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(54) **Satellite distribution device and system with remote selectable modes**

(57) A satellite signal distribution device (1) comprising input connectors (2), each configured to receive an intermediate satellite signal (11) having multiple transponders (10) from an input cable (3). The device also comprises an output connector (4) configured to transmit an output signal (18) to an output cable (13) and a controller (5) connected to input connectors (2) and the output connector (4). The controller (5) comprises transponder selection modules (6), each associated with a corresponding mode of operation. Each module is configured to generate the signal (18) such that it comprises one or more of the transponders (10) in function of the corresponding mode of operation. The device (1) also comprises a mode selection module (7) configured to provide the output signal of a selected module (6) to connector (4) according to a selected mode of operation. The module (7) is further configured to receive a dedicated mode selection command indicative for the selected mode of operation out of the plural modes of operation from a mode selection connector.

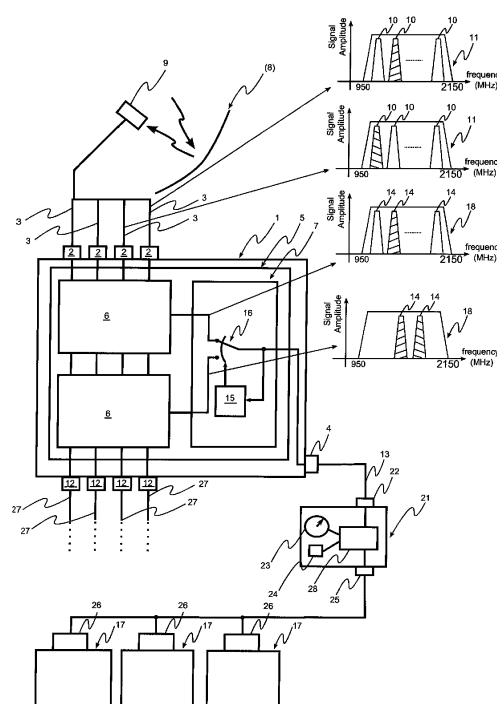


Figure 1

Description

Field of the Invention

[0001] The present invention generally relates to satellite distribution systems, more particularly to multiswitches for satellite intermediate frequency signal with several modes of operation and the selection of these modes.

Background of the Invention

[0002] In a typical satellite distribution system, a satellite dish captures the satellite signal and a Low Noise Block downconverter (LNB) converts the high frequency signal to four intermediate frequency (IF) satellite signals that are each put on a separate cable, for example a coaxial cable. Such an intermediate frequency or IF signal is divided in smaller bands, transponders, each containing one or more TV, radio or data channels. If more than one satellite dish is used, for example for the reception of signals from multiple satellites, again four extra cables are needed per dish. All these cables are then connected to the inputs of a satellite multiswitch or distribution device. Receiving devices such as Set Top Boxes (STB's) are then connected to the output of these multiswitch by a single cable. Typically the multiswitch also offers outputs for cascading the inputs to these outputs so that another multiswitch may on its turn be connected to the first multiswitch.

[0003] Several categories of multiswitches are known. A first category is the legacy multiswitch where the end user selects the IF signal of choice and the multiswitch puts the signal from the selected input to the output and, thus, to the receiver of the end user. The command for this selection is generated by the receiver and runs over the same cable as the selected satellite signal. The disadvantage of this category of multiswitches is that all devices connected by the same cable to the multiswitch can only select transponders from the same IF signal at the input of the switch. Therefore, when using for example a twin-tuner receiver for concurrent viewing and recording, still two cables are needed.

[0004] A second known category of multiswitches are the so called Channel Stacking Systems or Switches (CSS) operating in a channel stacking mode. This type of multiswitches enable the selection of a single transponder from an IF signal by a receiving device. The switch will then filter the selected transponder from the IF input signal and mix it on a specific carrier frequency dedicated to the receiving device. This way several receiving devices (or tuners) can be put on the same cable connected to the multiswitch whereby each receiving device is allocated a specific carrier frequency. In this mode of operation, the multiswitch can thus select different transponders from different input IF signals and put them on the same output.

[0005] In a single installation there is high probability

that both the legacy and CSS mode will need to be supported as not all receivers on the market support both modes. Therefore, hybrid or multi-mode satellite distribution devices are also available supporting both modes.

[0006] In the SPAUN product catalogue, page 56, as retrieved from http://www.spaun.de/pdf/spaun_16_en.pdf on 28/05/2013, a manually operated selector is available on the distribution device. In a first position of the switch, eight receivers can be connected on a single output in the Channel Stacking mode and the two other outputs are then configured in legacy mode. In a second position of the switch, three receivers can be connected to each of the three outputs, all operating in Channel Stacking mode.

[0007] However, the manually operated switch has the disadvantage that any incompetent user can change the setting of the switch when having access to the device. In a typical installation, the products are more or less accessible to everyone entering the building, so potentially everyone can change the setting of the switch, interrupting the reception at the receiver of an end user. This can bring an extra cost to the end user and/or to the installation company to fix such an issue.

[0008] In US7130576, in for example the embodiment of Figure 12, this disadvantage is solved by an automated and electronically operated mode selection. In this case, the switch detects the communication protocol used by the receiver, i.e. either legacy or channel stacking mode, and configures the output of the switch accordingly in an automated way.

[0009] The automated electronically operated mode selection has the disadvantage that the selection of the available modes are then within the software and hardware of the switch and, therefore, cannot be changed out of factory, for example from the side of the end user.

[0010] Though this solution offers an easier installation process to the end user without the need for an intervention from an installer, in practical cases only a handful of end users will be able to install, program and use the receiver. Therefore, in almost all cases an intervention from a professional installer will be needed to start up the new receiver, so while doing that, he can also set the satellite distribution multiswitch in the correct mode without the need for an extra intervention and the according costs. More-over, a professional installer still prefers to have the ability to select the mode himself and not to have it done in an automated way beyond his control. This is especially useful during start up or setup of a receiver or multiswitch and in case of trouble shooting where the professional installer needs a manual selection of the mode in order to analyse the problem.

[0011] An extra disadvantage in both of the above solutions is that it is not future proof. In both implementations the mode selection is fixed in the device. When a new operating mode comes available, the multiswitch satellite distribution unit has to be sent to the factory to be re-programmed. This is bringing unwanted interrup-

tion in a time frame of days or weeks of the satellite and terrestrial TV reception to the end user.

[0012] It is an object of the present invention to overcome the above mentioned disadvantages.

Summary of the Invention

[0013] Accordingly the invention relates, in a first aspect, to a satellite distribution device comprising a plurality of input connectors, each configured to receive an intermediate satellite signal frequency band from an input cable, each of the intermediate satellite signal frequency bands comprising a plurality of satellite transponders. The distribution device further comprises an output connector configured to transmit an output satellite signal to an output cable and a controller connected to the input connectors and the output connector. The controller comprises a plurality of transponder selection modules, each associated with a corresponding mode of operation, each transponder selection module configured to generate the output satellite signal such that it comprises one or more of said satellite transponders in function of said corresponding mode of operation. The controller further comprises a mode selection module configured to provide the output satellite signal of a selected transponder selection module to the output connector according to a selected mode of operation out of the plural modes of operation. The mode selection module is further configured to receive a dedicated mode selection command indicative for the selected mode of operation out of the plural modes of operation from a mode selection connector.

[0014] It is an advantage that the mode cannot be selected directly by means accessible to unauthorized persons, so no unauthorized changing of the modes is possible as unauthorized persons will not be able to issue the dedicated mode selection command. As the mode selection is based on a dedicated command an installer can easily change between modes of operation independently from other information received from the output connector.

[0015] According to an embodiment the mode selection connector is the output connector.

[0016] This allows sending the mode selection command from any place where the satellite output signal can be received, for example near the receiver installed at the end user.

[0017] Advantageously the satellite signal distribution device further comprises a plurality of cascade output connectors each being connected to a corresponding input connector and configured to output a cascade output satellite signal comprising the intermediate satellite signal frequency band received on the corresponding input connector to a cascade output cable.

[0018] This allows the daisy chaining of several satellite signal distribution devices in order to make use of the same satellite dish while having more output connectors available.

[0019] In a further embodiment, the selected transponder selection module is further configured to receive a transponder selection command from the output connector, where the transponder selection command is different from the dedicated mode selection command and comprises transponder selection information identifying at least one selected satellite transponder. The selected transponder selection module is also configured to generate the output satellite signal such that its satellite transponders comprise the selected satellite transponders.

[0020] This allows selecting the transponders from any receiving device connected to the output of the distribution device while the selection of the mode in which the receiving device can operate is independent from the selection commands selecting the transponders.

[0021] According to a further embodiment, the controller comprises a first transponder selection module associated with a first, legacy mode of operation from the plurality of modes of operation, that is configured to generate the output satellite signal such that it comprises all satellite transponders from the intermediate satellite signal frequency band comprising said selected satellite transponders.

[0022] This allows the selection of transponders from a single input within the mode selected by the dedicated mode selection command.

[0023] The controller may further comprise a second transponder selection module associated with a second, channel stacking mode of operation from the plurality of modes of operation. This second mode is configured to generate an output satellite signal such that it comprises only the selected satellite transponders.

[0024] This allows the selection of multiple transponders from several inputs within the mode selected by the dedicated mode selection command.

[0025] In the channel stacking mode of operation, the transponder selection command further comprises a receiver device identifier comprising information identifying the receiver device from which the transponder selection command originated. The second transponder selection module is then configured to generate a satellite output signal in which the one or more selected satellite transponders are each transferred to a predetermined output signal frequency associated with the receiver device identifier.

[0026] This allows to connect multiple receivers to a single output, each receiver having assigned a unique carrier frequency depending on its identifier.

[0027] According to an embodiment, the plural modes of operation comprise a transponder blocking mode of operation. The mode selection module is then further configured to provide none of the outputs of the transponder selection modules to the output connector upon reception of a dedicated mode selection command indicative for the transponder blocking mode of operation.

[0028] This allows to selectively disable the output of the distribution device without physically removing the cable attached to it.

[0029] According to a further embodiment, the plurality of transponder selection modules comprise at least one limited transponder selection module, associated with a corresponding mode of operation. The limited transponder selection module is configured to generate the output satellite signal such that it comprises one or more of the satellite transponders received from a predetermined subset of the plurality of input connectors.

[0030] This allows to block an output and thus a receiver from one or more inputs. This can be useful when an attached receiver is only fitted to receive a certain number of inputs or only inputs from a single antenna dish.

[0031] Advantageously the controller further comprises a memory and the mode selection module is further configured to:

- write the selected mode of operation to this memory when receiving the dedicated mode selection command; and
- read the selected mode of operation from the memory before providing the output satellite signal of a selected transponder selection module to the output connector according to the selected mode of operation.

[0032] It is an advantage that the mode setting for a certain output is memorized in order to restore the mode after the distribution device has been switched off or after a reset of the device.

[0033] In a further embodiment the selection command and/or transponder command is based on the protocol of Digital Satellite Equipment Control (DiSEqC). By defining the selection command as an extension of the DiSEqC protocol, the selection and transponder command will not interfere with each other and a seamless integration in existing setups is possible.

[0034] According to a second aspect, the invention relates to an assembly comprising the satellite distribution device according to the first aspect and an external mode programming device. This programming device comprises a first connector connected over the output cable to the output connector or to the mode selection connector of the satellite signal distribution device. The programming device further comprises generating means configured to generate the dedicated mode selection command and transceiving means configured to transmit the dedicated mode selection command over the first connector to the output connector or to the mode selection connector of the satellite signal distribution device.

[0035] This way the distribution device can easily be configured by an installer by connecting the programmer to the device. The programmer can be reused to program other distribution devices. When the programmer is removed, the mode of operation cannot be altered by any receiver.

[0036] Advantageously the generating means comprises a selector configured to select said selected mode

of operation. The transceiving means may also comprise a switch configured to activate the transmitting of the dedicated mode selection command comprising the selected mode of operation from said selector.

[0037] The external mode programming device may further comprise a second connector connectable to at least one receiver device and cascading means configured to cascade said output satellite signal from said first connector to said second connector.

[0038] This allows to configure the device near an end user device by inserting the programmer in between the receiver and the wall socket of the receiver cable. This way the installer can easily check if the programming was successful. No other cables or connections are further needed for the programming.

[0039] Advantageously the second connector is configured to receive the transponder selection command; and the cascading means are further configured to cascade the transponder selection command from the second connector to the first connector.

[0040] The assembly may then further comprise at least one receiver device; wherein each of the receiver devices comprise a connector connected to the second connector of the programming device and means for generating the transponder selection commands.

[0041] This allows to perform the programming of the mode of operation while the receiver is operational. This also allows to leave the programming device between the receiver and the distribution device after setup so the end-user can use it himself.

[0042] According to a third aspect the invention also relates to the external programmer for use in the assembly according to the second aspect.

[0043] In an embodiment of the external programmer the means for generating the dedicated mode selection command and the means for transceiving the dedicated mode selection can be controlled by means of a control signal received from a communication interface configured to interact with one or more of the following communication networks: the internet, a Local Area Network, I2C, a dedicated serial bus or a mobile telephone wireless network.

[0044] An advantage of this is that the external programmer can be remotely accessed without the need for a professional installer to come on site.

Brief Description of the Drawings

[0045] Figure 1 illustrates a satellite distribution device according to a preferred embodiment and an external programmer according to a further embodiment;

[0046] Figure 2 illustrates a further embodiment of the satellite distribution device;

[0047] Figure 3 illustrates an alternative embodiment of the satellite distribution device.

[0048] Figure 4 illustrates a further embodiment of the external programming device.

Detailed Description of Embodiments

[0049] Figure 1 shows a signal distribution device 1 according to an embodiment of the present invention. A satellite dish 8, typically installed on the roof or the side of a building picks up a high frequency satellite signal. This signal is reflected by the dish and focussed on a Low Noise Block downconverter (LNB) 9. This LNB downconverts the high bandwidth, high frequency satellite signal in blocks to an intermediate frequency (IF) signal. The IF signal is then put on a cable 3, for example a coaxial cable. Due to the bandwidth limitations of the cable 3, the IF signal has a typical frequency range of 950MHz-2150MHz providing a useful bandwidth of 1.2GHz. As the high frequency satellite signal has a much higher bandwidth, typically in the order of several GHz the LNB outputs several IF signals on several cables to cover the complete satellite's bandwidth. The signal bandwidth of the satellite signal and thus also the IF signal 11 is divided in transponders 10 with a limited bandwidth. The bandwidth of one such a transponder is typically between 20 and 36MHz depending on the symbol rate and properties of the satellite. The distribution device 1 comprises several input connectors 2 connected to the cables 3 from the LNB. Each input connector is thus configured to receive such an intermediate satellite signal frequency band or IF signal 11 from an input cable and every IF signal comprises a plurality of satellite transponders 10. The distribution device 1 also comprises at least one output connector 4. A controller 5 in the device 1 connected to the input connectors 2 and output connector 4 is used to take transponders from the signals on the input connectors and make them available on the output connector 4 as an output satellite or IF signal 18 that is then transmitted over an output cable 13 connected to the output connector 4. This output signal 14 again comprises transponders 14 with a limited bandwidth at an intermediate frequency.

[0050] According to a further embodiment the distribution device may comprise additional cascade output connectors 12. The controller 5 then cascades the IF signals on the input connectors to these output connectors 12. Every cascade output connector 12 is thus connected to a respective input connector 2. The cascade output connector 12 is then further configured to output a cascade output signal comprising the input satellite signal to a cascade output cable 27. This way another distribution device 1 may be connected with its inputs 2 to the cascade output connectors of the first device. This allows the daisy chaining of several distribution devices to a single LNB output of a satellite dish. This setup may be used in Multi Dwelling Units (MDU's) where several households or end users are within the same building or premises. Typical MDU's are for example hospitals, apartment buildings, hotels.

[0051] The controller 5 comprises a plurality of transponder selection modules 6 and a mode selection module 7. Each transponder selection module 6 is associated

with a corresponding mode of operation of the distribution device 1. A transponder selection module is configured to generate the output IF signal 18 such that it comprises one or more of the satellite transponders 14 from the input signals 11. How this is exactly done depends on the corresponding mode of operation for that transponder selection module.

[0052] According to an embodiment the transponder selection module generates the output IF signal 18 from the input signal 11 in function of commands identifying at least one of the selected transponders that are comprised in the output signal. According to this embodiment these transponder selection commands are received from the output connector 4. Typically these transponder selection commands are generated by a receiver connected to the output connector 4. For example, when a user selects a certain TV channel on his Set Top Box (STB), the STB will identify the needed transponder and send a transponder selection command identifying the requested transponder to the distribution device over the output connector 4.

[0053] A mode selection module 7 in the controller selects the output IF signal from one of the transponder selection modules 6 and provides it to the output connector 4. The mode selection module does this according to a selected mode of operation from all modes of operation each associated with a transponder selection module. According to this embodiment, in order to make a mode selection, the mode selection module receives a separate dedicated command from the output connector 4 indicating the selected mode of operation. In Figure 1 this command is extracted from the signal on the output connector in 15. The command may then further steer a switch 16 that connects the output connector 4 with the appropriate transponder selection module 6 according to the selected mode of operation.

[0054] Figure 2 illustrates two types 31 and 32 of transponder selection modules 6 according to a preferred embodiment. The first type of transponder selection module is associated with a legacy mode of operation. In this mode, the transponder selection module 31 receives and retrieves in block 33 a transponder selection command. The transponder selection module 31 then identifies the corresponding input IF signal comprising the selected transponder and puts this complete IF signal to its output 36. If the mode selection module then receives a command to operate in legacy mode, the output 36 will be made available on the output connector 4. The output signal is thus generated in such a way that it comprises all satellite transponders from the IF signal comprising the selected transponder. This generation of the signal at output 36 may be implemented by a switch 34 that enables switching between the available input IF signals 35 and thus the available input connectors 2. In the legacy mode of operation, it is thus not possible to concurrently select transponders from different input IF signals.

[0055] A second type of transponder selection module 32 is associated with a channel stacking mode of oper-

ation from the possible modes of operation. In this mode, the transponder selection module 32 receives and retrieves in block 43 a transponder selection command for selecting a transponder from a selected input IF signal. The input signal comprising the selected transponder is identified and selected by the switching block 45. After this selection, the selected input IF signal 46 comprising the selected transponder is connected to block 38. In block 38 the output signal 44 is generated comprising only the selected transponder on a selected carrier frequency f1 specific to this block 38. The transponder selection module 32 may have several blocks 38 annotated with the supported output carrier frequency f1 to fn for the selected transponder in Figure 2. The switching block 45 then has as many inputs as there are input IF signal and as many outputs as there are blocks 38. In other words, the transponder selection module 32 can select as many transponders at once as there are blocks 38 available. All the signals 44 are then added together in the mixer 37 to produce the output signal 39 of the transponder selection module 32.

[0056] According to a preferred embodiment and in case of the channel stacking mode, every time the transponder selection module receives a transponder selection command to select a specific transponder from an STB, the STB sends a receiver device identifier that identifies the receiver device that generated the transponder selection command. In block 43, every STB is associated with a specific carrier frequency ranging from frequency f1 to fn and is thus associated with a specific block 38. As many receivers can thus be supported as there are blocks 38 available in the transponder selection module where every receiver is allocated a different carrier frequency from the range f1 to fn.

[0057] The block 38 for generating the signal 44 comprising the selected transponder at the selected carrier frequency f1 to fn may for example be implemented by a mixer 47 followed by a filter 48. The mixer converts the carrier frequency of the selected transponder from the selected input signal 46 to the selected carrier frequency specific to the block 38. The filter 48 then filters the mixed signal such that the output signal 44 only contains the selected transponder at the selected carrier frequency specific to the block 38. It is clear that, depending on the roll-off properties of the filter, neighbouring unwanted transponders around the selected transponder may still partly pass through.

[0058] The distribution device 1 may further comprise a third mode of operation or blocking mode of operation. In this blocking mode the mode selection module is further configured to provide none of the outputs of the transponder selection modules 6 to the output connector. This mode may be implemented by having a switch position 40 for the switch 16 in the mode selection module where none of the outputs 36 or 39 are connected to the output connector 4. Alternatively this may be accomplished by switching of the power supply to the transponder selection modules (6). In the blocking mode of operation none

of the transponders from the input IF satellite signals can be put on the output connector regardless of the transponder selection commands that are sent from a receiver device. This allows to disconnect a receiver device or STB 17 from the distribution device 1 without the need to physically unplug cables. This may be done when, for example, the end user of the STB 17 has not paid his subscription fee. In typical installations, the user will still be able to receive terrestrial signals, if they are handled by the distribution device 1.

[0059] It is clear that although in the embodiment of Figure 1 and Figure 2 there is shown a single controller 5 associated with a single output connector 4, according to alternative embodiments the satellite distribution device 1 could comprise a plurality of such controllers 5 connected to the input connectors and each associated with a corresponding output connector 4.

[0060] According to a further embodiment as illustrated in Figure 3, the distribution device 1 may also further comprise a fourth mode of operation or limiting mode of operation associated with one or more limited transponder selection modules 51, 52. These limiting transponder selection modules are configured to generate an output satellite signal such that it comprises one or more of the satellite transponders from a predetermined subset of the input connectors. As shown in Figure 3, the transponder selection modules 31 and 32 receive all input satellite IF signal from the input connectors 2. As schematically shown, four input IF satellite signals come from a first satellite and four other input IF satellite signals come from a second satellite connected to the distribution device 1. The limited transponder selection modules 51 and 52 only receive a subset of the input IF satellite signals. Limited transponder selection module 51 receives a subset comprising the four input signals from Satellite 1 and limited transponder selection module 52 receives a subset comprising the four input signals from Satellite 2. Limited transponder selection modules 51 and 52 may further be configured to operate similarly as the legacy or channel stacking transponder selection modules 31 or 32 described above or any other suitable transponders selection module, for example comprising a combination of a limited transponder selection module and a legacy 31 or channel stacking 32 module. It is clear that although in Figure 3 the transponder selection modules 31, 32 and limited transponder selection modules are schematically shown to be distinct blocks, they could be formed by means of hardware components that are used in common. According to a further alternative embodiment the connections between limited transponder selection modules and input connectors 2 may be configurable by a suitable switching device. According to a mode of operation a module may then be operated in either legacy or channel stacking mode and may receive inputs from either Satellite 1, 2 or both as determined by the configuration of this switching device in function of the dedicated mode selection commands.

[0061] The embodiment of Figure 3 has been de-

scribed by a distribution device connecting to two satellite dishes, but is not limited thereto. The distribution device 1 may also be connected to more than two satellite dishes, each dish receiving IF satellite signals from different satellites. This way an end user may for example receive European, Asian and American TV channels at the same time. This way the distribution device 1 may comprise, for example, 4 by 4 input channels, i.e. four input channels from 4 satellite dishes, resulting in 16 input IF signals.

[0062] The mode selection module may further comprise a memory 42. When a mode selection command comprising a selected mode of operation is received 15, the mode of operation is written to this memory 42. Then, for example after a reset or power-up of the device 1 when no mode selection command has been received, the mode selection module reads the selected mode of operation from the memory 42 and provides the output satellite signal of a transponder selection module to the output connector 4 according to the read selected mode of operation. In order to retain the values of the selected mode in the memory after a cut of the power supply, it is preferred that the memory is a non-volatile memory.

[0063] In most satellite distribution devices available on the market, transponder selection commands generated by the STB or receiver are encoded according to a protocol based on DiSEqC. With this protocol bidirectional data signals and power can be transmitted and received over a coaxial cable without interfering with the IF satellite signals. Therefore, according to a further embodiment, the dedicated mode selection command may also be encoded and put on the output connector based on an extension of the DiSEqC protocol.

[0064] As further illustrated with respect to the embodiment shown in Figure 1, an external programmer or external mode programming device 21 may be connected to the output 4 of the distribution device 1. This programmer comprises a first connector 22 to connect to the output connector 4 of the device 1 over a cable 13, for example a coaxial cable. This external programmer comprises means 23 for generating the dedicated mode selection command and transceiving means 28 to transmit the command over the cable 13 to the mode selection module 7 in the distribution device 1. The selector may be a rotatable selector 23 where every position of the selector corresponds to one of the modes of operation of the distribution device 1. The programmer 21 may then further comprise a switch 24 which, after pressing, activates the transmission of the command to the distribution device 1. The transceiving means 28 may also be configured to receive commands and/or information from the mode selection module 7 in the distribution device 1. For example, the transceiving means 28 in the programmer 21 may receive information on the already selected mode of operation in the distribution device 1. A suitable indicator means, such as for example a LED, a suitable display or any other suitable display means on the programmer may then indicate the currently selected mode of

operation to the professional installer using the external programmer.

[0065] In a further embodiment of the external programmer 21 a second connector 25 is present on the programmer making it connectable to a connector 26 of a receiving device 17 which is normally directly connectable to the distribution device 1. Using cascading means, the programmer then cascades signals, for example the satellite IF signal and transponder selection commands, from the first connector to the second connector and vice versa. Such cascading means can be suitably implemented in the transceiver 28, but according to an alternative embodiment the cascading means could also be formed by alternative means such as for example a direct connection between the first connector 22 and the second connector 25. This allows to connect a receiver or STB to the programmer and thus to the distribution device and have it operational while the programmer is connected to the distribution device over the same connection 4. The STB 17 can then send transponder selection commands to the distribution device 10 and receive the output IF signal 14 from the distribution device while the external programmer is connected in between. This facilitates the setup of an STB or receiver by an installer as he can directly verify the functioning of the mode selection by the programmer on the STB or receiver. For example, when an STB can only select transponders in channel stacking mode from two input connectors, the installer chooses a mode with the external programmer that corresponds to the channel stacking and blocking all but two input connectors. The installer can then directly verify on the STB if transponders from input satellite signal 11 from these two input connectors can be selected. This way, the external programmer may also be left between the STB and distribution device after setup leaving the end user with the possibility to modify the mode of operation afterwards, for example when he buys a new STB. Preferably, when cascading transponder selection commands from connector 25 to connector 22, the commands are first received by the transceiving means 28. This way, when the programmer sends a mode selection command the programmer temporarily holds the commands from the connector 25 so that the commands from a receiver 17 do not interfere with the mode selection commands from the programmer. After transmission of the mode selection commands, the transceiver 28 then transmits transponder selection commands that were held back.

[0066] Figure 4 shows a further embodiment of the external programmer 21. According to this embodiment, the external programmer comprises one or more further connectors 61, 63 internally connected to the transceiving means 28 and the means for generating the dedicated mode selection command. This way the transceiver 28 may send or receive dedicated mode selection commands over these connectors 61, 63. Connector 63 is for example connectable to a cable 64. As this connector 63 is not the same any more as the connector 22 con-

nected to the output 4 of the distribution unit 1, the cable 64 does not need to be a cable of the same type as the cable 13 for the output IF signal. The cable may for example be an Ethernet cable connectable to RJ45 connectors where the dedicated mode selection command is embedded in an IP packet and the connection between the connectors is established by a UDP or TCP connection over a LAN or WAN network. The wired connection between the connectors may also be established by other types of cables whereby the reception of the dedicated selection command or transmission of other relevant information over connector 63 is for example done according to the 12C or a serial bus protocol.

[0067] As shown in Figure 4, connector 61 is for example connected to an antenna 62 so that a wireless link can be established between the external programmer and another external device, for example a smartphone, PC, tablet or portable computer. This external device may then connect to the external programmer 21 over the wireless link and send the dedicated mode selection commands to the transceiving means 28 that sends, on its turn, the mode selection commands to the mode selection module 7. If the wireless link is established over a Wireless LAN (WLAN) network or telecommunications network, any external device connectable to the internet may access the external programmer and, thus, send dedicated mode selection commands to the external programmer and, thus to the mode selection module 7.

[0068] In the above embodiments the distribution device has been described by the use of a single output connector 4, but the invention is not limited thereto. The distribution device 1 may also comprise multiple output connectors each connected to a separate mode selection module and transponder selection modules. The operation mode can then be configured separately for each output connector. When using several output connectors, transponder selections modules may be shared between outputs making them available to either one of the mode selection modules. For example, a distribution unit may comprise two output connectors, two legacy transponder selection modules and one channel stacking unit. Both output connectors may then be configured to either legacy or channel stacking mode, but both cannot be configured to channel stacking mode at the same time.

[0069] The satellite distribution device may also comprise a separate mode selection connector internally connected to the mode selection module. This connector is then not used as output of the output satellite IF signal but as a dedicated mode selection connector for receiving the dedicated mode selection commands for the distribution device. According to a particular embodiment such dedicated mode selection connector may accept similar connections as described with respect to connectors 61 and 63 thus allowing remote access to the satellite distribution device.

[0070] Although the present invention has been illustrated by reference to specific embodiments, it will be apparent to those skilled in the art that the invention is

not limited to the details of the foregoing illustrative embodiments, and that the present invention may be embodied with various changes and modifications without departing from the scope thereof. The present embodiments are therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein. In other words, it is contemplated to cover any and all modifications, variations or equivalents that fall within the scope of the basic underlying principles and whose essential attributes are claimed in this patent application. It will furthermore be understood by the reader of this patent application that the words "comprising" or "comprise" do not exclude other elements or steps, that the words "a" or "an" do not exclude a plurality, and that a single element, such as a computer system, a processor, or another integrated unit may fulfil the functions of several means recited in the claims. Any reference signs in the claims shall not be construed as limiting the respective claims concerned. The terms "first", "second", "third", "a", "b", "c", and the like, when used in the description or in the claims are introduced to distinguish between similar elements or steps and are not necessarily describing a sequential or chronological order. Similarly, the terms "top", "bottom", "over", "under", and the like are introduced for descriptive purposes and not necessarily to denote relative positions. It is to be understood that the terms so used are interchangeable under appropriate circumstances and embodiments of the invention are capable of operating according to the present invention in other sequences, or in orientations different from the one(s) described or illustrated above.

Claims

1. A satellite signal distribution device (1) comprising:

- a plurality of input connectors (2), each configured to receive an intermediate satellite signal frequency band (11) from an input cable (3), each of said intermediate satellite signal frequency bands comprising a plurality of satellite transponders (10);
- an output connector (4) configured to transmit an output satellite signal (18) to an output cable (13);
- a controller (5) connected to said plurality of input connectors (2) and said output connector (4);
- said controller (5) comprising:

- o a plurality of transponder selection modules (6), each associated with a corresponding mode of operation, each trans-

ponder selection module configured to generate said output satellite signal (18) such that it comprises one or more of said satellite transponders (10) in function of said corresponding mode of operation; and
 o a mode selection module (7) configured to provide said output satellite signal of a selected transponder selection module (6) to said output connector (4) according to a selected mode of operation out of said plural modes of operation;

CHARACTERIZED IN THAT

- said mode selection module (7) is further configured to receive a dedicated mode selection command indicative for said selected mode of operation out of said plural modes of operation from a mode selection connector.
2. A satellite signal distribution device according to claim 1, wherein said mode selection connector is said output connector (4).
 3. A satellite signal distribution device according to claim 1 or 2 further comprising:
 - a plurality of cascade output connectors (12) each being connected to a corresponding input connector (2) and configured to output a cascade output satellite signal comprising said intermediate satellite signal frequency band received on said corresponding input connector (2) to a cascade output cable (27).
 4. A satellite signal distribution device according to any one of claim 1 to 3, **characterised in that** said selected transponder selection module (6) is further configured to:
 - receive a transponder selection command from said output connector (4), said transponder selection command being different from said dedicated mode selection command and comprising transponder selection information identifying at least one selected satellite transponder;
 - generate said output satellite signal such that its satellite transponders comprise said selected satellite transponders.
 5. A satellite signal distribution device according to claim 4, wherein the controller (5) comprises a first transponder selection module (31) associated with a first, legacy mode of operation from said plurality of modes of operation, that is configured to generate said output satellite signal such that it comprises all satellite transponders from the intermediate satellite signal frequency band comprising said selected satellite transponders.

6. A satellite signal distribution device according to claim 5 wherein the controller further comprises a second transponder selection module (32) associated with a second, channel stacking mode of operation from said plurality of modes of operation, that is configured to generate an output satellite signal such that it comprises only the selected satellite transponders.
7. A satellite signal distribution device according to any of the preceding claims, wherein:
 - said plural modes of operation comprise a transponder blocking mode of operation;
 - said mode selection module further being configured (40) to provide none of the outputs of the transponder selection modules (6) to said output connector (4) upon reception of a dedicated mode selection command indicative for said transponder blocking mode of operation.
8. A satellite signal distribution device (1) according to any one of the preceding claims, wherein said plurality of transponder selection modules (6), comprises at least one limited transponder selection module (51) (52), associated with a corresponding mode of operation, said limited transponder selection module configured to generate said output satellite signal such that it comprises one or more of said satellite transponders received from a predetermined subset of said plurality of input connectors (2).
9. A satellite signal distribution device (1) according to any one of the preceding claims, wherein said controller further comprises a memory (42); and wherein said mode selection module (7) is further configured to:
 - write said selected mode of operation to said memory (42) when receiving said dedicated mode selection command; and
 - read said selected mode of operation from said memory (42) before providing said output satellite signal of a selected transponder selection module to said output connector according to said selected mode of operation.
10. An assembly comprising a satellite signal distribution device (1) according to any one of the preceding claims, wherein the assembly further comprises an external mode programming device (21) comprising:
 - a first connector (22) connected over said output cable (13) to said output connector (4) or to said mode selection connector of said satellite signal distribution device; and
 - generating means configured to generate said dedicated mode selection command; and

- transceiving means (28) configured to transmit said dedicated mode selection command over said first connector (22) to said output connector (4) or to said mode selection connector of said satellite signal distribution device.

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11. The assembly of claim 10 wherein said generating means comprises a selector (23) configured to select said selected mode of operation; and/or said transceiving means (28) comprises a switch configured to activate said transmitting of said dedicated mode selection command comprising said selected mode of operation from said selector.

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12. The assembly according to claim 10 or 11, when depending on claim 2, wherein said external mode programming device (21) further comprising:

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- a second connector (25) connectable to at least one receiver device (17);
- cascading means configured to cascade said output satellite signal from said first connector (22) to said second connector (25).

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13. The assembly according to claim 12, when dependent on claim 4, wherein:

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- said second connector (25) is configured to receive said transponder selection command; and
- said cascading means are further configured to cascade said transponder selection command from said second connector (25) to said first connector (22).

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14. An external programmer for use in the assembly according to any of the claims 10 to 13.

15. An external programmer according to claim 14, **characterised in that** said means for generating said dedicated mode selection command and said means for transceiving said dedicated mode selection can be controlled by means of a control signal received from a communication interface (61, 63) configured to interact with one or more of the following communication networks:

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- the internet;
- a Local Area Network;
- I2C;
- a dedicated serial bus;
- a mobile telephone wireless network.

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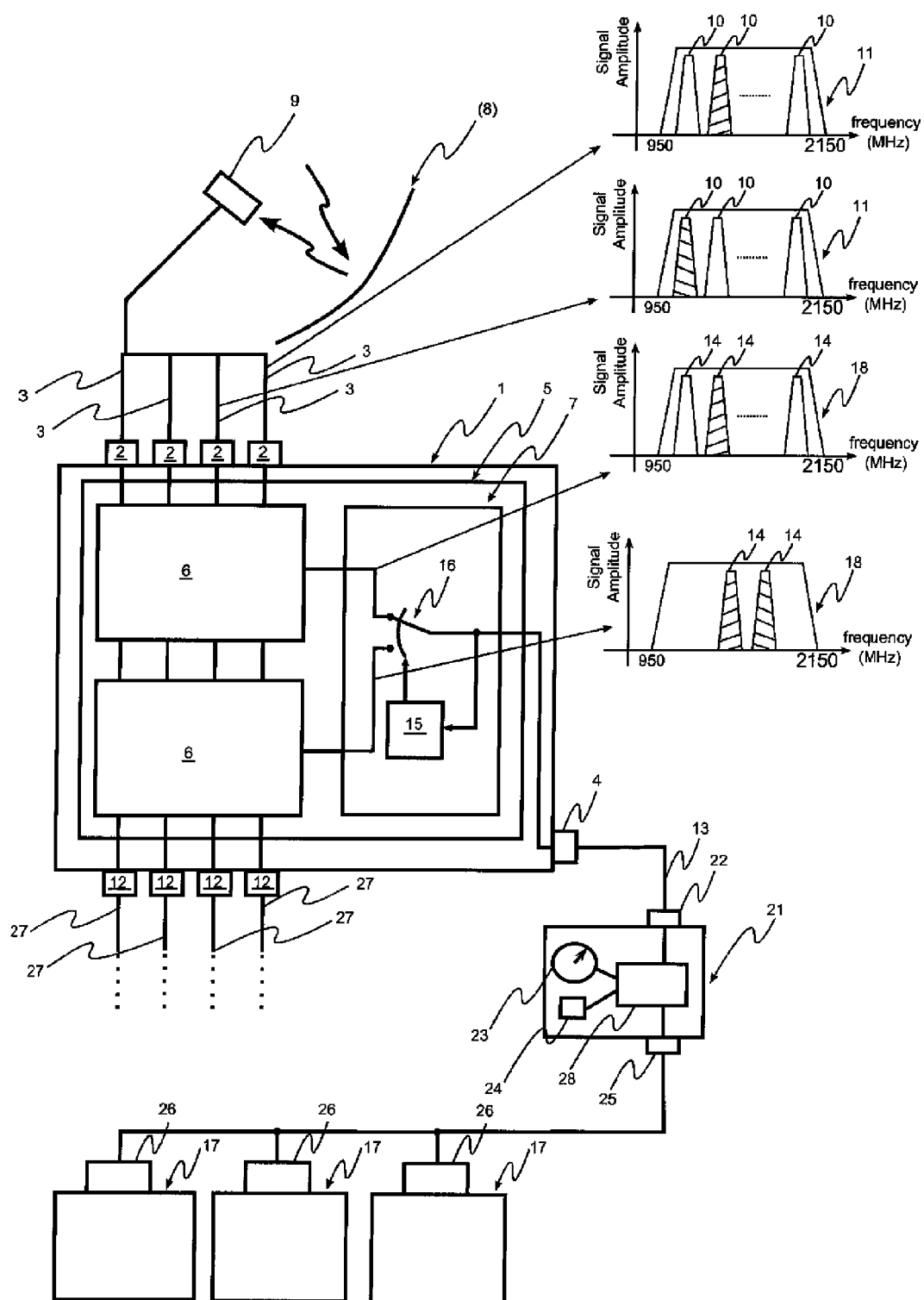


Figure 1

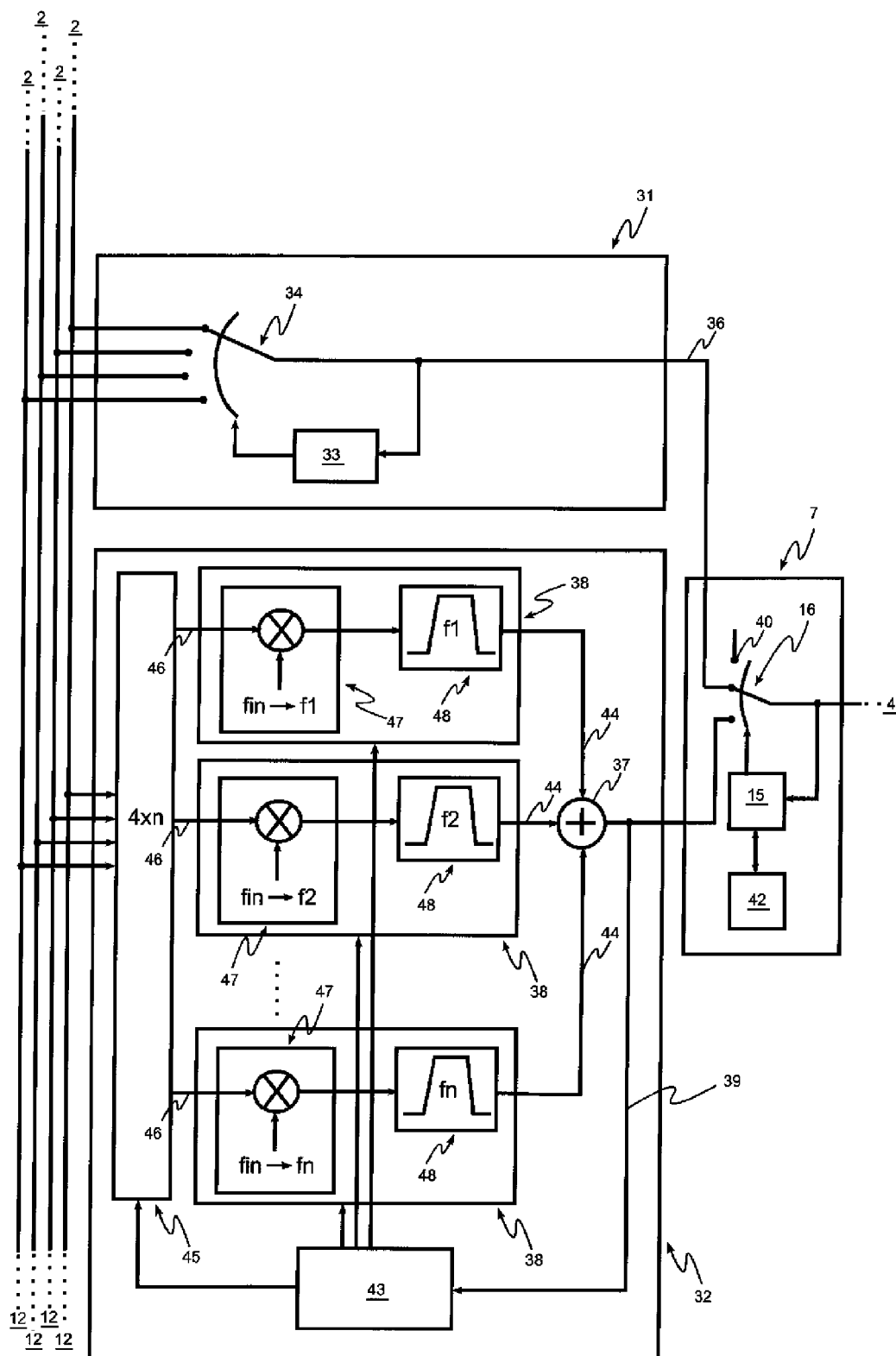


Figure 2

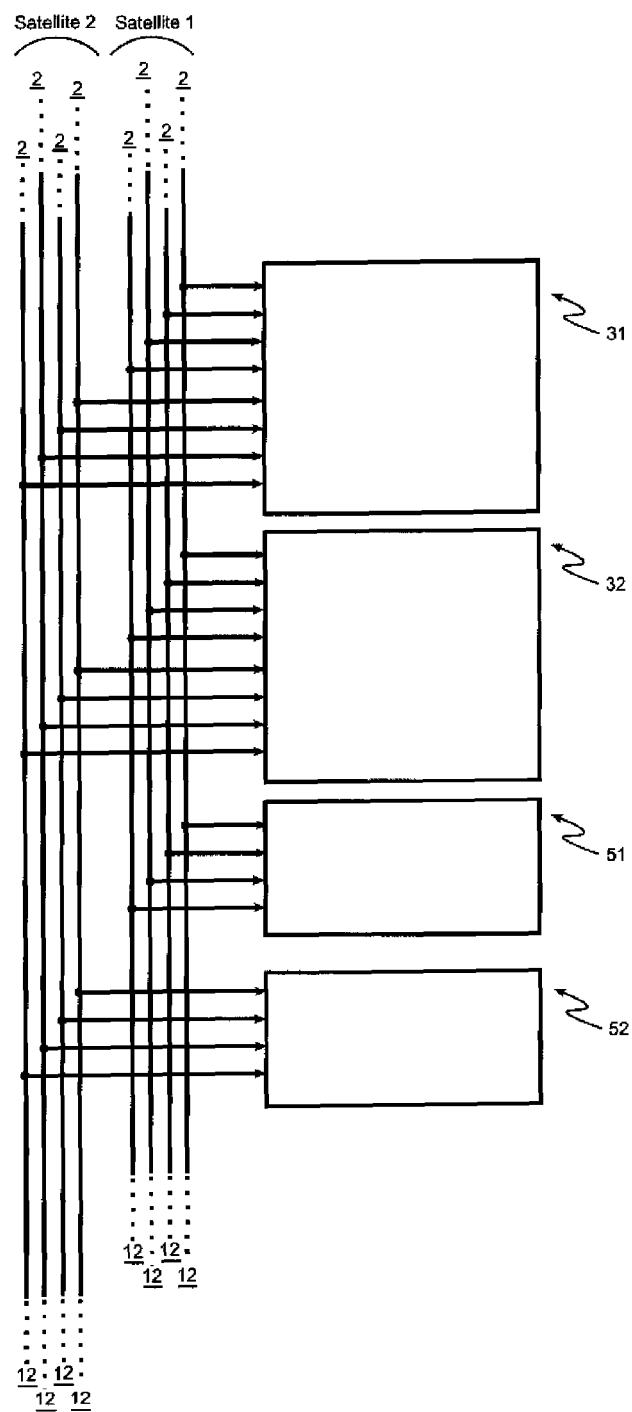


Figure 3

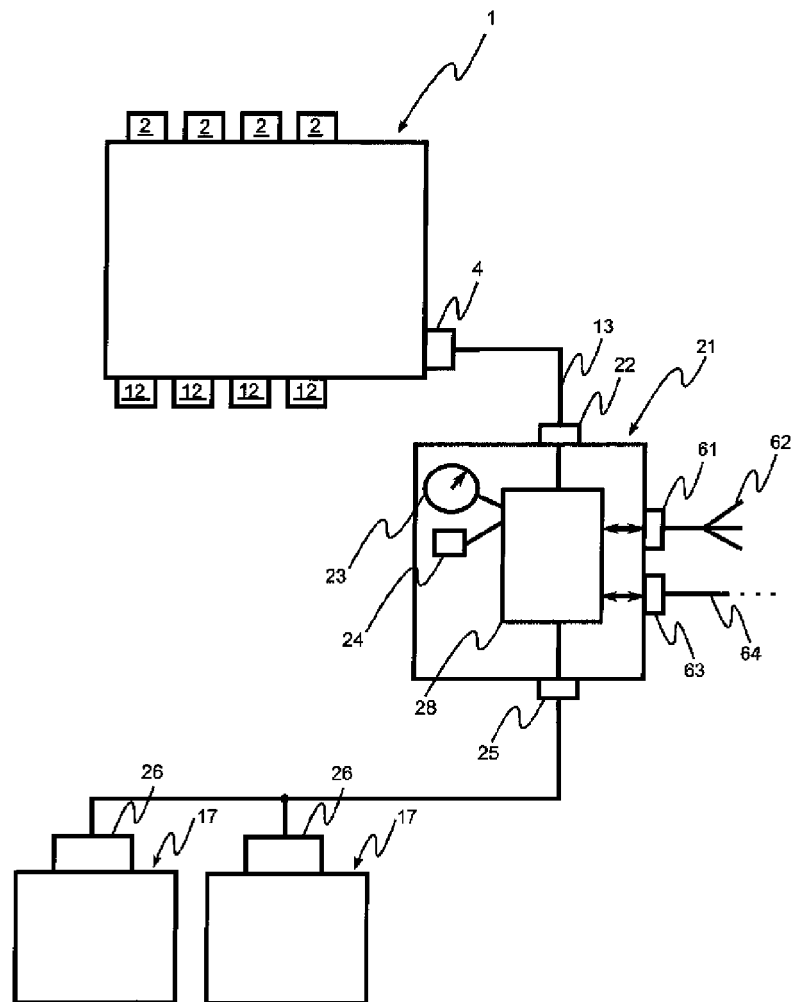


Figure 4



EUROPEAN SEARCH REPORT

Application Number
EP 13 17 0536

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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			TECHNICAL FIELDS SEARCHED (IPC)
			H04H H04N
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 4 October 2013	Examiner Taddei, Hervé
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.

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04-10-2013

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

REFERENCES CITED IN THE DESCRIPTION

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