 발명의 일 실시예에 따른 두 개의 튜너를 구비한 디지털 방송 수신기의 블록 구성도.

<5> 도 9는 본 발명의 일 실시예에 따른 디지털 방송 수신기에서의 튜너 지정 과정을 도시한 흐름도.

<6> 도 10은 본 발명의 다른 실시예에 따른 디지털 방송 수신기에서의 튜너 지정 과정을 도시한 흐름도.
<7> <도면의 주요 부분에 대한 부호 설명>

<8> 11 : 제1 튜너

<9> 13 : 제2 튜너

<10> 20 : 제어부

<11> 30 : 트랜스폰더 정보 저장부

<12> 50 : 유저 인터페이스부

【발명의 상세한 설명】

【발명의 목적】

【발명이 속하는 기술분야 및 그 분야의 종래기술】

본 발명은 디지털 방송 수신기에 관한 것으로서, 좀 더 상세하게는 복수 개의 튜너가 구비된 디지털 방송 수신기에서의 튜너 지정 방법 및 그 디지털 방송 수신기에 관한 것이다.

일반적으로 디지털 방송 수신기는 디지털 방송 프로그램을 하드디스크(HDD)와 같은 기록 매체에 기록 저장하는 개인 비디오 녹화 기능이 구비되어 있으며, 위성 방송 안테나와 텔레비전에 연결 접속될 수 있다. 이러한 디지털 방송 수신기는 사용자가 하나의 채널을 시청하면서, 다른 채널을 화면 속 화면 (picture in picture, PIP)으로 시청하거나 다른 채널을 녹화할 수 있도록 복수 개의 튜너를 사용하기도 한다.
또한, 디지털 방송 수신기는 채널 탐색 기능이 있는데 이는 사용자가 디지털 방송 수신기를 구입한 후 가장 먼저 수행해야 할 기능이며, 사용 중에도 변경된 채널 정보를 다시 등록하기 위하여 주기적으로 사용하는 기능이다.

도 1은 두 개의 튜너가 구비된 디지털 방송 수신기의 일반적인 채널 탐색 과정을 나타낸 순서도이다.

도 1을 참조하면, 디지털 방송 수신기와 디지털 방송 수신기에 연결된 위성의 안테나를 물리적으로 설정하게 되는데, 이것을 "안테나 연결 상태 설정"이라고 한다(단계 110).

안테나 연결 상태를 설정한 후에는 "안테나 세팅"을 하는데, 이는 안테나의 세팅 조건인 위성 정보, LNB 정보, 22 kHz 톤(Tone)의 사용 여부(on/off) 및 다이렉트 스위치(Diseqc switch) 값을 지정해 주는 것을 의미한다(단계 120).

여기서, 다이렉트 스위치는 여러 개의 안테나가 있을 때 안테나를 자동으로 선택해주는 기기로서, 4개의 위성 안테나까지 선택할 수 있다.

안테나 세팅 후, 두 개의 튜너에 대하여 어느 튜너에 탐색할 안테나가 연결되어 있는지 지정해 주어야 하는데, 이를 "튜너 지정"이라고 한다(단계 130).

안테나 세팅 후 튜너 지정 전, 또는 튜너 지정 후에 탐색할 트랜스폰더(Transponder; TP) 정보를 입력하여 "채널을 탐색"한다(단계 140).

종래에는 이러한 설치 과정 중에서도 튜너 지정을 사용자가 수동으로 입력하여야 했는데, 일반 사용자는 튜너에 대한 입력 조건을 이해하기 어려우므로 보통
설치 기사에게 디지털 방송 수신기 설치를 의뢰하고 있는 실정이다. 이러한 경우 추가 비용 및 시간이 소요되게 되고, 디지털 방송 수신기 구입시뿐만 아니라 새로운 채널을 추가할 때마다 이러한 설치 과정을 반복하여야 하는 불편함이 있었다.

【발명이 이루고자 하는 기술적 과제】

본 발명은 복수의 튜너가 구비된 디지털 방송 수신기에 있어서, 디지털 방송 수신기에 연결된 위성에 상응하는 트랜스폰더 목록의 트랜스폰더 정보를 이용하여 튜닝하고, 그 튜닝 결과에 상응하도록 튜너를 선택함으로써, 각 튜너를 지정하는 과정을 자동화하거나 간소화한 튜너 지정 방법 및 그 디지털 방송 수신기를 제공하는 것을 목적으로 한다.

본 발명의 다른 목적들은 이하에 서술되는 바람직한 실시예를 통하여 보다 명확해질 것이다.

【발명의 구성】

상술한 목적을 달성하기 위한 본 발명의 일 측면에 따르면, 복수의 튜너가 구비된 디지털 방송 수신기에서의 튜너 지정 방법에 있어서, 탐색하고자 하는 위성에 상응하는 목록의 트랜스폰더 정보를 이용하여 튜닝하고, 그 튜닝 성공 여부에 따른 각 튜너의 튜닝 성공율을 비교한 결과에 상응하도록 채널을 탐색할 하나의 튜너를 선택하게 된다.
또한, 본 발명의 다른 측면에 따르면, 복수 개의 튜너가 구비된 디지털 방송 수신기에서의 튜너 지정 방법에 있어서, 탐색하고자 하는 위성에 상응하는 어느 하나의 트랜스폰더 정보를 이용하여 각 튜너에서 튜닝을 시도한 결과, 하나의 튜너에서 튜닝이 성공된 경우 성공한 튜너로 위성의 채널을 탐색하고, 복수 개의 튜너 중 두 이상의 튜너에서 튜닝이 성공된 경우 각 튜너로부터 출력된 신호가 서로 동일성 여부에 따라 채널을 탐색할 하나의 튜너를 선택하게 된다.

또한, 본 발명의 또 다른 측면에 따르면, 복수 개의 튜너, 탐색하고자 하는 위성에 대한 하나 이상의 트랜스폰더 정보가 저장된 트랜스폰더 정보 저장부 및 각 튜너가 각 트랜스폰더 정보를 이용하여 튜닝한 결과에 따른 튜닝 성공음을 튜너별로 신출하며, 각 튜너의 튜닝 성공음을 비교한 결과에 상응하도록 위성의 채널을 탐색할 하나의 튜너를 선택하는 제어부를 포함하는 디지털 방송 수신기가 제공된다.

또한, 본 발명의 또 다른 측면에 따르면, 복수 개의 튜너, 탐색하고자 하는 위성에 상응하는 트랜스폰더 정보를 이용하여 각 튜너가 튜닝을 시도한 결과, 어느 한 튜너에서만 튜닝이 성공된 경우 성공한 튜너로 채널을 탐색하므로, 복수 개의 튜너 중 두 이상의 튜너에서 튜닝이 성공된 경우 각 튜너로부터 출력된 신호가 서로 동일한지 여부를 판단한 후 동일하다면 복수 개의 튜너 중 미리 지정된 기준에 따라 어느 한 튜너로 채널을 탐색하고, 상이한 경우 입력 신호에 따라 채널 탐색을 위한 어느 한 튜너를 선택하는 제어부; 및 유저 인터페이스부를 포함하는 디지털 방송 수신기가 제공된다.
위와 같이, 본 발명의 일 실시예에 의하면 트랜스폰더의 정보의 입력 과정과 그에 따른 튀너 지정 과정을 자동화하여 체널을 탑색할 수 있다. 또한, 본 발명의 다른 실시예에 의하면, 각 튀너에서 출력된 신호가 상이한 경우에만 사용자가 튀너 지정을 하도록 튀너 지정 과정을 간소화함으로써 튀너 지정 시간을 단축할 수 있게 된다.

본 발명은 다양한 변경을 가할 수 있고 여러 가지 실시예를 가질 수 있는 바, 특정 실시예들은 도면에 예시하고 상세한 설명에 상세하게 설명하고자 한다. 그러나, 이는 본 발명을 특정한 실시 형태에 대해 한정하려는 것이 아니며, 본 발명의 사상 및 기술 범위에 포함되는 모든 변경, 균등을 내지 대체물을 포함하는 것으로 이해되어야 한다.

제1, 제2 등과 같이 서수를 포함하는 용어는 다양한 구성 요소들을 설명하는 데 사용될 수 있지만, 상기 구성 요소들은 상기 용어들에 의해 한정되지 않는다는. 상기 용어들은 하나의 구성 요소를 다른 구성 요소로부터 구별하는 목적으로만 사용된다. 예를 들어, 본 발명의 권리 범위를 벗어나지 않으면서 제1 구성 요소는 제2 구성 요소로 명명될 수 있고, 유사하게 제2 구성 요소로 제1 구성 요소로 명명될 수 있다. 및/또는 이는 용어는 복수의 관련된 기재된 항목들의 조합 또는 복수의 관련된 기재된 항목들 중의 어느 항목을 포함한다.

어떤 구성 요소가 다른 구성 요소에 “연결되어” 있다거나 “접속되어” 있다고 언급된 때에는, 그 다른 구성 요소에 직접적으로 연결되어 있거나 또는 접속되어
있는 수도 있지만, 중간에 다른 구성 요소가 존재할 수도 있다고 이해되어야 할 것이다. 반면에, 어떤 구성 요소가 다른 구성 요소에 "직접 연결되어" 있다거나 "직 접 접속되어" 있다고 언급된 때에는, 중간에 다른 구성 요소가 존재하지 않는 것으로 이해되어야 할 것이다.

본 출원에서 사용한 용어는 단지 특정한 실시예를 설명하기 위해 사용된 것으로, 본 발명을 한정하려는 의도가 아니다. 단수의 표현은 문맥상 명백하게 다르게 뜻하지 않는 한, 복수의 표현을 포함한다. 본 출원에서, "포함하다" 또는 "가지다" 등의 용어는 명세서상에 기재된 특정, 숫자, 단계, 동작, 구성 요소, 부품 또는 이들을 조합한 것이 존재함을 지정하려는 것이지, 하나 또는 그 이상의 다른 특 징들이나 숫자, 단계, 동작, 구성 요소, 부품 또는 이들을 조합한 것들의 존재 또는 부가 가능성을 미리 배제하지 않는 것으로 이해되어야 한다.

다르게 정의되지 않는 한, 기술적이거나 과학적인 용어를 포함해서 여기서 사용되는 모든 용어들은 본 발명이 속하는 기술 분야에서 통상의 지식을 가진 자에 의해 일반적으로 이해되는 것과 동일한 의미가 있다. 일반적으로 사용되는 사전에 정의되어 있는 것과 같은 용어들은 관련 기술의 문맥상 가지는 의미와 일치하는 의미가 있는 것으로 해석되어야 하며, 본 출원에서 명백하게 정의하지 않는 한, 이상적이거나 과도하게 형식적인 의미로 해석되지 않는다.

이하에서는 설명의 편의를 위해 두 개의 튜너 (제1 튜너 및 제2 튜너)가 구비된 경우를 예로 들어 설명하기로 하되, 세 개 이상이 구비된 경우도 동일 또는 유사하게 구현될 수 있음을 이하의 설명을 통해 더욱 자명하게 될 것이다.
한편, 본 발명의 실시예를 구체적으로 설명하기에 앞서, 본 발명과 관련하여 디지털 방송 수신기에 연결된 위성 내의 메뉴 목록과 안테나 연결 상태를 구체적으로 설명하기로 한다.

도 2 내지 도 4는 디지털 방송 수신기에 연결된 위성 내의 메뉴 목록을 도시한 도면이다.

도 2 내지 도 4를 참조하면, 각 위성은 하나 이상의 트랜스폰더 (transponder: TP) 정보를 가진다. 디지털 위성 방송 신호를 중계하는 각 위성에는 대체로 수십 개의 트랜스폰더가 설치되어 있는데, 이들을 트랜스폰더 목록 (transponder list)이라 칭한다. 또한, 각 트랜스폰더에는 개수의 제한은 없으나, 전송되는 신호의 데이터 전송률이 허용하는 범위 내에서 대체로 수개 내지 수십 개의 채널이 설정되어 있다. 위와 같이 설정된 복수 개의 채널을 통해 다양한 디지털 위성 방송 신호가 디지털 방송 수신기로 수신된다.

여기서, 트랜스폰더는 지상에 위치한 방송국에서 송출한 송신 신호를 수신한 후에 이를 위성 내부에서 중복하여 지상으로 재송신하는 위성 중계기로서, 채널군 (channel group)이라 한다.

디지털 방송 수신기에서 위성 방송 정보는 위성 별로 관리 운영되는데 예를 들어, 도 2에 도시된 바와 같이 복수 개의 위성 중 위성 1에 연결되는 하위 메뉴는 위성 1에 속하는 채널 (CH 11 - CH 1L)로 구성되거나, 도 3에 도시된 바와
같이 위치 1에 속하는 트랜스포머 (TP 1 - TP M)로 구성된다. 또한, TP 1의 하위 메뉴는 도 4에 도시된 바와 같이 TP 1에 속하는 채널 (CH 111 - CH 11L)로 구성된다.

도 5 내지 도 7은 두 개의 투너를 구비한 디지털 방송 수신기의 안테나 연결 상태를 도시한 구성도이다.

도 5 내지 도 7을 참조하면, 안테나 연결 상태에선 싱글 투너 (single tuner) 형태, 루프 쓰루 (Loop-Through) 형태, 세퍼레이트 (Separate) 형태가 있다. 싱글 투너 형태로 안테나를 한 개의 투너에만 연결하는 형태로서, 두 개의 투너를 구비한 디지털 방송 수신기의 경우에는 제1 투너 또는 제2 투너 각각에 연결된 형태를 상정할 수 있다(도 5). 루프 쓰루 (Loop-Through) 형태는 하나의 신호선으로 들어오는 LNB 신호를 두 개의 투너가 공유하는 형태(도 6)이고, 세퍼레이트 (Separate) 형태는 두 개의 신호선으로 들어오는 LNB 신호를 각각의 투너에서 독립적으로 투영하는 형태이다(도 7).

이하, 첨부한 도면들을 참조하여 본 발명에 따른 바람직한 실시예를 상세히 설명하기로 하며, 첨부 도면을 참조하여 설명함에 있어 도면 부호에 상관없이 동일하거나 대응하는 구성 요소는 동일한 참조번호를 부여하고 이에 대한 중복되는 설명은 생략하기로 한다.
도 8은 본 발명의 일 실시예에 따른 두 개의 튜너를 구비한 디지털 방송 수신기의 블록 구성도를 도시한 것이다.

도 8에 도시된 바와 같이, 본 실시예에 따른 디지털 방송 수신기는 제1 튜너(11), 제2 튜너(13), 제어부(20), 트랜스폰더 정보 저장부(30), 채널 정보 저장부(40) 및 유저 인터페이스부(50)를 포함한다.

제1 튜너(11) 및 제2 튜너(13) 각각은 안테나로부터 입력되는 고주파 신호를 저장을 주파수 변환기(LNB, Low Noise Block down converter)에 의하여 변환된 신호로 받아, 영상 신호와 음성 신호 등으로 추출하여 추출된 신호를 텔레비전 등으로 송출하는 역할을 수행한다.

여기서, 저장을 주파수 변환기(LNB)는 위성에서 송출하는 4 ~ 12 GHz대의 고주파수를 1 GHz대의 중간 주파수로 변경하는 역할을 하는 것으로, 안테나의 중앙에 위치한다.

제어부(20)는 사용자로부터 입력된 튜너 지정 요구 또는 설정된 주기에 구동하여 담당 튜너가 탐색할 주파수 리스트인 트랜스폰더 목록을 인지하고, 인지한 트랜스폰더 목록의 각 트랜스폰더 정보를 담당 튜너에 제공하여 채널 정보를 얻으며 이를 채널 정보 저장부(30)에 저장시킨다.

또한, 제어부(20)는 각 튜너에서의 튜닝 성공 여부를 판단하고, 트랜스폰더의 트랜스포트 스트림(transport stream)으로부터 PSI/SI 데이터를 해석함으로써
각 튜너로부터 출력된 신호가 동일한지 여부를 판단하는 등 디지털 방송 수신기의 전반적인 동작을 제어하는 역할을 수행한다.

채널 정보 저장부(30)는 튜너에 의해 탐색된 채널 정보를 저장한다. 예를 들어, 채널 정보 저장부(30)는 램, 플래시 메모리, 하드디스크 등의 메모리 장치로 구현될 수 있다.


유저 인터페이스부(50)는 사용자 인터페이스를 제공하기 위한 것으로 예를 들어, 디스플레이부(55) (예컨대, 액정 등) 및 입력부(53) (예컨대, 버튼, 스위치 등)를 포함한다. 유저 인터페이스부(50)는 자동적으로 튜너를 지정할 수 없는 경우 사용자에게 탐색하고자 하는 위성에 대하여 어느 튜너를 지정할 것인지 선택할 수 있도록 UI(user interface) 화면을 표시하고, 어느 하나의 튜너에 대하여 선택 신호를 입력 받도록 가능하다.

이하, 본 발명의 바람직한 실시예에 따른 두 개의 튜너가 구비된 디지털 방
송신기가 튜너를 지정하는 과정을 설명하기로 한다.

도 9는 본 발명의 일 실시예에 따른 디지털 방송 수신기에서의 튜너 지정 과정을 도시한 흐름도이다.

도 9를 참조하면, 단계 210에서 자동 채널 설정 모드 키가 선택되어 자동 튜너 지정 요구가 수신 또는 입력되며, 디지털 방송 수신기는 단계 220에서 디지털 방송 수신기에 연결된 탐색하고자 하는 위성 중 어느 하나의 트랜스폰더 목록을 찾고, 그 트랜스폰더 목록의 모든 트랜스폰더 정보, 예를 들어 주파수, 심볼율, FEC 값 및 편파 등을 순차적으로 이용하여 제1 튜너(10) 및 제2 튜너(13)를 각각 튜닝 시킨다.

여기서, 디지털 방송 수신기에 연결된 위성 목록은 튜너 지정 과정 전에 디지털 방송 수신기에 입력되어 있으며, 그 위성들의 트랜스폰더 목록 및 각 트랜스폰더 정보 또한 트랜스폰더 정보 저장부(30)에 미리 저장되어 있는 것으로 가정한다.

다음, 디지털 방송 수신기는 모든 트랜스폰더 정보에 대한 튜닝이 완료되면, 트랜스폰더 별로 각 튜너에서의 튜닝 성공 여부를 판단하고, 이를 종합하여 튜너 각각의 튜닝 성공율을 계산한다(단계 230). 튜닝 성공율은 예를 들어, 모든 트랜스폰더 개수에 대한 해당 튜너의 성공 회수의 통합으로 계산될 수 있다.

한편, 탐색하고자 하는 위성에 연결된 튜너를 찾기 위하여 위성 내의 모든
트랜스폰더 정보를 이용하여 튜닝하는 이유는, 하나의 트랜스폰더 정보를 이용한 튜닝 성공 여부만 가지고는 어떤 튜너에서 신호가 들어오는지 판단할 수 없는 경우가 발생할 수 있기 때문이다. 예를 들어, 양 튜너에 서로 다른 위성의 신호가 들어올 에도 불구하고, 위성이 가지는 TP 개수가 많아지면 튜너의 일반적인 입력 주파수 범위인 950~2150 MHZ 내에서 위성간 중복되는 튜닝 정보(주파수, 심볼율, FEC, 편 파 등)를 가지는 경우가 발생될 수 있다. 즉, 유사한 트랜스폰더 정보를 이용하여 각 튜너가 튜닝할 경우, 디지털 방송 수신기는 어떤 튜너가 탐색하고자 하는 위성 에 연결된 것인지 판단할 수 없게 된다. 그러나, 본 실시예에 의하면 다른 신호가 들어오는 경우 위와 같은 이유로 잘못 탐색되는 경우를 방지할 수 있다.

단계 240에서 디지털 방송 수신기는 이렇게 계산된 각 튜너의 튜닝 성공율을 비교한다. 각 튜너에 대한 튜닝 성공율이 서로 상이한 경우에는, 튜닝 성공율이 더 높은 튜너가 탐색하고자 하는 위성이 연결된 것으로 판단하고 그 튜너를 선택한다 (단계 250).

예를 들어, 두 개의 튜너를 구비한 디지털 방송 수신기에 있어서 탐색하고자 하는 위성의 트랜스폰더가 1 부터 10까지 (TP 1, TP 2, …, TP 10) 있다고 가정하고, 양 튜너에 TP 1의 정보를 동시 튜닝하면 디지털 방송 수신기는 제1 튜너 (11)에서의 튜닝 성공 여부와 제2 튜너 (13)에서의 튜닝 성공 여부를 인식한다. TP 1부터 TP 10까지 순차적으로 양 튜너에서 동시 튜닝한 결과, 제1 튜너 (11)에서는 8 회 성공하였고 제2 튜너 (13)에서는 3회 성공하였다면 튜닝 성공율은 각각 80%와 30%로 계산되는데, 이때 제1 튜너 (11)의 성공율이 더 높으므로 디지털 방송 수신기
는 제1 튜너(11)에 탑색하고자 하는 위성이 연결되어 있는 것으로 판단하게 된다.

따라서, 안테나 세팅 후에는 사용자가 트랜스폰더 정보(주파수, 심볼율, FEC 값 및 편파 등)를 일일이 입력하거나 튜너를 지정 하지 않아도 된다.

만일, 두 개의 튜너에서의 튜닝 성공율이 동일한 경우라면, 트랜스포트 스트림으로부터 ISO/IEC 13181-1에 정의된 PSI 데이터 또는 ETSI EN 300 468에 정의된 SI 데이터를 해석하여 동일한 신호인지 판별한다(단계 260).

여기서, PSI(program specific information)는 MPEG-2 트랜스포트 스트림을 사용해서 전송되는 프로그램 제어용 표에 관한 프로그램 지정 정보로서 ISO/IEC 13818-1에 정의되어 있고, SI는 ETSI EN 300 468에 정의되어 있다.

만일, 양 튜너의 신호가 동일하다고 판명되면, 미리 설정된 우선 순위가 높은 튜너가 자동으로 선택된다(단계 270).

그러나, 양 튜너의 신호가 상이하다고 판명되면, 유저 인터페이스부(50)는 사용자가 탑색할 위성과 연결된 튜너를 직접 선택하도록 하는 UI 화면을 표시한다(단계 280). 이때, 디지털 방송 수신기는 입력 받은 신호에 따라 탑색할 위성 신호와 연결된 튜너를 지정하게 된다(단계 290).

단계 220 내지 단계 290은 디지털 방송 수신기에 연결된 안테나 수만큼 반복되어, 위성 별로 각 위성의 신호를 받는 튜너를 지정하게 된다.

한편, 본 실시예의 튜너 지정 방법은 안테나의 연결 상태가 세퍼레이트(Separate) 형태일 때 특히 유용하다. 싱글 튜너(single tuner) 형태인 경우나 루
프 쓰루 (loop through) 형태인 경우에는, 하나의 신호선만 연결되어 있기 때문에 군이 튜너를 지정하지 않을 수 있다. 그러나, 서로 다른 위성에 연결된 안테나가 각각의 튜너에 세퍼레이트 형태로 연결된 경우에는, 각각의 튜너에 들어오는 신호선이 다르기 때문에 어느 위성의 신호를 받고 있는지를 정의하기 위하여 튜너의 지정이 반드시 필요하게 되기 때문이다.

도 10은 본 발명의 다른 실시에 따른 디지털 방송 수신기에서의 튜너 지정 과정을 도시한 흐름도이다.

도 10을 참조하면, 단계 310에서 수동 튜너 지정 모드 키가 선택되어 튜너 지정 요구가 수신 또는 입력되면, 디지털 방송 수신기는 단계 320에서 탐색하고자 하는 위성의 어느 하나의 트랜스폰더 정보 (주파수, 심볼율, FEC, 편파 등)를 이용하여 각 튜너에서 동시에 튜닝을 시도하고, 단계 330에서 튜닝 성공 여부를 판별한다.

만일, 두 개의 튜너 중 어느 한 튜너에서만 튜닝이 성공된 경우라면, 디지털 방송 수신기는 성공한 튜너로 채널을 탐색한다 (단계 340).

그러나, 두 개의 튜너 모두에서 튜닝이 성공된 경우라면, 제어부 (20)는 트랜스포트 스트림으로부터 ISO/IEC 13181-1에 정의된 PSI 데이터 또는 ETSI EN 300 468에 정의된 SI 데이터를 해석하여 동일한 신호인지 판별한다 (단계 350).

만일, 단계 360과 같이 양 튜너의 신호가 동일하다고 판명되면, 미리 설정된
우선 순위가 높은 튜너가 자동으로 선택된다. 이때는 사용자가 메뉴에서 수동으로 튜너를 설정할 필요가 없다는 이점이 있다.

그러나, 단계 370과 같이 두 개의 튜너의 신호가 상이하다고 판정되면, 디지털 방송 수신기는 어느 한 튜너를 선택할 수 있는 UI(유저 인터페이스) 화면이 구비된 디스플레이 장치 (예컨대, 액정)에 표시하게 한다. 이후에는 단계 380에서 입력부에 의하여 입력된 신호에 따라 어느 하나의 튜너를 지정하게 된다.

본 발명은 상기 실시예에 한정되지 않으며, 많은 변형이 본 발명의 사상 내에서 당신에서 통상의 지식을 가진 자에 의하여 가능함은 물론이다.

【발명의 효과】

상술한 바와 같이 본 발명은, 트랜스폰더 정보의 입력 과정과 그에 따른 튜너 지정 과정을 자동화하여 채널을 탐색할 수 있다. 또한, 본 발명은 각 튜너에서 출력된 신호가 상이한 경우에만 사용자가 튜너 지정을 하도록 함으로써 튜너 지정 과정이 간소화된다.

한편, 사용자 입장에서는 디지털 방송 수신기를 처음 설치하거나 채널을 변경하는 경우 소요되는 노력과 비용을 절감할 수 있고, 나아가 사용자가 원하는 방송 채널을 보다 신속하고 효율적으로 선정 수신할 수 있는 효과가 있다.
상기에서는 본 발명의 바람직한 실시예를 참조하여 설명하였지만, 해당 기술 분야에서 통상의 지식을 가진 자라면 하기의 특허 청구범위에 기재된 본 발명의 사상 및 영역으로부터 벗어나지 않는 범위 내에서 본 발명을 다양하게 수정 및 변경시킬 수 있음을 이해할 수 있을 것이다.
【특허청구범위】

【청구항 1】

복수의 튜너가 구비된 디지털 방송 수신기에서의 튜너 지정 방법에 있어서,

탐색하고자 하는 위치에 상응하는 하나 이상의 트랜스폰더 정보를 이용하여
각 튜너를 투영시키는 단계 (a),

상기 각 튜너의 투영 성공률을 산출하는 단계 (b),

상기 각 튜너의 투영 성공률을 참조하여 상기 위치의 채널을 탐색할 튜너를
선택하는 단계 (c)를 포함하는 튜너 지정 방법.

【청구항 2】

제1항에 있어서,

상기 투영 성공률이 가장 높은 튜너가 선택되는 것을 특정으로 하는 튜너 지
정 방법.

【청구항 3】

제2항에 있어서,

상기 투영 성공률이 가장 높은 튜너가 둘 이상인 경우, 상기 단계 (c)는,
각 튜너로부터 출력된 신호가 서로 동일한지 여부를 판단하는 단계; 및
상기 신호가 동일한 경우 미리 설정된 우선 순위가 높은 튜너를 선택하는 단

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계를 더 포함하는 것을 특징으로 하는 튜너 지정 방법.

【청구항 4】

제3항에 있어서,

상기 신호가 서로 상이한 경우 튜너 지정을 위한 입력 신호에 상응하도록 하
나의 튜너가 선택되는 것을 특징으로 하는 튜너 지정 방법.

【청구항 5】

제3항에 있어서,

각 튜너로부터 출력된 신호가 서로 동일한지 여부는 트랜스폰더
(transponder)의 트랜스포트 스트림으로부터 PSI/SI 정보를 해석함으로써 판단되는
것을 특징으로 하는 튜너 지정 방법.

【청구항 6】

제1항에 있어서, 상기 단계 (a)는

상기 탑색하고자 하는 위치에 상응하는 모든 트랜스폰더 정보를 이용하여 상
기 각 튜너를 튜닝시키는 것을 특징으로 하는 튜너 지정 방법.
【청구항 7】

제1항에 있어서,

상기 단계 (a) 내지 단계 (c)는,

상기 디지털 방송 수신기에 연결된 안테나 수만큼 반복되는 것을 특징으로 하는 튜너 지정 방법.

【청구항 8】

제1항에 있어서,

상기 디지털 방송 수신기의 안테나 연결 상태는 세퍼레이트(separate) 형태인 것을 특징으로 하는 튜너 지정 방법.

【청구항 9】

제1항에 있어서,

상기 트랜스폰더 정보는 상기 디지털 방송 수신기에 미리 저장되어 있는 것을 특징으로 하는 튜너 지정 방법.

【청구항 10】

복수 개의 튜너;

탐색하고자 하는 위성에 대한 하나 이상의 트랜스폰더 정보가 저장된 트랜스
폰더 정보 저장부; 및

각 튜너가 상기 트랜스폰더 정보를 이용하여 튜닝한 결과에 따른 튜닝 성공율을 참조하여 상기 위성의 채널을 탐색할 하나의 튜너를 선택하는 제어부를 포함하는 디지털 방송 수신기.

【청구항 11】

제10항에 있어서, 상기 제어부는

각 튜너의 튜닝 성공율이 가장 높은 튜너를 선택하고,

상기 튜닝 성공율이 가장 높은 튜너가 둘 이상인 경우 각 튜너로부터 출력된 신호가 서로 동일한지 여부를 판단하여,

상기 신호가 동일한 경우에는 미리 설정된 우선 순위가 높은 튜너를 선택하고, 상기 신호가 서로 상이한 경우 입력 신호에 상응하도록 하나의 튜너를 선택하는 것을 특징으로 하는 디지털 방송 수신기.

【청구항 12】

제10항에 있어서,

상기 선택된 튜너에 의한 상기 채널 탐색이 도중에 중단되거나 모두 완료된 경우 탐색된 채널에 대한 채널 정보를 저장하는 채널 정보 저장부를 더 포함하는 디지털 방송 수신기.
【청구항 13】

복수 개의 튜너가 구비된 디지털 방송 수신기에서의 튜너 지정 방법에 있어,

탐색하고자 하는 위성에 상응하는 어느 하나의 트랜스폰더 정보를 이용하여 상기 각 튜너에서 튜닝을 시도하는 단계 (a),

하나의 튜너에서만 튜닝이 성공된 경우 성공한 튜너로 상기 위성의 채널을 탐색하는 단계 (b),

상기 복수 개의 튜너 중 하나 이상의 튜너에서 튜닝이 성공된 경우 상기 각 튜너로부터 출력된 신호의 동일성 여부에 따라 상기 채널을 탐색할 하나의 튜너를 선택하는 단계 (c)를 포함하는 튜너 지정 방법.

【청구항 14】

제13항에 있어서,

상기 단계 (c)에서 상기 각 튜너로부터 출력된 신호의 동일성 여부를 판단한 결과,

동일하다면 미리 설정된 우선 순위가 높은 튜너를 선택하고,

상이하다면 상기 채널을 탐색할 하나의 튜너를 선택하기 위한 UI(user interface) 화면을 표시하는 것을 특징으로 하는 튜너 지정 방법.
【청구항 15】

제13항에 있어서,

상기 각각의 신호가 동일한지 여부는 트랜스폰더의 트랜스포트 스트립으로부터 PSI/SI 정보를 해석함으로써 판단되는 것을 특정으로 하는 튜너 지정 방법.

【청구항 16】

복수 개의 튜너;

탐색하고자 하는 위성에 상응하는 트랜스폰더 정보를 이용한 각 튜너의 튜닝 시도 결과에 의하여, 하나의 튜너에서만 튜닝이 성공된 경우 성공한 튜너로 채널을 탐색하며, 툰 이상의 튜너에서 튜닝이 성공된 경우 각 튜너로부터 출력된 신호가 서로 동일한지 여부로써 채널 탐색을 위한 튜너를 선택하는 제어부; 및

입력 신호를 입력받기 위한 UI 화면을 표시하는 유저 인터페이스부를 포함하여,

상기 제어부는 튜닝 성공된 복수의 튜너로부터 출력된 신호가 동일한 경우 미리 지정된 우선 순위에 따라 하나의 튜너를 선택하되, 동일하지 않은 경우에는 상기 입력 신호에 따라 하나의 튜너를 선택하는 것을 특정으로 하는 디지털 방송 수신기.
【청구항 17】

제16항에 있어서,

상기 각각의 신호가 동일한지 여부는 상기 트랜스폰더 정보에 따른 트랜스폰더의 트랜스포트 스트림으로부터 PSI/SI 정보를 해석함으로써 판단되는 것을 특징으로 하는 디지털 방송 수신기.

【청구항 18】

제16항에 있어서,

상기 선택된 튜너에 의한 상기 채널 탐색이 도중에 중단되거나 모두 완료된 경우 탐색된 채널에 대한 채널 정보를 저장하는 채널 정보 저장부를 더 포함하는 디지털 방송 수신기.

【청구항 19】

제16항에 있어서, 상기 유저 인터페이스부는,

상기 UI 화면을 표시하는 디스플레이부; 및

상기 입력 신호를 입력받기 위한 입력부를 포함하는 것을 특징으로 하는 디지털 방송 수신기.
[도면]

[도 1]

시 작

안테나 연결 상태 설정  110

안테나 세팅  120

튜너 지정  130

채널 탐색  140

종료

[도 2]

위성 1

CH 11
CH 12
...
CH 1L
【도 3】

위성 1
TP 1
TP 2
...
TP M

【도 4】

위성 1 | TP 1
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CH 112 | 1
CH 113 | 1
... | ...
CH 11L | 1

【도 5】

제1 튜너 제2 튜너

신호선 In
Singal 튜너 형태

Out
【도 6】

【도 7】

【도 8】
【도 10】

시작

수동 채널 모드 310

탈색할 위치의 트랜스폰더 정보로 각 튜너를 동시 튜닝 320

동시 튜닝 성공? 330

예

동일한 신호? 350

예

우선순위가 높은 튜너 선택 360

아니오

튜닝 성공한 튜너 선택 340

아니오

튜너 지정할 UI 화면을 표시 370

종료

튜너 선택 380
**FILING RECEIPT**

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**CONFIRMATION NO. 8550**

34610
KED & ASSOCIATES, LLP
P.O. Box 221200
Chantilly, VA 20153-1200

Date Mailed: 11/02/2007

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. If an error is noted on this Filing Receipt, please write to the Office of Initial Patent Examination's Filing Receipt Corrections. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections.

**Applicant(s)**
Ho Yi, Residence Not Provided;

**Power of Attorney:** None

**Domestic Priority data as claimed by applicant**

**Foreign Applications**
REPUBLIC OF KOREA 10-2006-00113200 11/16/2006

**If Required, Foreign Filing License Granted:** 10/30/2007

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 11/872,282**

**Projected Publication Date:** To Be Determined - pending completion of Missing Parts

**Non-Publication Request:** No

**Early Publication Request:** No
PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process simplifies the filing of patent applications on the same invention in member countries, but does not result in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. A Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4158).

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Title 35, United States Code, Section 184
Title 37, Code of Federal Regulations, 5.11 & 5.15

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set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

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NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).
NOTICE TO FILE MISSING PARTS OF NONPROVISIONAL APPLICATION

FILED UNDER 37 CFR 1.53(b)

Filing Date Granted

Items Required To Avoid Abandonment:

An application number and filing date have been accorded to this application. The item(s) indicated below, however, are missing. Applicant is given TWO MONTHS from the date of this Notice within which to file all required items and pay any fees required below to avoid abandonment. Extensions of time may be obtained by filing a petition accompanied by the extension fee under the provisions of 37 CFR 1.136(a).

- The statutory basic filing fee is missing.
  Applicant must submit $310 to complete the basic filing fee for a non-small entity. If appropriate, applicant may make a written assertion of entitlement to small entity status and pay the small entity filing fee (37 CFR 1.27).
- The oath or declaration is missing.
  A properly signed oath or declaration in compliance with 37 CFR 1.63, identifying the application by the above Application Number and Filing Date, is required.
  Note: If a petition under 37 CFR 1.47 is being filed, an oath or declaration in compliance with 37 CFR 1.63 signed by all available joint inventors, or if no inventor is available by a party with sufficient proprietary interest, is required.

The applicant needs to satisfy supplemental fees problems indicated below.

The required item(s) identified below must be timely submitted to avoid abandonment:

- Additional claim fees of $210 as a non-small entity, including any required multiple dependent claim fee, are required. Applicant must submit the additional claim fees or cancel the additional claims for which fees are due.
- To avoid abandonment, a surcharge (for late submission of filing fee, search fee, examination fee or oath or declaration) as set forth in 37 CFR 1.16(f) of $130 for a non-small entity, must be submitted with the missing items identified in this notice.

SUMMARY OF FEES DUE:

Total additional fee(s) required for this application is $1370 for a non-small entity

- $310 Statutory basic filing fee.
- $130 Surcharge.
- The application search fee has not been paid. Applicant must submit $510 to complete the search fee.
• The application examination fee has not been paid. Applicant must submit $210 to complete the examination fee for a non-small entity.
• Total additional claim fee(s) for this application is $210
  • $210 for 1 independent claims over 3.

Replies should be mailed to:

Mail Stop Missing Parts
Commissioner for Patents
P.O. Box 1450
Alexandria VA 22313-1450

Registered users of EFS-Web may alternatively submit their reply to this notice via EFS-Web. https://sporal.uspto.gov/authenticate/AuthenticateUserLocalEPF.html

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/wjsale/

___________________________________________________________
Office of Initial Patent Examination (571) 272-4000 or 1-800-PTO-9199
UTILITY PATENT APPLICATION TRANSMITTAL UNDER 37 C.F.R. §1.53(b)

U.S. Patent and Trademark Office
Customer Service Window, MAIL STOP PATENT APPLICATION
Randolph Building
401 Dulany Street
Alexandria, VA 22314

Docket No.: EZ-0005

Sir:

Transmitted herewith for filing is the patent application of

INVENTORS: Ho YI

FOR: TUNER SELECTION IN DIGITAL BROADCASTING RECEIVER HAVING MULTIPLE TUNERS

Enclosed are:
1. ☑ 22 pages of specification, claims, abstract
2. ☑ 10 sheets of FORMAL drawings
3. ☐ ______ pages of newly executed Declaration & Power of Attorney (copy or original) (To Follow)
4. ☑ Priority claimed to Appln. No. 10-2006-00113200 filed on November 16, 2006 in Korea, whose entire disclosure is incorporated herein by reference.
5. ☐ Applicant claims Small Entity Status
6. ☐ Information Disclosure Statement, Form PTO-1449 and ______ references
7. ☐ Assignment papers for HUMAX Co., Ltd. ______ cover sheet, assignment and assignment fee) (To Follow)
8. ☐ Certified copy of Priority Application No. 10-2006-00113200 filed on November 16, 2006 in Korea (To Follow)
9. ☐ Two (2) return postcards
   ☐ Stamp & Return with Courier
   ☐ Prepaid postcard-stamped filing date & returned with unofficial Serial Number
10. ☐ Authorization under 37 C.F.R. §1.136(a)(3)
12. ☐ Other: ______

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☐ A check in the amount of $_______ (Check #_______) is attached.

☐ Please charge my Credit Card.

☐ Please charge my Deposit Account No. 16-0607 in the amount of $_____. A duplicate copy of this sheet is enclosed.

☐ The Commissioner is hereby authorized to charge payment of following fees during the pendency of this application or credit any overpayment to Deposit Account No. 16-0607.

☐ Any additional filing fees required under 37 C.F.R. 1.16.

☐ Any patent application processing fees under 37 C.F.R. 1.17.

☐ Any filing fees under 37 C.F.R. 1.16 for presentation of extra claims.

Respectfully submitted,
KED & ASSOCIATES, LLP

Daniel Y.J. Kim
Registration No. 36,186

Correspondence Address:
P.O. Box 221200
Chantilly, Virginia 20153-1200
703 766-3777 DYK/dak

Date: October 15, 2007

Please direct all correspondence to CustomerNumber 34610

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This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

**New Applications Under 35 U.S.C. 111**
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

**National Stage of an International Application under 35 U.S.C. 371**
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

**New International Application Filed with the USPTO as a Receiving Office**
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.
TUNER SELECTION IN DIGITAL BROADCASTING RECEIVER HAVING

MULTIPLE TUNERS

CROSS-REFERENCE TO RELATED PATENT APPLICATIONS

This application claims the benefit of Korean Patent Application No. 10-2006-0113200, filed on November 16, 2006, in the Korean Intellectual Property Office, the disclosure of which is incorporated herein in its entirety by reference.

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to a digital broadcasting receiver, particularly to a digital broadcasting receiver having multiple tuners and a method of selecting a tuner in the digital broadcasting receiver.

Description of the Related Technology

Generally, a digital broadcasting receiver is equipped with a PVR (Personal Video Recorder) function for recording a digital broadcasting program on a recording medium such as an HDD (Hard Disc Drive), and can be connected to a satellite broadcasting antenna and a television. This digital broadcasting receiver sometimes has multiple tuners so as to allow a user to watch one channel in a PIP (Picture in Picture) mode or record one channel while watching another channel.
In addition, the digital broadcasting receiver has a channel search function, which should be performed before the first use of the digital broadcasting receiver and is performed periodically to update channel data in use.

FIG. 1 is a flowchart showing how a digital broadcasting receiver having two tuners typically searches for channels.

Referring to FIG. 1, in step 110, an antenna of a satellite connected to the digital broadcasting receiver is physically configured to the digital broadcasting receiver, and this process is called “antenna connection state setup.”

After setting the antenna connection state, in step 120, “antenna setting” is performed to configure satellite data, LNB data, on/off of 22 KHz tone, and a value of Diseqc switch, which are antenna setting conditions.

The Diseqc switch is a device for automatically selecting an antenna when there are plural antennas, and can select up to four (4) antennas.

After setting the antenna, in step 130, a tuner connected to the antenna is selected, and this is referred to as “tuner selection.”

After the antenna setting and before the tuner selection, or after the tuner selection, transponder data is inputted in step 140 for “channel search”.

Conventionally, the user had to manually select the tuner. However, since it is not easy for ordinary users to understand the input condition for tuner selection, most users had to rely on the technician to setup the digital broadcasting receiver. Not only is
this costly and time-consuming, but also this procedure had to be repeated every time a new channel is added.

SUMMARY OF CERTAIN INVENTIVE ASPECTS

5 The present invention provides a digital broadcasting receiver and a method of selecting a tuner that make a tuning by use of transponder data in a transponder list corresponding to a satellite connected to the digital broadcasting receiver and select a tuner in accordance with the tuning result, thereby automating or simplifying the tuner selection.

10 An aspect of the present invention features a method of selecting a tuner in a digital broadcasting receiver having multiple tuners. In the method, each tuner is tuned with at least one of transponder data corresponding to a satellite to be searched, tuning completion rates of each tuner are produced, and a tuner to search channels of the satellite is selected to correspond to the tuning completion rates.

15 Another aspect of the present invention features a method of selecting a tuner in a digital broadcasting receiver having multiple tuners. If only one tuner completes tuning as a result of attempting to tune each tuner with at least one of transponder data corresponding to a satellite to be searched, channels of the satellite are searched by the tuner. If two or more tuners complete tuning, one tuner is selected to search the channel according to the identicalness of output signals from the tuners.
Yet another aspect of the present invention features a digital broadcasting receiver, which includes: a plurality of tuners; a transponder data storage, storing at least one of transponder data of a satellite to be searched; and a controller, selecting one tuner to search a channel of the satellite from the plurality of tuners in accordance with a plurality of tuning completion rates being produced by tuning the plurality of tuners with the transponder data.

Still another aspect of the present invention features a digital broadcasting receiver, which includes: a plurality of tuners; a controller, resulted from attempting to tune each tuner with transponder data corresponding to a satellite to be searched, selecting one tuner to search a channel if only one tuner completes tuning, or selecting one tuner from the plurality of tuners according the identicalness of output signals of the tuners if two or more tuners complete tuning; and a user interface, displaying a UI (User Interface) screen to receive an input signal.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG.1 is a flowchart showing a typical channel search procedure in a digital broadcasting receiver having multiple tuners;

FIGS. 2 to 4 show a menu list in a satellite connected to a digital broadcasting receiver;

FIGS. 5 to 7 show the antenna connection state of a digital broadcasting
receiver having two tuners;

FIG. 8 is a block diagram of a digital broadcasting receiver having two tuners in accordance with an embodiment of the present invention;

FIG. 9 is a flowchart of selecting a tuner in a digital broadcasting receiver in accordance with an embodiment of the present invention; and

FIG. 10 is a flowchart of selecting a tuner in a digital broadcasting receiver in accordance with another embodiment of the present invention.

DESCRIPTION OF CERTAIN INVENTIVE EMBODIMENTS

As described above, the embodiment of present invention can search channels by automated input step of transponder data and selecting step of tuner thereof. Also, another embodiment of present invention can simplify the tuner selection procedure and save tuner selection time by allowing user’s manual tuner selection only when output signals of each tuner are different.

Since there can be a variety of permutations and embodiments of the present invention, certain embodiments will be illustrated and described with reference to the accompanying drawings. This, however, is by no means to restrict the present invention to certain embodiments, and shall be construed as including all permutations, equivalents and substitutes covered by the spirit and scope of the present invention.

Terms such as “first” and “second” can be used in describing various elements,
but the above elements shall not be restricted to the above terms. The above terms are used only to distinguish one element from the other. For instance, the first element can be named the second element, and vice versa, without departing the scope of claims of the present invention. The term “and/or” shall include the combination of a plurality of listed items or any of the plurality of listed items.

When one element is described as being “connected” or “accessed” to another element, it shall be construed as being connected or accessed to the other element directly but also as possibly having another element in between. On the other hand, if one element is described as being “directly connected” or “directly accessed” to another element, it shall be construed that there is no other element in between.

The terms used in the description are intended to describe certain embodiments only, and shall by no means restrict the present invention. Unless clearly used otherwise, expressions in the singular number include a plural meaning. In the present description, an expression such as “comprising” or “consisting of” is intended to designate a characteristic, a number, a step, an operation, an element, a part or combinations thereof, and shall not be construed to preclude any presence or possibility of one or more other characteristics, numbers, steps, operations, elements, parts or combinations thereof.

Unless otherwise defined, all terms, including technical terms and scientific terms, used herein have the same meaning as how they are generally understood by those of ordinary skill in the art to which the invention pertains. Any term that is
defined in a general dictionary shall be construed to have the same meaning in the context of the relevant art, and, unless otherwise defined explicitly, shall not be interpreted to have an idealistic or excessively formalistic meaning.

Hereinafter, for the convenience of description, an example of having two tuners (a first tuner and a second tuner) will be mainly described. It shall be apparent, however, that the present invention can be embodied in the same or similar manner in a case of having three or more tuners.

In addition, before describing some embodiments of the present invention, a menu list in a satellite connected to a digital broadcasting receiver and an antenna connection state will be described in detail.

FIG. 2 to FIG. 4 show a menu list in a satellite connected to the digital broadcasting receiver.

Referring to FIG. 2 to FIG. 4, each satellite has more than one transponder (TP) data. Several tens of transponders are installed in each satellite delivering digital satellite broadcasting signals, and this list of transponders is referred to as transponder list. Also, although there is no limit on the number, several to several tens of channels are set up in each transponder within the range of data transmission rate of signal being transmitted. The digital broadcasting receiver can receive various satellite broadcasting signals through the plural channels that are set up as described above.

Here, the transponder, which is referred to as a “channel group”, is a satellite
relay that receives a radio wave transmitted from a broadcasting station on the ground and then amplifies and retransmits the radio wave back to the ground.

Satellite broadcasting data is managed separately in the digital broadcasting receiver. For example, a sub menu linked with satellite 1 among the plural satellites consists of channels (CH11 – CH11L) that belong to satellite 1, as shown in FIG. 2, or transponders (TP 1 – TP M) included in satellite 1, as shown in FIG. 3. Also, a sub menu of TP 1 consists of channels (CH111 – CH111L) included in TP 1, as shown in FIG. 4.

FIG. 5 to FIG. 7 show the antenna connection state of the digital broadcasting receiver having two tuners.

Referring to FIG. 5 to FIG. 7, the antenna connection state can be one of a single tuner type, loop-through type, and separate type. The single tuner type connects the antenna to one tuner, and if the digital broadcasting receiver has two tuners, the antenna is connected to one of the first tuner or the second tuner (FIG. 5). In the loop-through type, two tuners share an LNB signal inputted via one signal line (FIG. 6), and in the separate type, the LNB signals coming from two signal lines are tuned by two tuners independently (FIG. 7).

Hereinafter, some embodiments will be described in detail with reference to the accompanying drawings. In describing the present invention, identical or corresponding elements will be given the same reference numerals, regardless of the figure number.
FIG. 8 is a block diagram of a digital broadcasting receiver having two tuners according to an embodiment of the present invention.

As shown in FIG. 8, the digital broadcasting receiver according to this embodiment includes a first tuner 11, a second tuner 13, a controller 20, a transponder data storage 30, a channel data storage 40, and a user interface 50.

Each of the first tuner 11 and the second tuner 13 receives a converted signal from an LNB (Low Noise Block down converter), which converts high frequency signals inputted from the antenna, and extracts video signals and audio signals from the converted signals for transmission to a TV or another device.

The LNB converts a high frequency of 4 ~ 12 GHz transmitted from a satellite into an intermediate frequency of 1 GHz, and is located in the center of an antenna.

The controller 20 operates on receiving a tuner selection request by the user or on a predetermined period to recognize the transponder list, i.e., the frequency list to be searched by a tuner in charge, obtains channel data by providing each transponder data in the recognized transponder list to the tuner in charge, and stores it on the channel data storage 30.

In addition the controller 20 entirely controls the operation of the digital broadcasting receiver by determining whether or not each tuner completes tuning, and whether or not output signals from each tuner are the same by decoding PSI/SI data from the transport stream of the transponder.
The channel data storage 30 stores channel data searched by the tuner. For example, the channel data storage 30 may be embodied by a memory device such as a RAM, flash memory, or hard disc drive.

The transponder data storage 40 stores data of a satellite connected to the digital broadcasting receiver and transponder data of the satellite. The transponder data includes frequencies, symbol rates, FEC values, and polarization of each transponder, and the transponder list and transponder data can be pre-stored in the digital broadcasting receiver, for example, by referencing a website such as www.lyngsat.com or www.satcodx.com, in which updated satellite data can be found.

The user interface 50 provides an interface to the user, and includes, for example, a display (e.g., an LCD) 55 and an input device (e.g., a button, a switch, etc.) 53. In case it is not possible to select a tuner automatically, the user interface 50 displays a UI (User Interface) screen to allow the user to select any one of the tuners to the satellite to be searched, and receives input of a selection signal for the designated tuner.

Hereinafter, the procedure of selecting a tuner by the digital broadcasting receiver having two tuners according to an embodiment of the present invention will be described.

FIG. 9 is a flowchart of selecting a tuner in the digital broadcasting receiver according to an embodiment of the present invention.
Referring to FIG. 9, in step 210, when an auto tuner selection request is received or inputted by selecting an auto channel setup mode key, the digital broadcasting receiver in step 220 searches one of the transponder list of one of the satellites being connected to the digital broadcasting receiver, and tunes the first tuner 10 and the second tuner 13 by successively using all transponder data such as frequency, symbol rate, FEC value, and polarization.

It is assumed that the list of satellites connected to the digital broadcasting receiver is already inputted in the digital broadcasting receiver prior to selecting the tuner, and the transponder list of the satellites and each of the transponder data are also already stored in the transponder data storage 30.

When tuning on all of the transponder data is complete, the digital broadcasting receiver determines whether each tuner is successfully tuned for each transponder, and collects the results of the determination to calculate a tuning completion rate in step 230.

The tuning completion rate can be, for example, the total sum of the number of completion for the tuner over all transponders.

The reason why the tuning is performed by use of all of the transponder data to find the tuner connected to the satellite to be searched is because it may not be possible to determine through which tuner the signal comes in based on the completion of tuning by use of one of the transponder data only. For example, although there are signals
coming into each tuner from different satellites, if the number of TP that the satellite has
increases, it may happen that tuning data (frequency, symbol rate, FEC, polarization,
etc.) of each satellite is overlapped within the general input frequency range, 950–2150
MHz. Namely, if each tuner performs the tuning with similar transponder data, the
digital broadcasting receiver cannot determine which tuner is connected to the satellite
to be searched. According to the embodiment, however, even if there is an unknown
signal input, the wrong search due to the aforementioned reason can be prevented.

In step 240, the digital broadcasting receiver compares the tuning completion
rates of each tuner. If the tuning completion rates of each tuner are different from each
other, it is determined that the tuner of a higher tuning completion rate is connected to
the satellite to be searched, and the tuner is selected in step 250.

For example, in a digital broadcasting receiver having two tuners, assuming
that there are 1 to 10 transponders (TP, 1, TP2… TP 10) for the satellite and both tuners
are tuned to the data of TP 1 concurrently, the digital broadcasting receiver recognizes
the tuning completion of both the first tuner 11 and the second tuner 13. Assuming that
the first tuner completes 8 times and the second tuner completes 3 times after tuning to
TP 1 to TP 10 successively, the tuning completion rates of each tuner are calculated to
be 80% and 30% respectively, and since the first tuner’s completion rate is higher than
the second tuner’s, the digital broadcasting receiver determines that the satellite to be
searched is connected to the first tuner 11.
Therefore the user does not need to manually input the transponder data
(frequency, symbol rate, FEC value, and polarization, etc.) or to select tuner any more.

If both tuners have same tuning completion rates, PSI data as defined in
ISO/IEC 13181-1 or SI data as defined in EN 300 468 from transport stream is analyzed
to determine whether both signals are identical, in step 260.

Here, the PSI (program specific information), which is program selection data
on a program control table being transmitted by use of MPEG-2 transport stream, is
defined in ISO/IEC 13818-1, and the SI is defined in ETSI EN 300 468.

If it is determined that the signals in both tuners are identical, the tuner having
higher predetermined priority is selected at step 270.

If it is determined, however, that the signals in both tuners are not identical, the
user interface 50 displays a UI screen for the user to select the tuner connected to the
satellite to be searched, in step 280. According to the input from the user, the digital
broadcasting receiver selects the tuner connected to the satellite to be searched, in step
290.

Step 220 to step 290 are repeated as many times as the number of antennas
connected to the digital broadcasting receiver to select the tuners for receiving signals
from each satellite.

In addition, the method of selecting a tuner according to the embodiment is
more effective with the separate type of antenna connection. In the single tuner type or
loop-through type, one signal line is connected so it may be not needed to select the tuner. However, in case each antenna connected to a different satellite is connected to each tuner in the separate type, the signal lines coming into each tuner are different so it is needed to select the tuner to determine from which satellite the signal comes.

FIG. 10 is a flowchart of selecting a tuner in the digital broadcasting receiver according to another embodiment of the present invention.

Referring to FIG. 10, in step 310, when a tuner selection request is received or inputted by selecting a manual tuner selection mode key, the digital broadcasting receiver in step 320 makes each tuner simultaneously perform the tunings with one of the transponder data (frequency, symbol rate, FEC, polarization, etc.) of the satellite to be searched and, in step 330, determines the completion of tuning.

If only one of the two tuners completes tuning, the digital broadcasting receiver searches a channel on the complete tuner in step 340.

However, if all tuners complete the tuning, the controller 20 analyzes THE PSI data as defined in ISO/IEC 13181-1 or the SI data as defined in EN 300 468 from a transport stream to determine whether both signals are identical, in step 350.

If it is determined that the signals in both tuners are identical, in step 360, the tuner having a higher predetermined priority is selected. In this case, it is better for the user not to manually set the tuner on a menu.

If it is determined, however, that the signals in both tuners are not identical, in
step 370, the digital broadcasting receiver displays a user interface screen on a display device (e.g., LCD) for the user to select one out of the two tuners. After this, in step 380, the tuner is selected according to the input signal from an input device.

The present invention is not intended to limit to the aforementioned embodiments, and it is also possible for those who skilled in the art to make various modifications, changes, and additions within the mete and scope of the present invention.
WHAT IS CLAIMED IS:

1. A method of selecting a tuner in a digital broadcasting receiver having multiple tuners, comprising:
   tuning each tuner with at least one of transponder data corresponding to a satellite to be searched;
   calculating a tuning completion rate of each tuner; and
   selecting a tuner to search channels of the satellite by referencing the tuning completion rate of each tuner.

2. The method of Claim 1, wherein a tuner with the highest tuning completion rate is selected from the multiple tuners.

3. The method of Claim 2, wherein, if two or more tuners have the same highest tuning completion rate, the selecting further comprises:
   determining whether or not a signal outputted from each of the tuners is identical to each other; and
   if the signal is identical to each other, selecting a tuner having a higher predetermined priority.
4. The method of Claim 3, wherein, if the signal is not identical to each other, a tuner is selected to correspond to an input signal for tuner selection.

5. The method of Claim 3, wherein identicalness of the signal outputted from each of the tuners is determined by interpreting PSI/SI data from a transport stream of a transponder.

6. The method of Claim 1, wherein the tuning tunes each tuner by use of all of the transponder data corresponding to the satellite to be searched.

7. The method of Claim 1, wherein the tuning to selecting steps are repeated as many times as the number of antennas connected to the digital broadcasting receiver.

8. The method of Claim 1, wherein an antenna connection state of the digital broadcasting receiver is a separate type.

9. The method of Claim 1, wherein the transponder data is pre-stored in the digital broadcasting receiver.

10. A digital broadcasting receiver comprising:
a plurality of tuners;

to be searched is stored; and

a controller, selecting one tuner to search a channel of the satellite from the

plurality of tuners by referencing tuning completion rates resulted from tuning the

plurality of tuners by use of the transponder data.

11. The digital broadcasting receiver of Claim 10, wherein the controller:

selects a tuner having the highest tuning completion rate;

if two or more tuners have the same highest tuning completion rate, determines

whether or not output signals from both tuner are identical; and

selecting a tuner having a predetermined higher priority if the output signals

are identical, and selecting a tuner corresponding to an input signal if the output signals

are not identical.

12. The digital broadcasting receiver of Claim 10 further comprising a channel

data storage, storing channel data of a searched channel if the channel search by the

selected tuner is stopped or completed.

13. A method of selecting a tuner in a digital broadcasting receiver having
multiple tuners, comprising:

    attempting to tune each tuner by use of any one of transponder data

corresponding to a satellite to be searched;

    if only one tuner completes tuning, searching a channel of the satellite with the
5    tuner; and

    if two or more tuners complete tuning, selecting one tuner to search the channel

according to the identicalness of output signals from each tuner.

14. The method of Claim 13, wherein, according to a result of determining the
10 identicalness of output signals from each tuner in the selecting step,

    a tuner having a predetermined higher priority is selected if the output signals

are identical, and

    a UI (User interface) screen for selecting a tuner to search the channel is

displayed if the output signals are not identical.

15

15. The method of Claim 13, wherein the identicalness of the output signals

from each tuner is determined by interpreting PSI/SI data from a transport stream of a

transponder.

20    16. A digital broadcasting receiver comprising:
a plurality of tuners;

a controller, selecting only one tuner to search a channel if the tuner is the only tuner that completes tuning, and selecting a tuner by determining whether signals outputted from each tuner are identical if two or more tuners complete tuning, in accordance with a result of attempting to tune each tuner with transponder data corresponding to a satellite to be searched; and

a user interface, displaying a UI (User Interface) screen to receive an input signal,

whereas the controller selects one tuner based on a predetermined priority if signals outputted from the plurality of tuners completing tunings are identical, and selects one tuner based on the input signal if the signals are not identical.

17. The digital broadcasting receiver of Claim 16, wherein the identicalness of the signals from each tuner are determined by interpreting PSI/SI data from a transport stream of a transponder according to the transponder data.

18. The digital broadcasting receiver of Claim 16 further comprising a channel data storage, storing channel data of a searched channel if the channel search by the selected tuner is stopped or completed.
19. The digital broadcasting receiver of Claim 16, wherein the user interface comprises:

a display, displaying the UI screen; and

an input device, receiving the input signal.
ABSTRACT

A digital broadcasting receiver having multiple tuners and a method of selecting a tuner in the digital broadcasting receiver. An embodiment of the present invention attempts to tune each tuner with transponder data of a satellite being connected to a digital broadcasting receiver having multiple tuners and selects one tuner to search channels according to the result of tuning. The transponder input procedure and the following tuner selection procedure can be omitted such that the tuner selection procedure can be simplified.
FIG. 1

START

SET ANTENNA CONNECTION STATE

SET ANTENNA

SELECT TUNER

SEARCH CHANNEL

END
<table>
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</table>
FIG. 5

FIRST TUNER

SECOND TUNER

SIGNAL LINE

In

Out

SINGLE TUNER TYPE
FIG. 7

FIRST TUNER  SECOND TUNER

SIGNAL LINE1       SIGNAL LINE2

In   Out

SEPARATE TYPE
FIG. 9

START

AUTO CHANNEL SETUP MODE 210

TUNING EACH TUNER WITH TRANSPONDER DATA OF SATTELITE TO BE SEARCHED 220

CHECKING TUNING COMPLETION RATES AT EACH TUNER 230

TUNING COMPLETION RATES AT EACH TUNER ARE DIFFERENT? 240

YES

SELECTING A TUNER HAVING HIGHEST TUNING COMPLETION RATE 250

NO

SAME SIGNALS? 260

YES

SELECTING A TUNER HAVING HIGHER PRIORITY 270

NO

DISPLAYING UI SCREEN FOR SELECTING TUNER 290

SELECTING TUNER

END
FIG. 10

START

MANUAL CHANNEL MODE 310

SIMULTANEOUSLY TUNING EACH TUNER WITH TRANSPONDER DATA OF SATELLITE TO BE SEARCHED 320

SIMULTANEOUS TUNING COMPLETE? 330

YES

SAME SIGNALS? 350

NO

SELECTING A TUNER COMPLETING TUNING 340

SELECTING A TUNER HAVING HIGHER PRIORITY 360

DISPLAYING UI SCREEN FOR SELECTING TUNER 370

SELECTING TUNER 380

END
# PATENT APPLICATION FEE DETERMINATION RECORD

## APPLICATION AS FILED – PART I

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## APPLICATION AS AMENDED – PART II

<table>
<thead>
<tr>
<th>AMENDMENT A</th>
<th>CLAIMS REMAINING AFTER AMENDMENT</th>
<th>HIGHEST NUMBER PREVIOUSLY PAID FOR</th>
<th>PRESENT EXTRA</th>
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<tbody>
<tr>
<td>(37 CFR 1.16(i))</td>
<td>* Minus ** =</td>
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<tr>
<td>Independent (37 CFR 1.16(h))</td>
<td>* Minus *** =</td>
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<tr>
<td>Application Size Fee (37 CFR 1.16(a))</td>
<td>FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))</td>
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<tr>
<th>AMENDMENT B</th>
<th>CLAIMS REMAINING AFTER AMENDMENT</th>
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<th>PRESENT EXTRA</th>
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<table>
<thead>
<tr>
<th>SMALL ENTITY OR OTHER THAN SMALL ENTITY</th>
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<tbody>
<tr>
<td>RATE ($)</td>
</tr>
<tr>
<td>----------</td>
</tr>
<tr>
<td>X =</td>
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<td>185</td>
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<table>
<thead>
<tr>
<th>ADD'T FEE</th>
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<tbody>
<tr>
<td>OR TOTAL</td>
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</table>

<table>
<thead>
<tr>
<th>OR TOTAL</th>
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</thead>
</table>

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.

** If the "Highest Number Previously Paid For" in this space is less than 20, enter "20".

*** If the "Highest Number Previously Paid For" in this space is less than 3, enter "3".

And/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS.

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