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(54) Title: MOBILE ATSC 3.0 RECEIVER AS SIGNAL METER

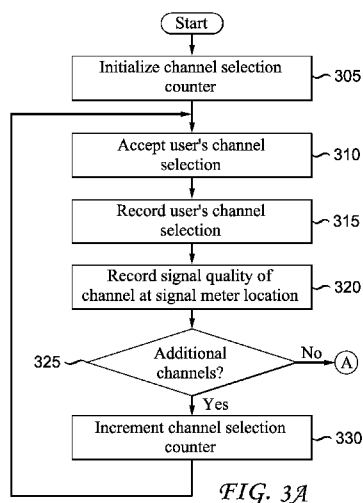


FIG. 3A

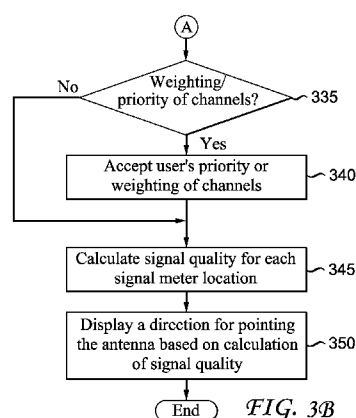


FIG. 3B

(57) Abstract: A method for determining an antenna for best signal reception, including accepting a channel selection, recording the channel selection, recording signal quality of the selected channel at a signal meter location, wherein a portable ATSC 3.0 receiver acts as a signal meter, determining if there are additional channels for which signal quality is to be determined, assigning weights for each of the channels for which signal quality was measured and recorded, calculating signal quality for each the selected channels at the signal meter location and displaying a best direction for pointing the antenna based on the calculation.

MOBILE ATSC 3.0 RECEIVER AS SIGNAL METER

FIELD OF THE INVENTION

The present invention is directed to a method to determine the best fixed antenna
5 location and antenna orientation using a portable ATSC 3.0 receiver as an antenna
installation aide.

BACKGROUND OF THE INVENTION

In multicast and broadcast applications, data are transmitted from a server to
10 multiple receivers over wired and/or wireless networks. A multicast system as used
herein is a system in which a server transmits the same data to multiple receivers
simultaneously, where the receivers form a subset of all the receivers up to and including
all of the receivers. A broadcast system is a system in which a server transmits the same
data to all of the receivers simultaneously. That is, a multicast system by definition can
15 include a broadcast system.

This section is intended to introduce the reader to various aspects of art, which
may be related to the present embodiments that are described below. This discussion is
believed to be helpful in providing the reader with background information to facilitate a
better understanding of the various aspects of the present disclosure. Accordingly, it
20 should be understood that these statements are to be read in this light.

Currently most antennas are installed in the most convenient locations regardless
of the signal quality at the installation location (e.g., attic installation). In a professional
installation, the installer may have a dedicated device to determine the signal level but
most home antennas are not professionally installed. For pointing of the antenna, this is
25 usually done via a trial and error method.

SUMMARY OF THE INVENTION

The next generation TV standard is currently being developed as ATSC 3.0. One
of the goals of this standard is to not only provide services to fixed devices such as
30 televisions, but to also provide services to mobile devices such as cell phones and tablet
devices to name a few. This means that in the future it will be common to have a portable

device that will include an ATSC 3.0 receiver. This portable device will also generally have a WiFi receiver. One use for a portable ATSC 3.0 receiver could be to help locate the best placement for an antenna for a fixed ATSC 3.0 receiver. In the current environment, a fixed antenna is generally just located in a convenient place and then
5 wired to the TV. A portable ATSC 3.0 receiver could be used as signal quality meter and moved around to the possible fixed antenna locations to determine the best location. In addition, if the portable device has a WiFi (internet) connection, the portable device could communicate with the TV. The communication would be over the WiFi connection of both the TV and the portable device. The TV is connected to the fixed antenna and the
10 portable device could be used as a second screen device. As a second screen device, the portable device could be used to monitor the signal quality at the TV and therefore be used to properly point the fixed antenna to get the maximum signal strength or the best overall signal quality considering multiple channels.

A method for determining an antenna for best signal reception, including
15 accepting a channel selection, recording the channel selection, recording signal quality of the selected channel at a signal meter location, wherein a portable ATSC 3.0 receiver acts as a signal meter, determining if there are additional channels for which signal quality is to be determined, assigning weights for each of the channels for which signal quality was measured and recorded, calculating signal quality for each the selected channels at the
20 signal meter location and displaying a best direction for pointing the antenna based on the calculation.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention is best understood from the following detailed description
25 when read in conjunction with the accompanying drawings. The drawings include the following figures briefly described below:

Fig. 1 is a schematic diagram of how a portable ATSC 3.0 receiver can be used as a signal meter.

Figs. 2A and 2B together are a flowchart of the operation of an exemplary
30 embodiment of the present invention for a first scenario where an antenna location needs to be determined as well as pointing the antenna once located.

Figs. 3A and 3B together are a flowchart of the operation of an exemplary embodiment of the present invention for a second scenario where the antenna has already been installed and the antenna needs to be pointed for best signal reception.

Fig. 4 is a block diagram of an exemplary portable ATSC 3.0 receiver in accordance with the principles of the present invention.

It should be understood that the drawing(s) are for purposes of illustrating the concepts of the disclosure and is not necessarily the only possible configuration for illustrating the disclosure.

10 DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present description illustrates the principles of the present disclosure. It will thus be appreciated that those skilled in the art will be able to devise various arrangements that, although not explicitly described or shown herein, embody the principles of the disclosure and are included within its scope.

All examples and conditional language recited herein are intended for educational purposes to aid the reader in understanding the principles of the disclosure and the concepts contributed by the inventor to furthering the art, and are to be construed as being without limitation to such specifically recited examples and conditions.

Moreover, all statements herein reciting principles, aspects, and embodiments of the disclosure, as well as specific examples thereof, are intended to encompass both structural and functional equivalents thereof. Additionally, it is intended that such equivalents include both currently known equivalents as well as equivalents developed in the future, i.e., any elements developed that perform the same function, regardless of structure.

Thus, for example, it will be appreciated by those skilled in the art that the block diagrams presented herein represent conceptual views of illustrative circuitry embodying the principles of the disclosure. Similarly, it will be appreciated that any flow charts, flow diagrams, state transition diagrams, pseudocode, and the like represent various processes which may be substantially represented in computer readable media and so executed by a computer or processor, whether or not such computer or processor is explicitly shown.

The functions of the various elements shown in the figures may be provided through the use of dedicated hardware as well as hardware capable of executing software in association with appropriate software. When provided by a processor, the functions may be provided by a single dedicated processor, by a single shared processor, or by a plurality of individual processors, some of which may be shared. Moreover, explicit use of the term “processor” or “controller” should not be construed to refer exclusively to hardware capable of executing software, and may implicitly include, without limitation, digital signal processor (DSP) hardware, read only memory (ROM) for storing software, random access memory (RAM), and nonvolatile storage.

Other hardware, conventional and/or custom, may also be included. Similarly, any switches shown in the figures are conceptual only. Their function may be carried out through the operation of program logic, through dedicated logic, through the interaction of program control and dedicated logic, or even manually, the particular technique being selectable by the implementer as more specifically understood from the context.

In the claims hereof, any element expressed as a means for performing a specified function is intended to encompass any way of performing that function including, for example, a) a combination of circuit elements that performs that function or b) software in any form, including, therefore, firmware, microcode or the like, combined with appropriate circuitry for executing that software to perform the function. The disclosure as defined by such claims resides in the fact that the functionalities provided by the various recited means are combined and brought together in the manner which the claims call for. It is thus regarded that any means that can provide those functionalities are equivalent to those shown herein.

The proposed method uses a portable device (e.g., cell phone or tablet) that has an ATSC 3.0 receiver as a portable antenna installation aide. The portable ATSC 3.0 receiver is used to monitor the signal quality from one or more TV channels to find the optimum fixed antenna location. Since the antenna on the portable device is not the same as the fixed antenna, this would be a general signal quality indication. It could also help avoid locations that had particular interference problems (e.g., noise generated from motors, car ignitions, etc). If the portable device had an external antenna input, then the portable device could give a much more accurate signal quality indication.

The portable ATSC 3.0 receiver will generally have a WiFi connection. Once the best location for a fixed antenna is found, then the portable device could communicate with the TV connected to the fixed antenna via WiFi. The ATSC 3.0 portable device would communicate with the ATSC 3.0 receiver over the WiFi connection of each device. This connection could be used to send the signal quality being received at the TV to the portable device. This connection, in turn, could be used to point the fixed antenna in the optimum direction.

There are actually two scenarios in using the proposed method and apparatus. If the fixed antenna has not yet been installed then the portable ATSC 3.0 receiver can be moved around to possible fixed antenna location sites to determine the location for the installation of the fixed antenna having the best signal based on a number of channels. The portable ATSC 3.0 receiver can communicate with the ATSC 3.0 TV (receiver) over the WiFi (internet) connection available on both ATSC portable device and the ATSC 3.0 TV (receiver). The portable ATSC 3.0 receiver can tune to the channels most viewed by the user and the signal quality detected. This can be performed at several possible sites for the installation of the fixed antenna and the best location for the fixed antenna can be determined.

In a second scenario (or further to the first scenario), once the fixed antenna is installed, the portable ATSC 3.0 device can be used to point the installed fixed antenna to the best direction. Once again, the portable ATSC 3.0 device can be tuned to the channels most viewed by the user and based on the measured signal quality the fixed antenna can be pointed to the best direction.

Referring to Figs. 2A and 2B, which together are a flowchart of the operation of an exemplary embodiment of the present invention (for the portable ATSC 3.0 receiver) for a first scenario where an antenna location needs to be determined as well as pointing the antenna once located. At 205 a signal meter location counter is initialized by the portable ATSC 3.0 receiver. At 210 the user's designation of the signal meter location is accepted and recorded by the portable ATSC 3.0 receiver. Possible signal meter locations are the attic, above master bedroom, above baby's room, etc. That is, any indication that will help the user identify the location when he/she actually installs the antenna is acceptable. At 215 a channel selection counter is initialized by the portable ATSC 3.0

receiver. A WiFi connection is established between the portable ATSC 3.0 (at signal meter location) and the ATSC 3.0 receiver (e.g., TV). At 220 the user's channel selection is accepted by the portable ATSC 3.0 receiver. The user's channel selection is recorded at 225 by the portable ATSC 3.0 receiver. At 230 the portable ATSC 3.0 receiver records
5 the signal quality of the selected channel at the designated signal meter location from the ATSC 3.0 receiver. The ATSC 3.0 receiver measures the signal quality and communicates the measured signal quality to the portable ATSC 3.0 receiver over the WiFi connection. At 235 the portable ATSC 3.0 receiver determines if the user wants to measure signal quality of another channel. If the user wants to measure signal quality of
10 another channel then the channel selection counter is incremented at 240. Processing then proceeds to 220. If the user does not want to measure signal quality of another channel then at 245 the portable ATSC 3.0 receiver determines if the users wants to move to another signal meter location. If users wants to move to another signal meter location then at 250 the portable ATSC 3.0 receiver increments the signal meter location counter.
15 If users does not want to move to another signal meter location then at 255 the portable ATSC 3.0 receiver determines if the user wants to assign weights or priorities to the selected channels. If the user wants to assign weights or priorities to the selected channels then at 260 the portable ATSC 3.0 receiver accepts the user's channel weights or priorities. At 265 the portable ATSC 3.0 receiver calculates signal quality for each signal
20 meter location. The signal quality is calculated using the weights or priorities specified by the user. The signal quality may be a total signal quality at each signal meter location or an average signal quality at each signal meter location. At 270 the best antenna installation location is displayed based on the signal quality calculation. If the user does not want to assign weights or priorities to the selected channels then processing proceed
25 to 265.

Referring to Figs. 3A and 3B which together are a flowchart of the operation of an exemplary embodiment of the present invention (for a portable ATSC 3.0 receiver) for a second scenario where the antenna has already been installed and the antenna needs to be pointed for best signal reception. At 305 a channel selection counter is initialized by the
30 portable ATSC 3.0 receiver. A WiFi connection is established between the portable ATSC 3.0 (at signal meter location) and the ATSC 3.0 receiver (e.g., TV). At 310 the

user's channel selection is accepted by the portable ATSC 3.0 receiver. The user's channel selection is recorded at 315 by the portable ATSC 3.0 receiver. At 320 the portable ATSC 3.0 receiver records the signal quality of the selected channel at the designated signal meter location. The ATSC 3.0 receiver measures the signal quality and communicates the measured signal quality to the portable ATSC 3.0 receiver over the WiFi connection. At 325 the portable ATSC 3.0 receiver determines if the user wants to measure signal quality of another channel. If the user wants to measure signal quality of another channel then the channel selection counter is incremented at 330. Processing then proceeds to 310. If the user does not want to measure signal quality of another channel then at 335 the portable ATSC 3.0 receiver determines if the user wants to assign weights or priorities to the selected channels. If the user wants to assign weights or priorities to the selected channels then at 340 the portable ATSC 3.0 receiver accepts the user's channel weights or priorities. At 345 the portable ATSC 3.0 receiver calculates signal quality for each signal meter location. The signal quality is calculated using the weights or priorities specified by the user. The signal quality may be a total signal quality at each signal meter location or an average signal quality at each signal meter location. At 350 the best direction for pointing the antenna is displayed based on the signal quality calculation. If the user does not want to assign weights or priorities to the selected channels then processing proceed to 345.

Fig. 4 is a block diagram of an exemplary ATSC 3.0 receiver in accordance with the principles of the present invention. The ATSC 3.0 receiver shown in Fig. 4 may be a portable ATSC 3.0 receiver (device) or an ATSC 3.0 receiver (e.g., TV or relatively fixed ATSC 3.0 receiver). There is an I/O (input/output module) for communication with the user. The I/O module for communication with the user includes a display, a keyboard or any other means for the user to receive and enter data. Specifically, the I/O module for communication with the user includes means for and accepts the user's designation of the signal meter location (210), accepts the user's channel selection (220, 310), accepts an indication as to whether the user wants to measure signal quality of another channel (235, 325), accepts an indication if the users wants to move to another signal meter location (245), accepts an indication if the user wants to assign weights or priorities to the selected channels (255, 335), accepts the user's weights or priorities to the selected channels (260,

340) and displays the best location for antenna installation (270). The storage (memory) is in bi-directional communication with the I/O module for communication with the user. The storage (memory) is the repository of the user specified signal meter location (210), the user's channel selection (225, 315) and the signal quality at the signal meter location (230, 320). The processing module is in bi-directional communication with the I/O module for communication with the user and in bi-directional communication with the storage (memory). The processing module initializes the signal meter location counter (205), initializes the channel selection counter (215, 305), increments the channel selection counter (240, 330) and increments the signal meter location counter (250) and calculates the signal quality (265, 345). The I/O module for WiFi communication is in bi-directional communication with the processing module and the storage (memory). The I/O module for WiFi communication receives the signal quality measurement from the ATSC 3.0 receiver (e.g., TV). The ATSC 3.0 receiver is not shown but is in communication with the portable ATSC 3.0 device. In the case where the portable device is being used to find the best location, the ATSC 3.0 receiver of the portable device is used. In the case where the portable device is used for pointing, the ATSC 3.0 receiver in the TV is used.

It is to be understood that the present invention may be implemented in various forms of hardware, software, firmware, special purpose processors, or a combination thereof. Special purpose processors may include application specific integrated circuits (ASICs), reduced instruction set computers (RISCs) and/or field programmable gate arrays (FPGAs). Preferably, the present invention is implemented as a combination of hardware and software. Moreover, the software is preferably implemented as an application program tangibly embodied on a program storage device. The application program may be uploaded to, and executed by, a machine comprising any suitable architecture. Preferably, the machine is implemented on a computer platform having hardware such as one or more central processing units (CPU), a random access memory (RAM), and input/output (I/O) interface(s). The computer platform also includes an operating system and microinstruction code. The various processes and functions described herein may either be part of the microinstruction code or part of the application program (or a combination thereof), which is executed via the operating system. In

addition, various other peripheral devices may be connected to the computer platform such as an additional data storage device and a printing device.

It should be understood that the elements shown in the figures may be implemented in various forms of hardware, software or combinations thereof. Preferably, these elements are implemented in a combination of hardware and software on one or more appropriately programmed general-purpose devices, which may include a processor, memory and input/output interfaces. Herein, the phrase "coupled" is defined to mean directly connected to or indirectly connected with through one or more intermediate components. Such intermediate components may include both hardware and software based components.

It is to be further understood that, because some of the constituent system components and method steps depicted in the accompanying figures are preferably implemented in software, the actual connections between the system components (or the process steps) may differ depending upon the manner in which the present invention is programmed. Given the teachings herein, one of ordinary skill in the related art will be able to contemplate these and similar implementations or configurations of the present invention.

CLAIMS:

1. A method for determining an antenna for best signal reception, said method comprising:
 - accepting a channel selection;
 - 5 recording said channel selection;
 - recording signal quality of said selected channel at a signal meter location, wherein a portable ASTC 3.0 receiver acts as a signal meter;
 - determining if there are additional channels for which signal quality is to be determined;
 - 10 assigning weights for each of said channels for which signal quality was measured and recorded;
 - calculating signal quality for each said selected channels at said signal meter location; and
 - displaying a best direction for pointing said antenna based on said calculation.
- 15 2. The method according to claim 1, further comprising:
 - initializing a channel selection counter; and
 - incrementing said channel selection counter.
- 20 3. The method according to claim 1, said method further comprising determining a best location for said antenna.
4. The method according to claim 3, said method further comprising:
 - accepting a designation of signal meter location;
 - determining if additional signal meter locations are to be designated and said signal quality measured at said additional signal meter locations; and
 - 25 displaying a best location for antenna installation based on said calculation at each said signal meter location.
5. The method according to claim 4, further comprising:
 - initializing a signal meter location counter; and
 - incrementing said signal meter location counter.
- 30 6. The method according to claim 4, further comprising:
 - initializing a channel selection counter; and

incrementing said channel selection counter.

7. A portable ATSC 3.0 receiver for determining an antenna for best signal reception, comprising:

means for accepting a channel selection;

5

means for recording said channel selection;

means for recording signal quality of said selected channel at a signal meter location, wherein a portable ATSC 3.0 receiver acts as a signal meter;

means for determining if there are additional channels for which signal quality is to be determined;

10

means for assigning weights for each of said channels for which signal quality was measured and recorded;

means for calculating signal quality for each said selected channels at said signal meter location; and

15

means for displaying a best direction for pointing said antenna based on said calculation.

8. The portable ATSC 3.0 receiver according to claim 7, further comprising:

means for initializing a channel selection counter; and

means for incrementing said channel selection counter.

9. The portable ATSC 3.0 receiver according to claim 7, further comprising means for determining a best location for said antenna.

20

10. The portable ATSC 3.0 receiver according to claim 9, further comprising:

means for accepting a designation of signal meter location;

means for determining if additional signal meter locations are to be designated and said signal quality measured at said additional signal meter locations; and

25

means for displaying a best location for antenna installation based on said calculation at each said signal meter location.

11. The portable ATSC 3.0 receiver according to claim 10, further comprising:

means for initializing a signal meter location counter; and

30

means for incrementing said signal meter location counter.

12. The portable ATSC 3.0 receiver according to claim 10, further comprising:

means for initializing a channel selection counter; and

means for incrementing said channel selection counter.

13. A portable ATSC 3.0 receiver for determining an antenna for best signal reception, comprising:

5 a user input/output communications module, said user input/output communications modules accepting a channel selection;

 a storage module, said storage module recording said channel selection, said storage module in bi-directional with said user input/output communications module;

10 said storage module, recording signal quality of said selected channel at a signal meter location, wherein a portable ATSC 3.0 receiver acts as a signal meter;

 a processing module, said processing module determining if there are additional channels for which signal quality is to be determined, said processing module in bi-directional communication with said user input/output communications module, said processing module also in bi-directional communication with said storage module;

 said processing module assigning weights for each of said channels for which signal quality was measured and recorded;

20 said processing module calculating signal quality for each said selected channels at said signal meter location; and

 said user input/output communications module displaying a best direction for pointing said antenna based on said calculation.

14. The portable ATSC 3.0 receiver according to claim 13, further comprising:

25 said processing module initializing a channel selection counter; and

 said processing module incrementing said channel selection counter.

15. The portable ATSC 3.0 receiver according to claim 13, wherein said processing module determines a best location for said antenna.

16. The portable ATSC 3.0 receiver according to claim 15, further comprising:

30 said user input/output communications module accepting a designation of signal meter location;

said processing module determining if additional signal meter locations are to be designated and said signal quality measured at said additional signal meter locations; and

said user input/output communications module displaying a best location for antenna installation based on said calculation at each said signal meter location.

17. The portable ATSC 3.0 receiver according to claim 16, further comprising:

said processing module initializing a signal meter location counter; and

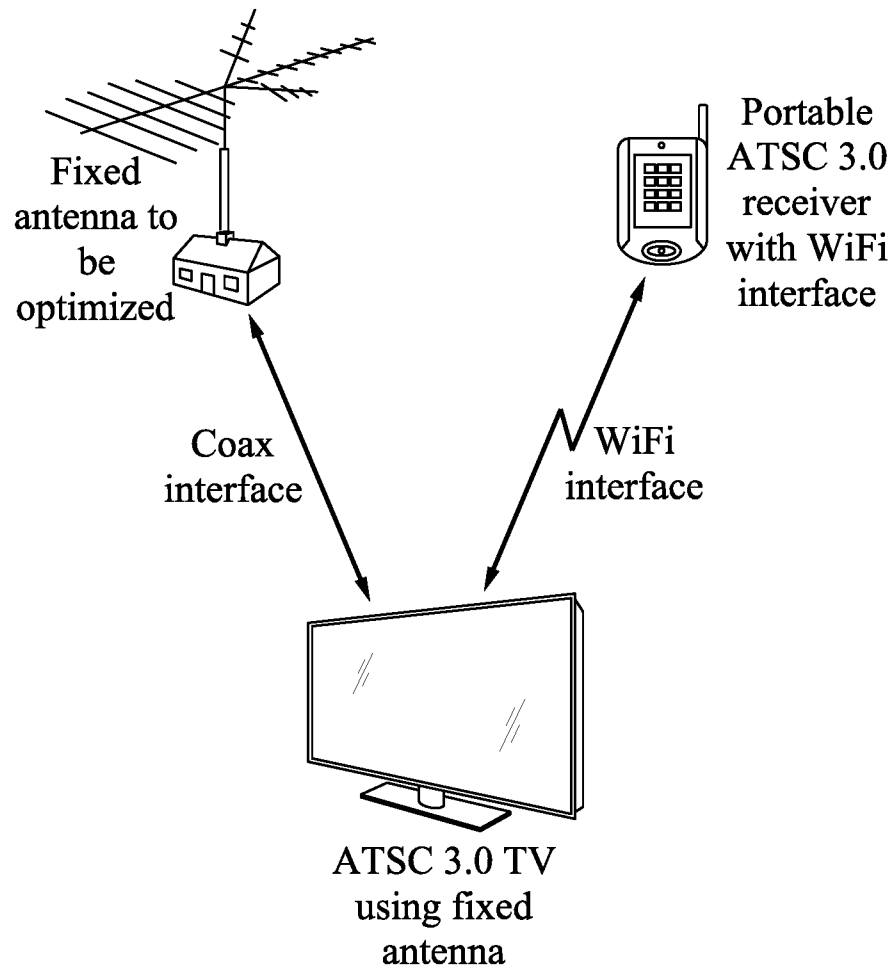
said processing module incrementing said signal meter location counter.

18. The portable ATSC 3.0 receiver according to claim 16, further comprising:

said processing module initializing a channel selection counter; and

said processing module incrementing said channel selection counter.

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*FIG. 1*

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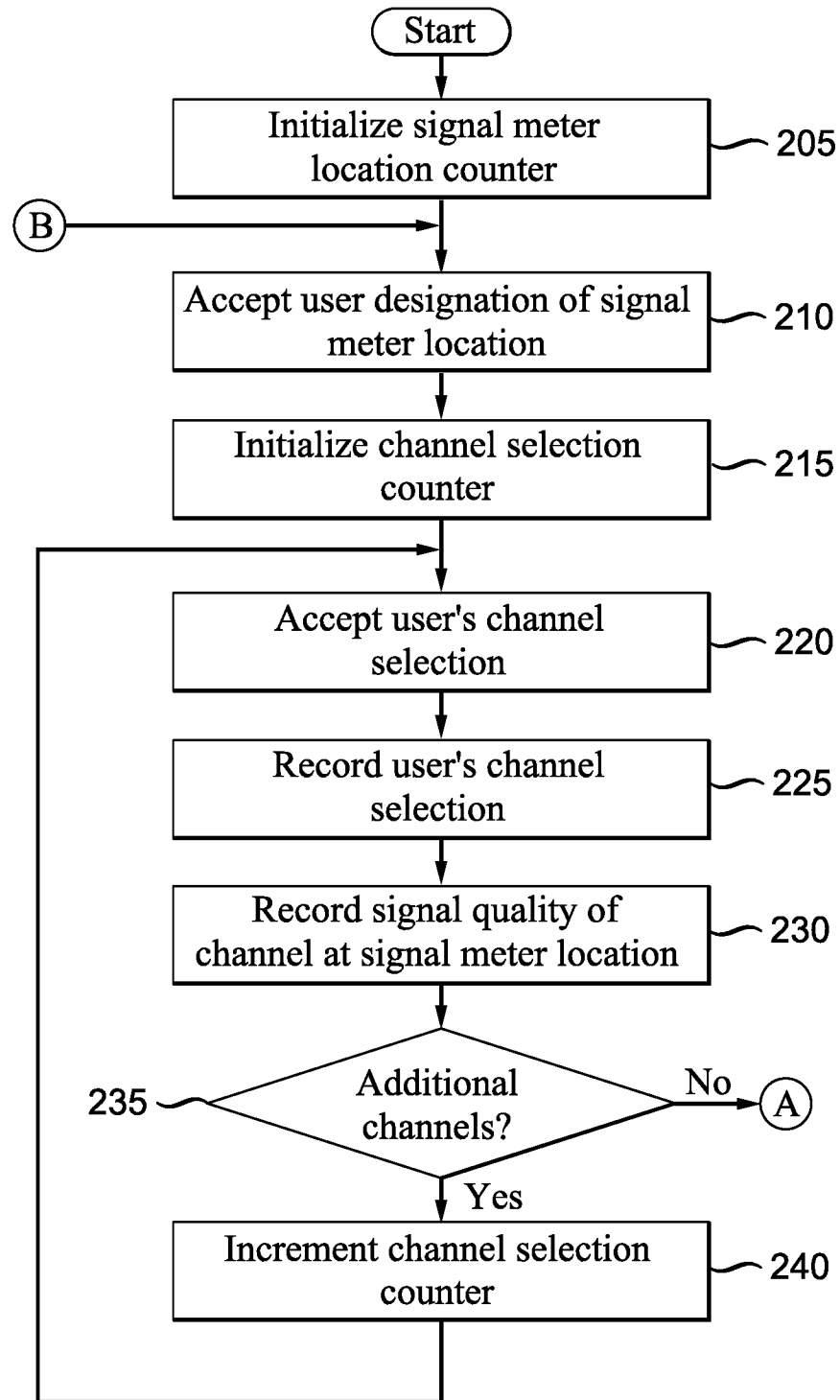


FIG. 2A

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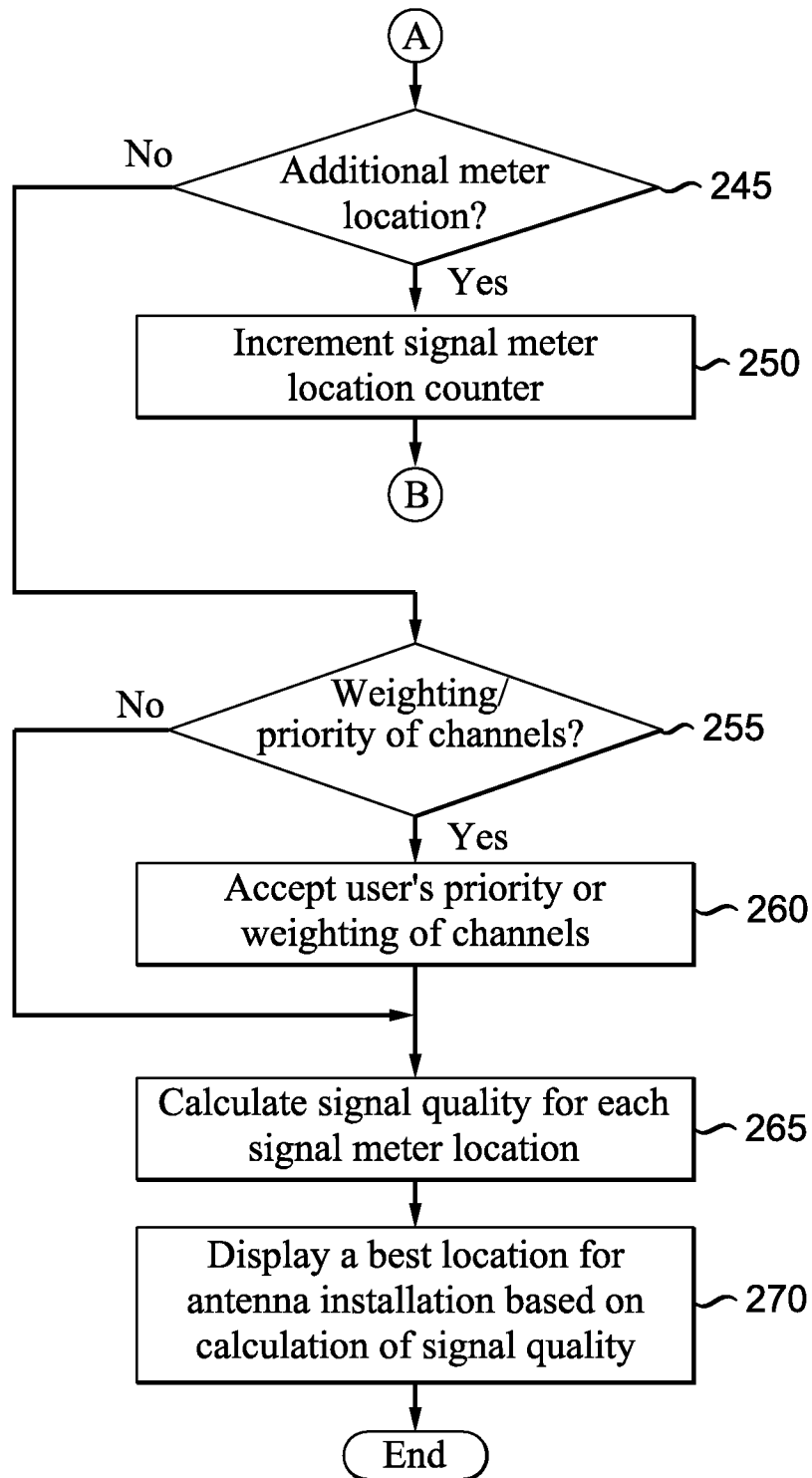


FIG. 2B

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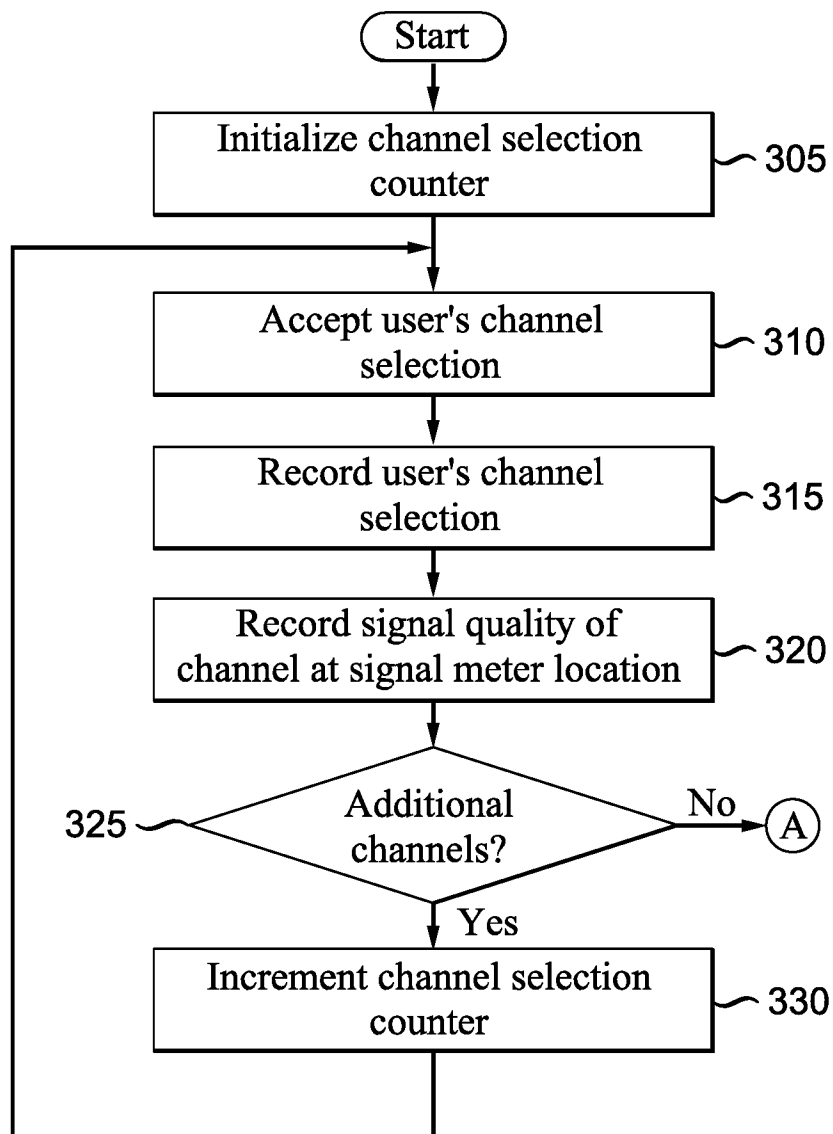
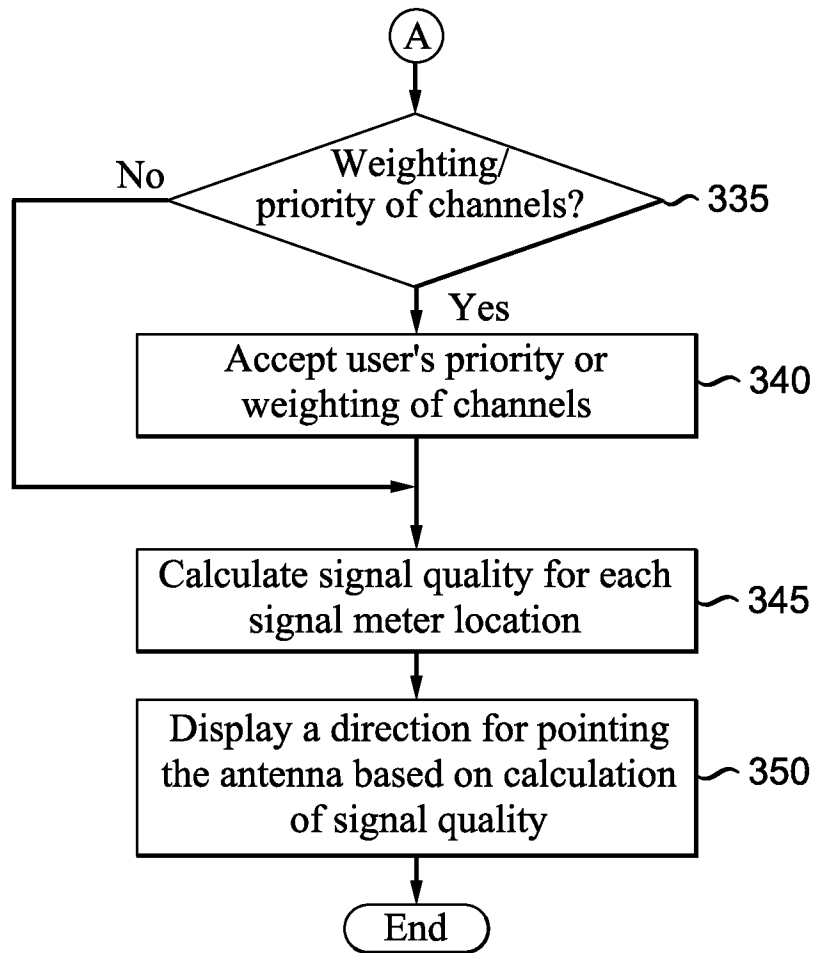
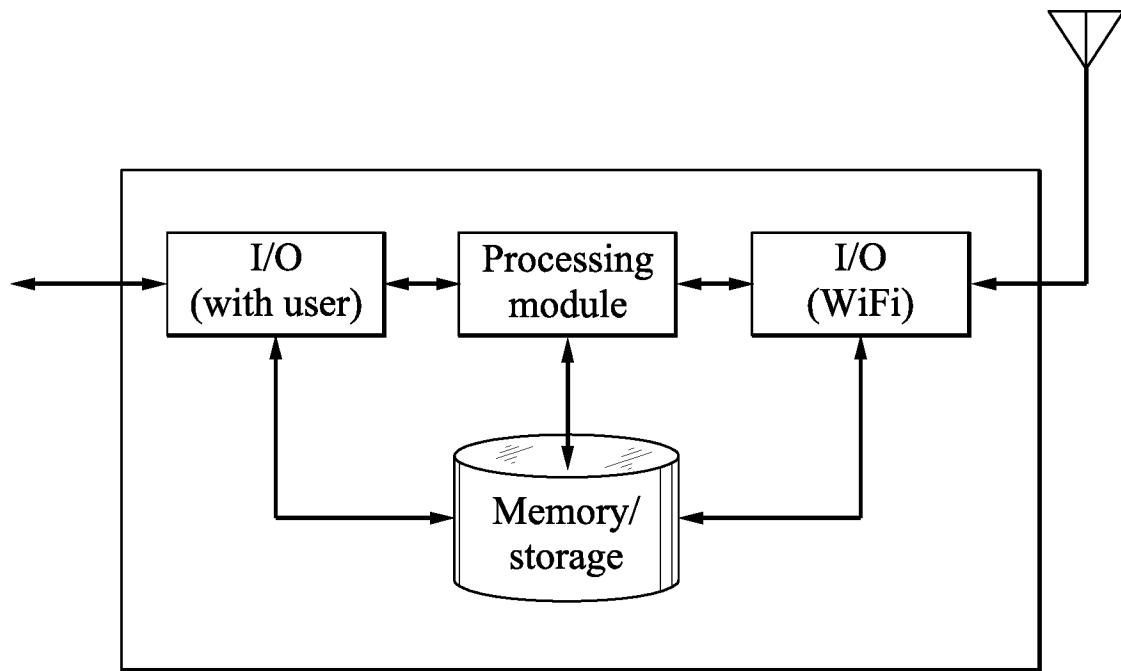


FIG. 3A

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*FIG. 3B*

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*FIG. 4*

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2016/015343

A. CLASSIFICATION OF SUBJECT MATTER

INV. G01S3/02 G01S3/04 G01S3/40 G01S3/74 G01F15/06
H01Q1/12 H01Q3/00 H04N5/44 H04N21/61

ADD.

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)

G01S G01F H01Q H04N H04H

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

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

EP0-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 2006 086753 A (MATSUSHITA ELECTRIC IND CO LTD) 30 March 2006 (2006-03-30) paragraphs [0033], [0034], [0101], [0102], [0104], [0107], [0108], [0109], [0111], [0120]; figures 2,14,16 -----	1-18



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 application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

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10/06/2016

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
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Authorized officer

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2016/015343

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 2006086753 A	30-03-2006	NONE	
