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(72) Inventor: **KIRAZ, Alp**
45030 Manisa (TR)

(74) Representative: **Flint, Adam**
Page White & Farrer
Bedford House
John Street
London WC1N 2BF (GB)

(71) Applicant: **Vestel Elektronik Sanayi ve Ticaret A.S.**
45030 Manisa (TR)

(54) **SATELLITE BROADCAST SIGNAL RECEIVER AND METHOD OF OPERATION**

(57) A satellite broadcast signal receiver (10) has a demodulator (15) for demodulating a satellite broadcast signal received at a satellite dish (20) to which the receiver (10) is connected via a connection (30). A controller (16) of the receiver (10) generates a control signal for providing over the connection (30) to the satellite dish

(20) to select at least one of a frequency band and a polarisation for the broadcast signal that is received at the satellite dish (20). A detector (40) detects the presence of a different control signal on the connection to the satellite dish (20).

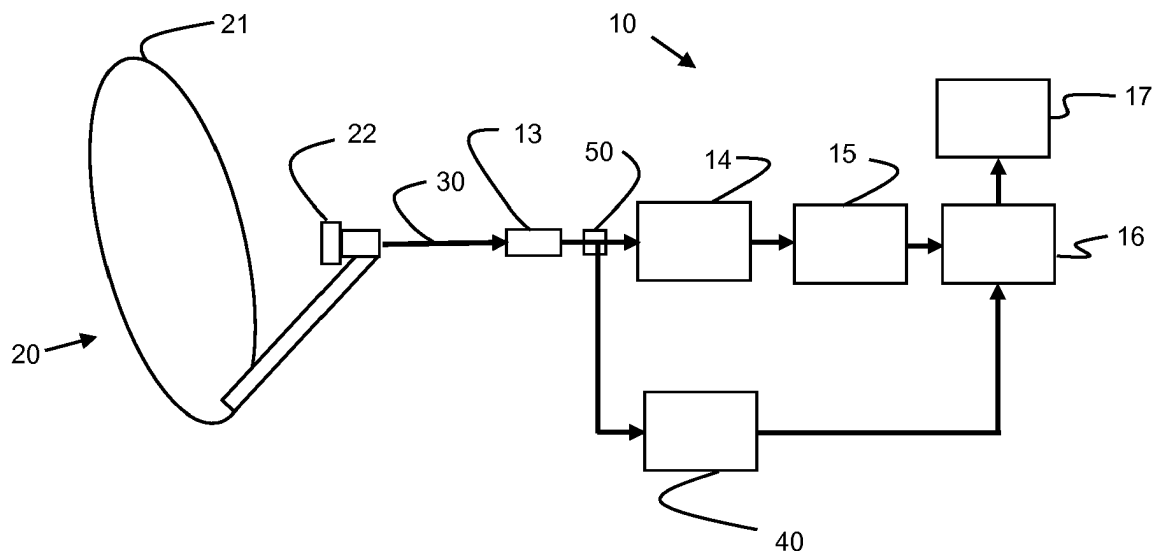


Fig. 2

Description

Technical Field

[0001] The present disclosure relates to a satellite broadcast signal receiver and a method of operating a satellite broadcast signal receiver.

Background

[0002] A satellite broadcast signal receiver is connected in use to a satellite dish in order to receive signals broadcast by a satellite, typically for receiving television and/or radio channels. The receiver sends control signals to the satellite dish as required in order to reconfigure the satellite dish to select a desired channel that can be received by the satellite dish. However, problems can arise if more than one receiver is connected to the same satellite dish.

Summary

[0003] According to a first aspect disclosed herein, there is provided a satellite broadcast signal receiver, the receiver comprising:

- a demodulator for demodulating a satellite broadcast signal received at a satellite dish to which the receiver is connected via a connection in use;
- a controller arranged to generate a control signal for providing over a said connection to a said satellite dish to which the receiver is connected in use to select at least one of a frequency band and a polarisation for the broadcast signal that is received at said satellite dish; and
- a detector for detecting the presence of a different control signal on a said connection to a said satellite dish.

[0004] The detector may be provided for example as part of the receiver or as a separate device which can be connected to the receiver in use. The receiver may be provided as a component of for example a television or video recorder or the like or as a stand-alone unit, such as a set-top box or card for use in a computer or the like.

[0005] In an example, the receiver is arranged to output a warning to a user if the presence of a different control signal on a said connection to a said satellite dish is detected. The warning may be for example an audio warning and/or a visual warning, which is displayed on a display device associated with the receiver.

[0006] In an example, the receiver has non-volatile data storage and is arranged to store in the non-volatile data storage an indication that the presence of a different control signal on a said connection to a said satellite dish has been detected.

[0007] In an example, the controller is arranged to send a control signal to a said satellite dish regardless of

whether or not a different control signal on a said connection to a said satellite dish is detected. For example, the receiver may be designed to be a "master" and so always sends a control signal regardless.

[0008] In an example, the controller is arranged not to send a control signal to a said satellite dish if a different control signal on a said connection to a said satellite dish is detected. For example, the receiver may be designed to be an "auxiliary" and so does not send a control signal if a different control signal is present on the connection.

[0009] In an example, the controller is selectively configurable so that the controller can be selectively arranged to send a control signal to a said satellite dish regardless of whether or not a different control signal on a said connection to a said satellite dish is detected or not to send a control signal to a said satellite dish if a different control signal on a said connection to a said satellite dish is detected. In this example, the setting of the receiver as a master or as an auxiliary may be a setting that is freely settable by the user for example.

[0010] In an example, the controller is arranged to output a control signal that has different voltages for different polarisations of broadcast signals that are capable of being received at a satellite dish to which the receiver is connected in use. In this example, the controller may for example want to select a first polarisation and would normally therefore transmit a control signal having a corresponding first voltage to the satellite dish. The detector in such a case is capable of detecting that a different (second) voltage is present on the connection between the receiver and the satellite dish. As a specific example, in Europe say, a 13V signal may be output to the satellite dish to select a vertical or right hand circular polarisation for the broadcast signal that is received at the satellite dish, and an 18V signal may be output to the satellite dish to select a horizontal or left hand circular polarisation for the broadcast signal that is received at the satellite dish.

[0011] In an example, the controller is arranged to output a control signal that has a tone signal having a particular frequency to select a particular frequency band that is received at said satellite dish in use. In this example, the controller may output a control signal that has a tone signal having the particular frequency to select the particular frequency band that is received at the satellite dish in use and may output a control signal having no tone signal, or a tone signal having a different frequency, to select a different frequency band that is received at the satellite dish in use.

[0012] According to a second aspect disclosed herein, there is provided a method of operating a satellite broadcast signal receiver which is connected to a satellite dish via a connection, the method comprising:

- generating a control signal for providing over the connection to the satellite dish to select at least one of a frequency band and a polarisation for the broadcast signal that is received at the satellite dish; and

detecting the presence of a different control signal on the connection to the satellite dish.

[0013] In an example, the method comprises outputting a warning to a user if the presence of a different control signal on the connection to the satellite dish is detected.

[0014] In an example, the method comprises storing in non-volatile data storage an indication that the presence of a different control signal on the connection to the satellite dish has been detected.

Brief Description of the Drawings

[0015] To assist understanding of the present disclosure and to show how embodiments may be put into effect, reference is made by way of example to the accompanying drawings in which:

Figure 1 shows schematically an example of two satellite broadcast signal receivers connected to a satellite dish; and

Figure 2 shows schematically an example of a satellite broadcast signal receiver having a detector as described herein connected to a satellite dish.

Detailed Description

[0016] Referring first to Figure 1, this shows schematically an example of two satellite broadcast signal receivers 10 connected to a satellite dish 20. The satellite broadcast signal receivers 10 may be for example televisions, set-top boxes, PVR (personal video recorder), an expansion card for a computer, etc., and may in general be the same type of device or different devices. The satellite broadcast signal receivers 10 have one or more processors 11, non-volatile data storage 12 for storing data, etc.

[0017] Each satellite broadcast signal receiver 10 is connected to the satellite dish 20 by a wired connection 30, which is partially shared. For example, there may be a first, single cable 31 from the satellite dish 20 to a junction box 32 and then separate cables 33 from the junction box 32 to the respective receivers 10. There may be more than two receivers 10, each with their own cables 33 to the junction box 32. The cables 30, 31, 32 are typically coaxial cables.

[0018] As is well known per se, the satellite dish 20 has a parabolic reflector 21 which focusses signals received from a broadcasting satellite (not shown) to a so-called LNB (low-noise block downconverter) 22. The LNB 22 is located at the focal point of the parabolic reflector 21, or at least as close to the focal point as is practical. An LNB 22 is typically in effect a combination of a low-noise amplifier, a frequency mixer, a local oscillator and an intermediate frequency (IF) amplifier. The LNB 22 receives the (microwave) signal transmitted by the broad-

casting satellite and collected by the satellite dish, amplifies it, and down converts the block of frequencies to a lower block of intermediate frequencies (IF). The down conversion at the LNB 22 permits the use of relatively inexpensive coaxial cable to connect the LNB 22 to the satellite broadcast signal receivers 10. The cables 30, 31, 32, 33 are connected to the LNB 22.

[0019] As is known, the broadcast signals transmitted by the satellite for receipt by satellite dishes 20 are typically in one or more specific frequency bands and may use a specific polarisation. For example, in Europe, the frequencies currently used by digital broadcast satellite services are 10.7-12.75 GHz on two polarisations H (Horizontal) and V (Vertical). This range is divided into a "low band" with 10.7-11.7 GHz and a "high band" with 11.7-12.75 GHz. This results in two frequency bands, each with a bandwidth of about 1 GHz, each with two possible polarisations. In the LNB 22, these bands are down converted to 950-2150 MHz, which is the frequency range allocated for the satellite service on the coaxial cable between LNB 22 and the receiver 10. Numerous individual channels (i.e. television and/or radio channels) are transmitted within each band and having one polarisation or the other.

[0020] Figure 2 shows schematically an example of some further components of the satellite broadcast signal receivers 10. The receiver 10 has an antenna socket 13 to which the cable 30, 33 to the satellite dish 20 is connected. The down converted IF signal from the satellite dish 20 is passed to a tuner block 14. The tuner block 14 selects the channel desired by the user by filtering that channel from the multiple channels received in the signal carried by the cable 30, 33 from the satellite dish 20, converts the channel signal to a lower intermediate frequency, and decrypts the signal if the received signal is encrypted. A demodulator block 15 demodulates the channel signal and sends the resulting video and/or audio signal to the main processor 16 of the receiver 10, which sends the video and/or audio signal to the display device/speakers 17 for play back. The display device/speakers may be part of the receiver 10 in the case that the receiver 10 is for example a television, or may be separate components in the case that the receiver 10 is for example a set-top box or a computer expansion card, etc.

[0021] In order to be able to receive and demodulate a particular channel as selected by a user, the receiver 10 transmits a control signal to the LNB 22 to cause the LNB 22 to receive and process the correct corresponding signal that is broadcast by the satellite. For example, the control signal may cause the LNB 22 to receive and process the corresponding band (high or low) having the corresponding polarisation (horizontal or vertical) that is broadcast by the satellite. As a specific example to illustrate this, the United Kingdom television channel BBC One HD is (currently) broadcast with a frequency of 10,847 GHz and vertical polarisation. Accordingly, to enable the user to watch BBC One HD, a control signal is

sent by the receiver 10 to the LNB 22 to instruct the LNB 22 to tune to the low frequency band with vertical polarisation.

[0022] A number of different arrangements and standards for such control signals are possible and are used. As a specific example to illustrate this, a voltage of 13V may be transmitted to select a vertical polarisation and a voltage of 18V may be transmitted to select a horizontal polarisation; and a "tone signal" of 22kHz may be transmitted to select the high frequency band, the absence of a tone signal being taken by the LNB 22 as selection of the low frequency band.

[0023] In the case that two or more receivers 10 are connected to the LNB 22, problems can arise if one receiver 10 attempts to send a control signal of one type (e.g. having the low selection voltage (13V) to select the vertical polarisation and having the tone signal (of 22kHz) to select the high frequency band) whilst another receiver attempts to a control signal of a different type (e.g. having the high selection voltage (18V) to select the horizontal polarisation and not having a tone signal to select the low frequency band). For example, one or both (or all) of the receivers 10 may be damaged and in any event abnormal operation may occur, meaning at least that the user is not presented with the desired TV channel, and it is not immediately obvious to the user why this has occurred.

[0024] To address this, in examples described herein, when one of the receivers 10 has a control signal to send to the LNB 22, a check is made as to whether a different control signal is present on the connection (the cables 30) to the LNB 22. If a different control signal is present on the connection to the LNB 22, one or more further steps may be taken.

[0025] For example, a warning may be caused to be output to a user to the effect that a different control signal is present. For example, a warning may be caused to be displayed on the display device 17 of the receiver 10 that has a different control signal to send. That warning may include functionality that asks the user whether or not they want to proceed, enabling the user to select an option to proceed regardless or to cancel the request to retune. As another example, an indication of the presence of a different control signal on the connection to the LNB 22 may alternatively or additionally be recorded in the non-volatile data storage 12 of the receiver 10 that has a different control signal to send. This can be used for future diagnostic purposes, for example if the receiver 10 concerned develops a fault.

[0026] Moreover, in some examples, a particular receiver 10 may be designated as a "master" or as an "auxiliary" device. This designation of the receivers 10 may be provided as an option for the user, by for example software running on the main processor 16 of the receiver 10. In the case that a particular receiver 10 is designated as a master, then the control signal to select a different band and/or polarisation is sent to the LNB 22 regardless of whether or not a different control signal is present on

the connection to the LNB 22. On the other hand, in the case that a particular receiver 10 is designated as an auxiliary, then a control signal to select a different band and/or polarisation is not sent to the LNB 22 if a different control signal is present on the connection to the LNB 22. As an alternative in the case that a particular receiver 10 is designated as an auxiliary and a different control signal is present on the connection to the LNB 22, then the user may be provided with an option (for example, displayed on a display device associated with the receiver 10) to cause the new control signal to be sent to the LNB 22, effectively to override the different control signal that was present on the connection. Finally, in the case that a particular receiver 10 is designated as an auxiliary and the same control signal is present on the connection to the LNB 22, then it may not be necessary for a control signal to be sent again, or the control signal may be sent again regardless, or the user may be provided with an option (for example, displayed on a display device associated with the receiver 10) to cause the control signal to be sent to the LNB 22 again.

[0027] Referring again to Figure 2, this shows schematically a detector block 40 for detecting the presence of a control signal on the connection between the receiver 10 and the LNB 22. There may be a detector block 40 for each receiver 10 that is connected to the satellite dish 20. The detector block 40 may be provided as a separate device or may be provided integrally with the receiver 10.

[0028] In this example, the detector block 40 has an input connection at a location between the tuner block 14 and the antenna socket 13 of the receiver 10, to which the cable 30 to the satellite dish 20 is connected. The input connection of the detector block 40 may be such that the detector block 40 is effectively isolated from the cable 30. This may be achieved by for example connecting the detector block 40 to the cable 30 using a signal splitter or a switch 50.

[0029] The output of the detector block 40 in this example is provided to a controller port of the main processor 16 of the receiver 10. Depending on the precise nature of the detector block 40, the main processor 16 of the receiver 10 may have an ADC (analogue-to-digital converter) input to convert an analogue output of the detector block 40 to a digital signal which can be processed by the main processor 16 of the receiver 10.

[0030] The main processor 16 of the receiver 10 may operate a routine such that the input to the or each controller port of the receiver 10 is checked, for example continuously or whenever a channel selection is made by a user. If the current channel selection by a user results in a control signal that is different from a current control signal on the cable 30 as detected by the detector block 40, then one or more actions may be carried out, as indicated above.

[0031] It is mentioned here that so-called "single cable distribution" is known (sometimes known by the name "unicable") which enables the delivery of broadcast programming to multiple receivers (typically for multiple us-

ers) over a single coaxial cable. The receiver 10 may be provided with a functionality that enables the user(s) to disable the use of the detection as described herein for such cases.

[0032] It will be understood that the processor or processing system or circuitry referred to herein may in practice be provided by a single chip or integrated circuit or plural chips or integrated circuits, optionally provided as a chipset, an application-specific integrated circuit (ASIC), field-programmable gate array (FPGA), digital signal processor (DSP), graphics processing units (GPUs), etc. The chip or chips may comprise circuitry (as well as possibly firmware) for embodying at least one or more of a data processor or processors, a digital signal processor or processors, baseband circuitry and radio frequency circuitry, which are configurable so as to operate in accordance with the exemplary embodiments. In this regard, the exemplary embodiments may be implemented at least in part by computer software stored in (non-transitory) memory and executable by the processor, or by hardware, or by a combination of tangibly stored software and hardware (and tangibly stored firmware).

[0033] Reference is made herein to data storage for storing data. This may be provided by a single device or by plural devices. Suitable devices include for example a hard disk and non-volatile semiconductor memory.

[0034] Although at least some aspects of the embodiments described herein with reference to the drawings comprise computer processes performed in processing systems or processors, the invention also extends to computer programs, particularly computer programs on or in a carrier, adapted for putting the invention into practice. The program may be in the form of non-transitory source code, object code, a code intermediate source and object code such as in partially compiled form, or in any other non-transitory form suitable for use in the implementation of processes according to the invention. The carrier may be any entity or device capable of carrying the program. For example, the carrier may comprise a storage medium, such as a solid-state drive (SSD) or other semiconductor-based RAM; a ROM, for example a CD ROM or a semiconductor ROM; a magnetic recording medium, for example a floppy disk or hard disk; optical memory devices in general; etc.

[0035] The examples described herein are to be understood as illustrative examples of embodiments of the invention. Further embodiments and examples are envisaged. Any feature described in relation to any one example or embodiment may be used alone or in combination with other features. In addition, any feature described in relation to any one example or embodiment may also be used in combination with one or more features of any other of the examples or embodiments, or any combination of any other of the examples or embodiments. Furthermore, equivalents and modifications not described herein may also be employed within the scope of the invention, which is defined in the claims.

Claims

1. A satellite broadcast signal receiver, the receiver comprising:
 - a demodulator for demodulating a satellite broadcast signal received at a satellite dish to which the receiver is connected via a connection in use;
 - a controller arranged to generate a control signal for providing over a said connection to a said satellite dish to which the receiver is connected in use to select at least one of a frequency band and a polarisation for the broadcast signal that is received at said satellite dish; and
 - a detector for detecting the presence of a different control signal on a said connection to a said satellite dish.
2. A receiver according to claim 1, arranged to output a warning to a user if the presence of a different control signal on a said connection to a said satellite dish is detected.
3. A receiver according to claim 1 or claim 2, the receiver having non-volatile data storage and being arranged to store in the non-volatile data storage an indication that the presence of a different control signal on a said connection to a said satellite dish has been detected.
4. A receiver according to any of claims 1 to 3, wherein the controller is arranged to send a control signal to a said satellite dish regardless of whether or not a different control signal on a said connection to a said satellite dish is detected.
5. A receiver according to any of claims 1 to 3, wherein the controller is arranged not to send a control signal to a said satellite dish if a different control signal on a said connection to a said satellite dish is detected.
6. A receiver according to any of claims 1 to 3, wherein the controller is selectively configurable so that the controller can be selectively arranged to send a control signal to a said satellite dish regardless of whether or not a different control signal on a said connection to a said satellite dish is detected or not to send a control signal to a said satellite dish if a different control signal on a said connection to a said satellite dish is detected.
7. A receiver according to any of claims 1 to 6, wherein the controller is arranged to output a control signal that has different voltages for different polarisations of broadcast signals that are capable of being received at a satellite dish to which the receiver is connected in use.

8. A receiver according to any of claims 1 to 7, wherein the controller is arranged to output a control signal that has a tone signal having a particular frequency to select a particular frequency band that is received at said satellite dish in use. 5

9. A method of operating a satellite broadcast signal receiver which is connected to a satellite dish via a connection, the method comprising: 10
 - generating a control signal for providing over the connection to the satellite dish to select at least one of a frequency band and a polarisation for the broadcast signal that is received at the satellite dish; and 15
 - detecting the presence of a different control signal on the connection to the satellite dish.

10. A method according to claim 9, comprising outputting a warning to a user if the presence of a different control signal on the connection to the satellite dish is detected. 20

11. A method according to claim 9 or claim 10, comprising storing in non-volatile data storage an indication that the presence of a different control signal on the connection to the satellite dish has been detected. 25

12. A method according to any of claims 9 to 11, wherein the controller is arranged to send the control signal to the satellite dish regardless of whether or not a different control signal on the connection to the satellite dish is detected. 30

13. A method according to any of claims 9 to 11, wherein the controller is arranged not to send a control signal to the satellite dish if a different control signal on the connection to the satellite dish is detected. 35

14. A method according to any of claims 9 to 11, wherein the controller is selectively configurable so that the controller can be selectively arranged to send a control signal to the satellite dish regardless of whether or not a different control signal on the connection to the satellite dish is detected or not to send a control signal to the satellite dish if a different control signal on the connection to the satellite dish is detected. 40 45

15. A receiver according to any of claims 9 to 14, wherein the controller is arranged to output a control signal that has different voltages for different polarisations of broadcast signals that are capable of being received at the satellite dish and a tone signal having a particular frequency to select a particular frequency band that is received at said satellite dish in use. 50 55

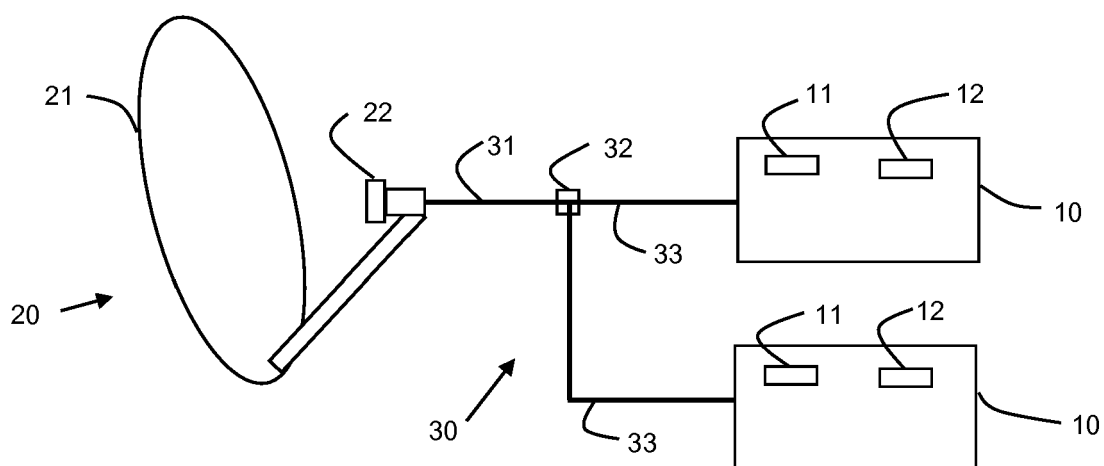


Fig. 1

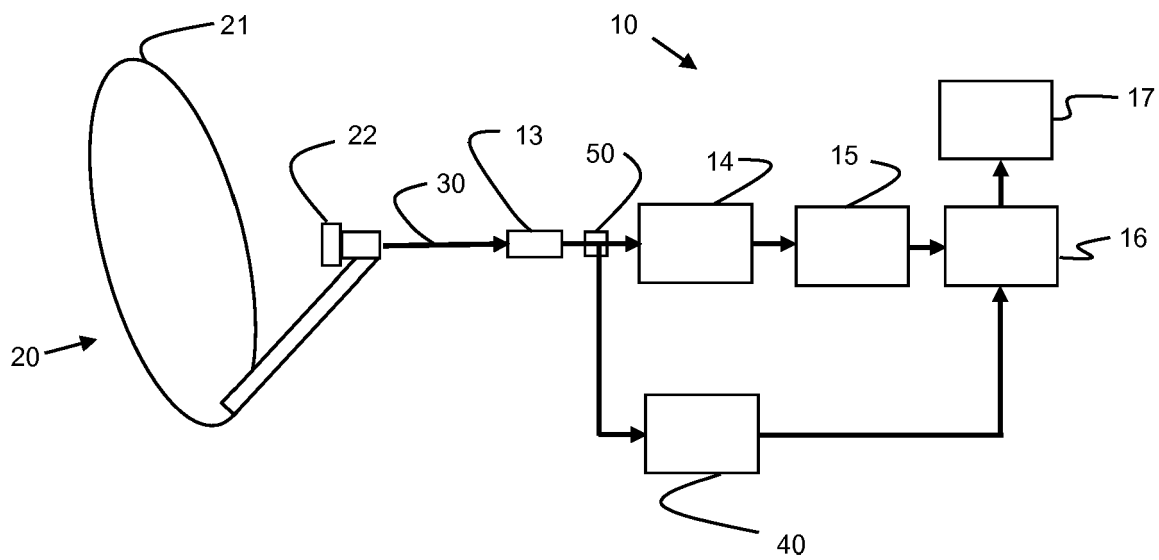


Fig. 2



EUROPEAN SEARCH REPORT

 Application Number
 EP 17 19 2443

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DOCUMENTS CONSIDERED TO BE RELEVANT			
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			TECHNICAL FIELDS SEARCHED (IPC)
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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 4 December 2017	Examiner Torcal Serrano, C
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 17 19 2443

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