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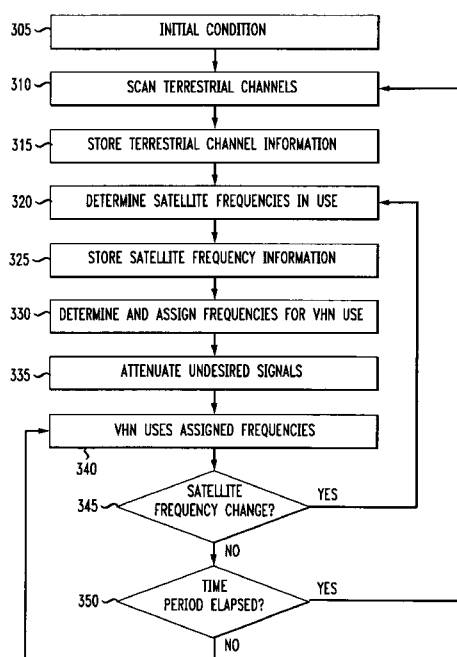
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FIG. 3 300



(57) Abstract: A method and apparatus manage a frequency spectrum associated with a network to facilitate the co-existence of signals originating from both signal sources external to the network and signal sources internal to the network. According to an exemplary embodiment, the method (300) includes steps of searching a range of frequencies for potential use by an internal video signal distribution network (310, 320), and attenuating an undesired signal within the range of frequencies, wherein the undesired signal is originated from a signal source external to the internal video signal distribution network (335).

METHOD AND APPARATUS FOR MANAGING A FREQUENCY SPECTRUM

The present invention generally relates to signal communications, and more particularly, to a method and apparatus for managing a frequency spectrum associated with a network to facilitate the co-existence of signals originating from both signal sources external to the network and signal sources internal to the network.

Frequency spectrum is a limited resource in many, if not most, networks. For example, in networks where multiple signal sources exist, there is an inherent problem regarding what portions of the available frequency spectrum are to be used by each given signal source. A notable example of this problem is in a network where there are one or more signal sources external to the network, as well as one or more signal sources internal to the network. This is the case, for example, with current networks that distribute signals from external signal sources such as a terrestrial and/or satellite antenna, and that also distribute signals from internal signal sources such as one or more digital video recorders (DVRs). In such a case, the determination of how the signals originating from these external and internal signal sources can co-exist within the network is a major concern. Improper allocation of the available frequency spectrum can interfere with the proper distribution and reception of desired signals within the network.

At present, the general problem of managing a frequency spectrum has been addressed in various different ways. One approach, known as the "MoCA" standard, is used in cable television applications. This approach, however, is deemed deficient in that it fails to adequately facilitate the co-existence of signals from other signal sources, such as satellite. Another approach, known as a frequency translation technique, is used in satellite applications. This approach, which remaps signals from satellite transponders in order to manage a frequency spectrum, is likewise deemed deficient in that it also fails to adequately facilitate the co-existence of signals from other signal sources, such as cable.

Accordingly, there is a need for a method and apparatus that addresses the aforementioned problems, and manages a frequency spectrum

associated with a network to facilitate the co-existence of signals originating from both signal sources external to the network and signal sources internal to the network. The present invention addresses these and/or other issues.

In accordance with an aspect of the present invention, a method is disclosed. According to an exemplary embodiment, the method comprises steps of searching a range of frequencies for potential use by an internal video signal distribution network, and attenuating an undesired signal within the range of frequencies, wherein the undesired signal is originated from a signal source external to the internal video signal distribution network.

In accordance with another aspect of the present invention, an apparatus is disclosed. According to an exemplary embodiment, the apparatus comprises means, such as circuitry, for searching a range of frequencies for potential use by an internal video signal distribution network, and means, such as filter, for attenuating an undesired signal within the range of frequencies, wherein the undesired signal is originated from a signal source external to the internal video signal distribution network.

The above-mentioned and other features and advantages of this invention, and the manner of attaining them, will become more apparent and the invention will be better understood by reference to the following description of embodiments of the invention taken in conjunction with the accompanying drawings, wherein:

FIG. 1 is a diagram of a system according to an exemplary embodiment of the present invention;

FIG. 2 is a block diagram illustrating further details of the spectrum manager apparatus of FIG. 1 according to an exemplary embodiment of the present invention;

FIG. 3 is a flowchart illustrating steps according to an exemplary embodiment of the present invention; and

FIGS. 4(A) to 4(D) are diagrams illustrating frequency spectrums according to exemplary embodiments of the present invention.

The exemplifications set out herein illustrate preferred embodiments of the invention, and such exemplifications are not to be construed as limiting the scope of the invention in any manner.

Referring now to the drawings, and more particularly to FIG. 1, a system 100 according to an exemplary embodiment of the present invention is shown. System 100 comprises a plurality of external signal sources including a terrestrial source (e.g., a VHF and/or UHF television antenna) 10, a satellite source (e.g., a satellite antenna system, including an LNB) 15 and a cable (data-over-cable-service-interface-specification – DOCSIS) source 20 that are each operative to provide signals including audio, video and/or data content. A point of entry 25 to a network receives the signals provided from external signal sources 10, 15 and 20. A spectrum manager apparatus 30 receives the signals from point of entry 25, and according to principles of the present invention is operative to perform various functions to manage a frequency spectrum associated with the network. Details of the functionality of spectrum manager apparatus 30 will be provided later herein.

Spectrum manager apparatus 30 is coupled to a signal distribution system 35 which distributes the received signals to a plurality of other apparatuses, devices and/or systems within the network via a wired medium (e.g., coaxial cable, fiber, Ethernet, etc.) having an associated frequency spectrum. As shown in FIG. 1, these other apparatuses/devices/systems comprise a video home network (VHN) coordinator device 40, and a plurality of VHN client devices 45 and 50. VHN devices 40, 45 and 50 are operatively coupled to televisions (TVs) 55, 60 and 65, respectively. The network of FIG. 1 further comprises a stand-alone TV 70, a combiner 75, another VHN client device 80, a cable modem 85 and a personal computer (PC) 90. The network shown in FIG. 1 is exemplary only in terms of its configuration and elements, and is not intended to limit the application of the present invention in any manner.

According to an exemplary embodiment, VHN coordinator device 40 is distinguishable from VHN client devices 45, 50 and 80 in FIG. 1 in that VHN coordinator device 40 operates as a communication coordinator or intermediary between spectrum manager apparatus 30 and VHN client devices 45, 50 and 80. In this manner, information communicated between spectrum manager apparatus 30 and VHN client devices 45, 50 and 80

passes through VHN coordinator device 40. However, according to another exemplary embodiment, each of the VHN devices 40, 45, 50 and 80 may communicate directly with spectrum manager apparatus 30 on its own behalf. For purposes of example and explanation, FIG. 1 shows four VHN devices 40, 45, 50 and 80. However, a different number of such VHN devices 40, 45, 50 and 80 may be employed depending on the particular network implementation.

Also according to an exemplary embodiment, VHN coordinator device 40, and VHN client devices 45 and 50 are each embodied as a satellite set-top box (STB) having an associated digital recording device such as a DVR (which may for example be integrated into the VHN devices 40, 45 and 50). As such, each of these VHN devices 40, 45 and 50 is operative to receive and decode satellite signals provided from a signal source (i.e., satellite source 15) that is external to the network, and is also operative to store and distribute digital video signals internally within the network via its associated DVR (thereby operating as an internal signal source of the network). Also according to an exemplary embodiment, VHN device 80 is embodied as a PC-based DVR and is operative to distribute stored digital video signals internally within the network in the same manner as VHN devices 40, 45 and 50. The internal video signal distribution network serviced by the operation of VHN devices 40, 45, 50 and 80 as internal signal sources may be referred to herein as a "video home network" (VHN).

According to principles of the present invention, VHN devices 40, 45, 50 and 80 use one or more frequencies assigned by spectrum manager apparatus 30 to internally distribute digital video signals from their associated DVRs to other devices within the VHN. As will be described later herein, spectrum manager apparatus 30 manages the frequency spectrum associated with the network of FIG. 1 to facilitate co-existence of video signals originating from both the aforementioned external signal sources (i.e., terrestrial source 10, satellite source 15 and cable (DOCSIS) source 20), and the internal signal sources (i.e., VHN devices 40, 45, 50 and 80) that exist within the network of FIG. 1.

Referring now to FIG. 2, a block diagram illustrating further details of spectrum manager apparatus 30 of FIG. 1 according to an exemplary embodiment of the present invention is shown. Spectrum manager apparatus 30 of FIG. 2 comprises a first interface 110, a signal splitter 115, a filter block 120, a channel scanner 125, a memory 130, a controller 135, and a second interface 140. Some of the foregoing elements of FIG. 2 may be embodied using integrated circuits (ICs), and some elements may for example be included on one or more ICs. For clarity of description, certain conventional elements associated with spectrum manager apparatus 30 such as certain control signals, power signals and/or other elements may not be shown in FIG. 2.

First interface 110 is operative to couple spectrum manager apparatus 30 to point of entry 25 in a bi-directional manner. According to an exemplary embodiment, first interface 110 provides an impedance match, and may also provide a gain to compensate for any signal loss of spectrum manager apparatus 30 and/or perform frequency conversion if necessary.

Signal splitter 115 is operative to separate terrestrial broadcast signals received via terrestrial source 10 from other signals received from satellite source 15 and cable (DOCSIS) source 20. According to an exemplary embodiment, signal splitter 115 allows the signals received from terrestrial source 10, satellite source 15 and cable (DOCSIS) source 20 to pass to filter block 120 (preferably with 0 dB loss), but taps the terrestrial broadcast signals received via terrestrial source 10 for channel scanner 125. Also according to an exemplary embodiment, the terrestrial broadcast signals may occupy a frequency range from 54 to 800 MHz.

Filter block 120 is operative to filter (e.g., attenuate) signals under the control of controller 135. According to an exemplary embodiment, filter block 120 is comprised of one or more tunable filters and reduces signal interference from point of entry 25 in response to control signals from controller 135. Filter block 120 is also operative to prevent undesired signals from the network of FIG. 1 from leaking back to point of entry 25. Filter block 120 may, however, allow certain return channel signals, such as those

associated with cable modem 85 and the STBs of VHN devices 40, 45 and 50 to pass back to point of entry 25.

Channel scanner 125 is operative to perform a channel scan operation. According to an exemplary embodiment, channel scanner 125 scans the terrestrial broadcast signals provided from signal splitter 115 under the control of controller 135 to thereby identify which terrestrial channels are presently available from terrestrial source 10.

Memory 130 is operative to perform data storage functions of spectrum manager apparatus 30. According to an exemplary embodiment, memory 130 stores data including, but not limited to, software code, data indicating the terrestrial channels that are currently available and the satellite frequencies currently being used in the network, data indicating the one or more frequencies currently assigned to the internal video signal distribution network (i.e., VHN), and/or other data.

Controller 135 is operative to perform various processing and control functions associated with the frequency spectrum management functions of spectrum manager apparatus 30. According to principles of the present invention, controller 135 assigns one or more frequencies for use by the internal video signal distribution network (i.e., VHN) of FIG. 1. Controller 135 is also operative to perform and/or enable other functions of spectrum manager apparatus 30 including, but not limited to, processing user inputs made thereto, reading and writing data from and to memory 130, and/or other operations. Further details regarding controller 135 and the aforementioned frequency spectrum management functions will be provided later herein.

Second interface 140 is operative to couple spectrum manager apparatus 30 to signal distribution system 35 in a bi-directional manner. According to an exemplary embodiment, second interface 140 provides signals received from the various network devices to controller 135, and also provides signals from controller 135 to various network devices.

Referring now to FIG. 3, a flowchart 300 illustrating steps according to an exemplary embodiment of the present invention is shown. For purposes of example and explanation, the steps of FIG. 3 will be described with reference to the previously described elements of FIGS. 1 and 2. The steps of FIG. 3

are exemplary only, and are not intended to limit the present invention in any manner.

At step 305, an initial condition state exists. According to an exemplary embodiment, the initial condition state of step 305 refers to whether or not a default frequency assignment for the internal video signal distribution network (i.e., VHN) of FIG. 1 has been made by spectrum manager apparatus 30 prior to any frequency use determinations for the overall network. According to at least one exemplary embodiment, no such frequency assignment for the internal video signal distribution network is made by spectrum manager apparatus 30 prior to any frequency use determinations (performed at steps 310 and 320) for the overall network. However, according to at least one other exemplary embodiment, a default frequency assignment for the internal video signal distribution network of FIG. 1 is made by spectrum manager apparatus 30 prior to any frequency use determinations for the overall network.

According to this latter embodiment, spectrum manager apparatus 30 communicates the default frequency assignment to VHN coordinator 40, which in turn communicates the same to VHN client devices 45, 50 and 80 on a predetermined frequency (e.g., 345 MHz which is a gap in the terrestrial band between UHF and VHF2). However, spectrum manager apparatus 30 could also communicate the default frequency assignment directly to each VHN device 40, 45, 50 and 80 individually. As will be described later herein, the frequencies assigned by spectrum manager apparatus 30 are used by VHN devices 40, 45, 50 and 80 when they operate as signal sources (i.e., via their associated DVRs) to distribute video data within the internal video signal distribution network of FIG. 1.

At step 310, spectrum manager apparatus 30 scans the terrestrial channels to determine which of a plurality of terrestrial channels are presently available. According to an exemplary embodiment, channel scanner 125 scans portions of the frequency spectrum (e.g., 54 to 800 MHz) under the control of controller 135 to thereby detect which terrestrial channels are currently being received by terrestrial source 10 (see FIG. 1). As will be explained later herein, those portions of the frequency spectrum that are

determined to include terrestrial channels are not to be assigned to or used by the internal video signal distribution network (i.e., VHN) of FIG. 1 regardless of whether or not any of those terrestrial channels are currently tuned by a network device.

5 At step 315, spectrum manager apparatus 30 stores terrestrial channel information obtained from the performance of step 310. According to an exemplary embodiment, the terrestrial channel information indicates which terrestrial channels (and corresponding frequencies) are currently being received by terrestrial source 10, and is stored in memory 130 of spectrum
10 manager apparatus 30 at step 315 under the control of controller 135.

 At step 320, spectrum manager apparatus 30 determines which satellite frequencies are currently in use. According to an exemplary embodiment, controller 135 communicates with VHN coordinator device 40 to thereby determine which satellite transponders are currently used (i.e., tuned)
15 by VHN devices 40, 45 and 50. Alternatively, controller 135 could communicate directly with VHN devices 40, 45 and 50 individually to obtain this information. From this transponder use information, controller 135 determines which corresponding satellite frequencies are currently in use within the network of FIG. 1.

20 At step 325, spectrum manager apparatus 30 stores satellite frequency information obtained from the performance of step 320. According to an exemplary embodiment, the satellite frequency information is stored in memory 130 of spectrum manager apparatus 30 at step 325 under the control of controller 135.

25 At step 330, spectrum manager apparatus 30 determines and assigns frequencies for use by the internal video signal distribution network (i.e., VHN). According to an exemplary embodiment, controller 135 selects and assigns these frequencies based on the channel/frequency use determinations of steps 310 and 320. That is, those terrestrial channels
30 determined at step 310 to be available, and the satellite frequencies determined at step 320 to be in use are not selected and assigned for use by the internal video signal distribution network (i.e., VHN) at step 330. At step 330, controller 135 may communicate the assigned frequencies to VHN

coordinator device 40 (which in turn communicates the same to VHN client devices 45, 50 and 80), or may directly communicate the assigned frequencies to VHN devices 40, 45, 50 and 80 individually.

To facilitate a better understanding of the principles of the present invention and the frequency assignment of step 330, reference is now made to FIGS. 4(A) to 4(D) which illustrate frequency spectrums according to exemplary embodiments of the present invention. The specific numerical frequencies referenced in FIGS. 4(A) to 4(D) are exemplary only, and are not intended to limit the present invention in any manner.

First, FIG. 4(A) depicts the frequency spectrum at point of entry 25 of FIG. 1, without any frequencies assigned for use by the internal video signal distribution network (i.e., VHN). Also, as depicted in FIGS. 4(A) to 4(D), the frequency spectrum associated with the network of FIG. 1 may include a dedicated frequency band 405 for cable (DOCSIS) operation. Because of its placement within the frequency spectrum (i.e., 5-42 MHz), this frequency band 405 may not pose an interference problem for the frequencies used by the internal video signal distribution network (i.e., VHN).

Moreover, as shown in FIGS 4(A), 4(C) and 4(D), the frequency spectrum associated with the network of FIG. 1 may also include a frequency band (e.g., 54 to 800 MHz) for terrestrial channels. This is the frequency band scanned by spectrum manager apparatus 30 at step 310 described above. As depicted in FIGS 4(A), 4(B) and 4(D), this terrestrial frequency band includes one available channel 410 (i.e., channel 13) which extends from 210 to 216 MHz. As previously indicated herein, this channel 410 will not be selected and assigned for use by the internal video signal distribution network (i.e., VHN) at step 330.

Next, as shown in FIGS 4(A) to 4(D), the frequency spectrum associated with the network of FIG. 1 may also include a frequency band for satellite use. This is the frequency band checked for use by spectrum manager apparatus 30 at step 320 described above. The frequency band used for satellite may vary depending on the particular implementation. For example, as depicted in FIGS. 4(A), 4(B) and 4(D), the satellite frequency band may begin and extend upwardly from around 950 MHz. According to

another example, as depicted in FIG. 4(C), the satellite frequency band may be extended, and thus begin and extend upwardly from around 250 MHz. In this latter example, no terrestrial channels may be available as the terrestrial portion of the frequency spectrum may be occupied by satellite signals.

5 Unlike terrestrial signals, the entire frequency range of signals allocated for satellite use is generally always available within the network of FIG. 1. That is, all of the broadcast satellite signals (i.e., for all available transponders) are generally available in the network for tuning at any given time. Hence, at step 320 described above, spectrum manager apparatus 30
10 determines which satellite frequencies are currently in use at a given time, as opposed to determining whether the corresponding signals are available (which is performed for terrestrial channels at step 310).

As depicted in FIGS. 4(A) to 4(D), satellite frequency bands 415, 420 and 425 are shown as being available for tuning within the network, and
15 bands 415 and 425 are shaded to indicate that they are currently in use (i.e., being tuned). The extended satellite range of FIG. 4(C) also includes a satellite frequency band 440, which is shown as currently being in use. As previously indicated herein, those satellite frequencies determined at step 320 to be in use are not selected and assigned for use by the internal video signal
20 distribution network (i.e., VHN) at step 330.

FIGS. 4(B) to 4(D) illustrate exemplary frequency assignments that may be made by spectrum manager apparatus 30 at step 330. In particular, FIGS. 4(B) and 4(C) show an exemplary frequency band 450 that may be assigned for use by the internal video signal distribution network (i.e., VHN) at
25 step 330. FIG. 4(D) shows an alternative embodiment where the assigned frequencies 451 to 455 are not contiguous and exist, for example, within pre-defined channel guard bands. The actual amount of bandwidth assigned for use by the internal video signal distribution network (i.e., VHN) at step 330 may vary depending on factors such as design choice and/or the
30 channel/frequency use determinations of steps 310 and 320. For purposes of example and explanation, FIGS. 4(B) to 4(D) depict an assigned bandwidth of 50 MHz.

At step 335, spectrum manager apparatus 30 attenuates any undesired signals originating from one or more of the external signal sources (i.e., terrestrial source 10, satellite source 15 and cable (DOCSIS) source 20). According to an exemplary embodiment, filter block 120 attenuates such
5 undesired signals at step 335 in response to one or more control signals from controller 135. Also according to an exemplary embodiment, filter block 120 attenuates the frequencies adjacent to the frequencies assigned for use by the internal video signal distribution network (i.e., VHN) at step 330. The amount of attenuation and the range of adjacent frequencies that are
10 attenuated at step 335 may be set as a matter of design choice. Examples of this adjacent frequency attenuation are shown in FIGS. 4(B) to 4(D).

At step 340, the internal video signal distribution network (i.e., VHN) of FIG. 1 uses the frequencies assigned by spectrum manager apparatus 30 at step 330 to distribute signals (see again FIGS 4(B) to 4(D)).

15 At step 345, spectrum manager apparatus 30 makes a determination as to whether any satellite frequency change has occurred. According to an exemplary embodiment, controller 135 receives updates from VHN coordinator device 40 (or from VHN devices 40, 45, 50 and 80 individually) whenever a satellite frequency change occurs within the network of FIG. 1. A
20 satellite frequency change occurs, for example, when a new transponder is tuned and/or when a previously tuned transponder is no longer tuned.

If the determination at step 345 is positive, process flow loops back to step 320 where spectrum manager apparatus 30 makes another determination as to which satellite frequencies are currently in use, and
25 process flow continues in the previously described manner. Alternatively, if the determination at step 345 is negative, process flow advances to step 350 where spectrum manager apparatus 30 makes a determination as to whether a predetermined time period (e.g., one day, one week, one month, etc.) has elapsed since the terrestrial channel band was last scanned. According to an
30 exemplary embodiment, controller 135 detects at step 350 when this predetermined time period has elapsed. This predetermined time period may be set according to design choice.

If the determination at step 350 is positive, process flow loops back to step 310 where spectrum manager apparatus 30 scans the terrestrial channels, and process flow continues in the previously described manner. Alternatively, if the determination at step 350 is negative, process flow loops
5 back to step 340 where the internal video signal distribution network (i.e., VHN) of FIG. 1 continues to use the frequencies assigned by spectrum manager apparatus 30 at step 330 to distribute signals, and process flow continues in the previously described manner.

As described herein, the present invention provides a method and
10 apparatus for managing a frequency spectrum associated with a network to facilitate the co-existence of signals originating from both signal sources external to the network and signal sources internal to the network. While this invention has been described as having a preferred design, the present invention can be further modified within the spirit and scope of this disclosure.
15 This application is therefore intended to cover any variations, uses, or adaptations of the invention using its general principles. Further, this application is intended to cover such departures from the present disclosure as come within known or customary practice in the art to which this invention pertains and which fall within the limits of the appended claims.

CLAIMS

1. A method (300), comprising steps of:
searching a range of frequencies for potential use by an internal video signal distribution network (310, 320); and
attenuating an undesired signal within said range of frequencies, wherein said undesired signal is originated from a signal source external to said internal video signal distribution network (335).
2. The method (300) of claim 1, wherein said searching step comprises:
determining which of a plurality of terrestrial channels are present (310); and
determining which of a plurality of satellite frequencies are in use (320).
3. The method (300) of claim 2, further comprising steps of:
selecting a band of frequencies within said range of frequencies in response to said determining steps; and
assigning said selected band of frequencies for use by said internal video signal distribution network (330).
4. The method (300) of claim 3, wherein said searching step is periodically repeated and said selecting and assigning steps are repeated in response to repeating said searching step.
5. The method (300) of claim 3, wherein said selected band of frequencies exist within channel guard bands.
6. The method (300) of claim 1, wherein said signal source external to said internal video signal distribution network includes at least one of a terrestrial signal source and a satellite signal source.

7. An apparatus (30), comprising:
means (125, 135) for searching a range of frequencies for potential use by an internal video signal distribution network; and
means (120) for attenuating an undesired signal within said range of frequencies, wherein said undesired signal is originated from a signal source external to said internal video signal distribution network.
8. The apparatus (30) of claim 7, wherein said searching means (125, 135) determines which of a plurality of terrestrial channels are present, and determines which of a plurality of satellite frequencies are in use.
9. The apparatus (30) of claim 8, wherein said searching means (125, 135) selects a band of frequencies within said range of frequencies in response to said determinations, and assigns said selected band of frequencies for use by said internal video signal distribution network.
10. The apparatus (30) of claim 9, wherein said searching means (125, 135) repeatedly searches said range of frequencies on a periodic basis, and repeatedly selects and assigns a selected band of frequencies for use by said internal video signal distribution network in response to each of said repeated searches.
11. The apparatus (30) of claim 9, wherein said selected band of frequencies exist within channel guard bands.
12. The apparatus (30) of claim 7, wherein said signal source external to said internal video signal distribution network includes at least one of a terrestrial signal source and a satellite signal source.

13. An apparatus (30), comprising:
circuitry (125, 135) operative to search a range of frequencies for potential use by an internal video signal distribution network; and
a filter (120) operative to attenuate an undesired signal within said range of frequencies, wherein said undesired signal is originated from a signal source external to said internal video signal distribution network.

14. The apparatus (30) of claim 13, wherein said circuitry (125, 135) is further operative to determine which of a plurality of terrestrial channels are present, and to determine which of a plurality of satellite frequencies are in use.

15. The apparatus (30) of claim 14, wherein said circuitry (125, 135) is further operative to select a band of frequencies within said range of frequencies in response to said determinations, and to assign said selected band of frequencies for use by said internal video signal distribution network.

16. The apparatus (30) of claim 15, wherein said circuitry (125, 135) repeatedly searches said range of frequencies on a periodic basis, and repeatedly selects and assigns a selected band of frequencies for use by said internal video signal distribution network in response to each of said repeated searches.

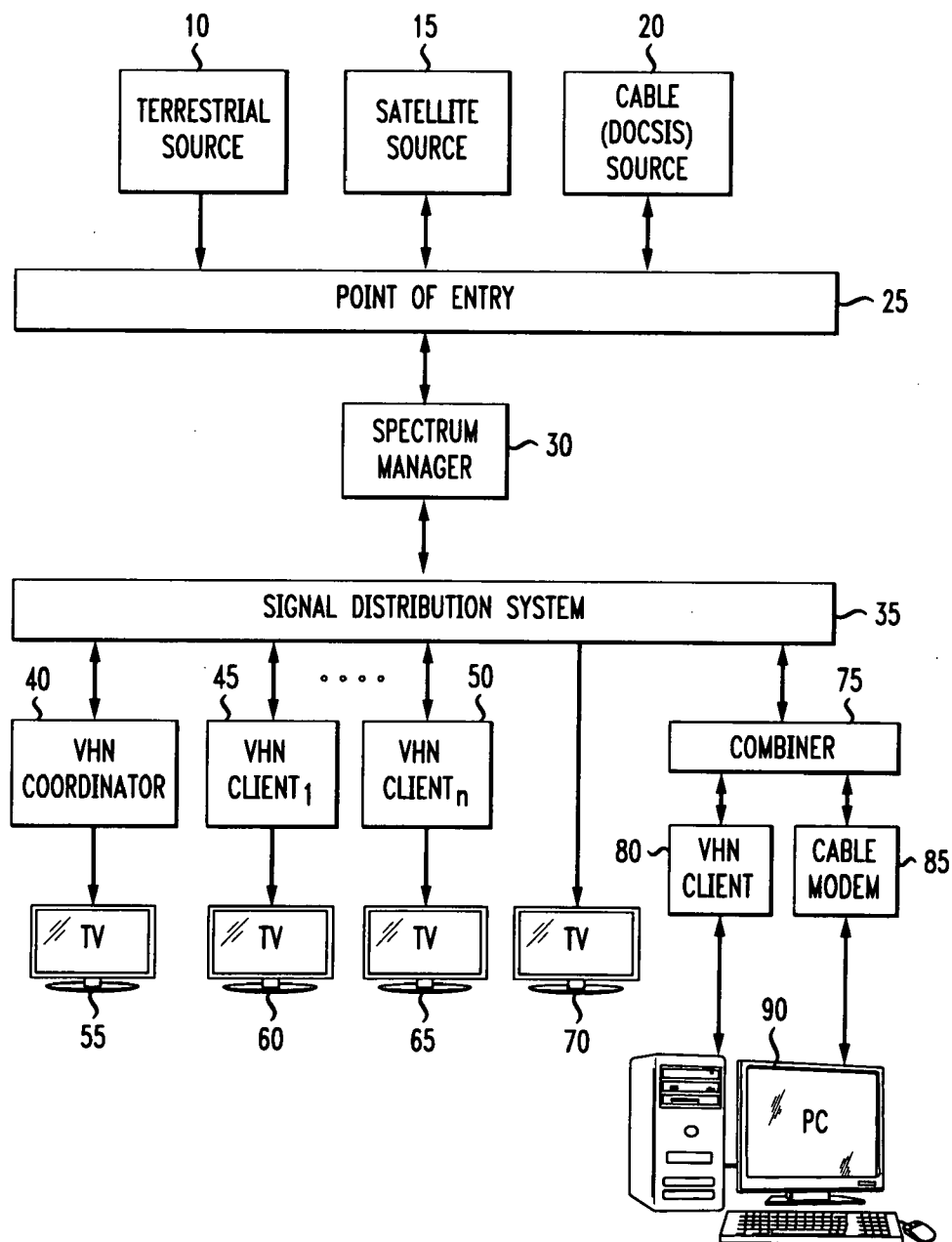
17. The apparatus (30) of claim 15, wherein said selected band of frequencies exist within channel guard bands.

18. The apparatus (30) of claim 13, wherein said signal source external to said internal video signal distribution network includes at least one of a terrestrial signal source and a satellite signal source.

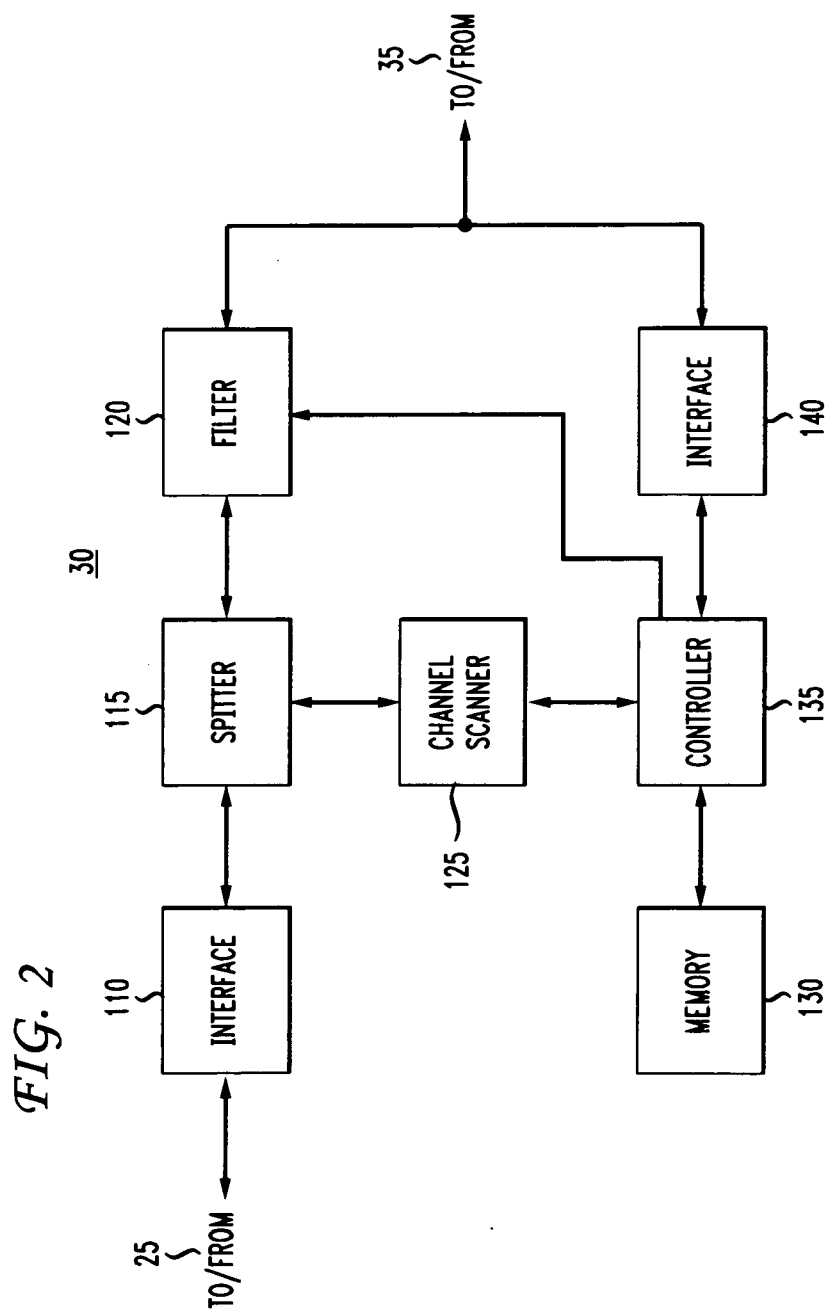
1/5

FIG. 1

100



2/5



3/5

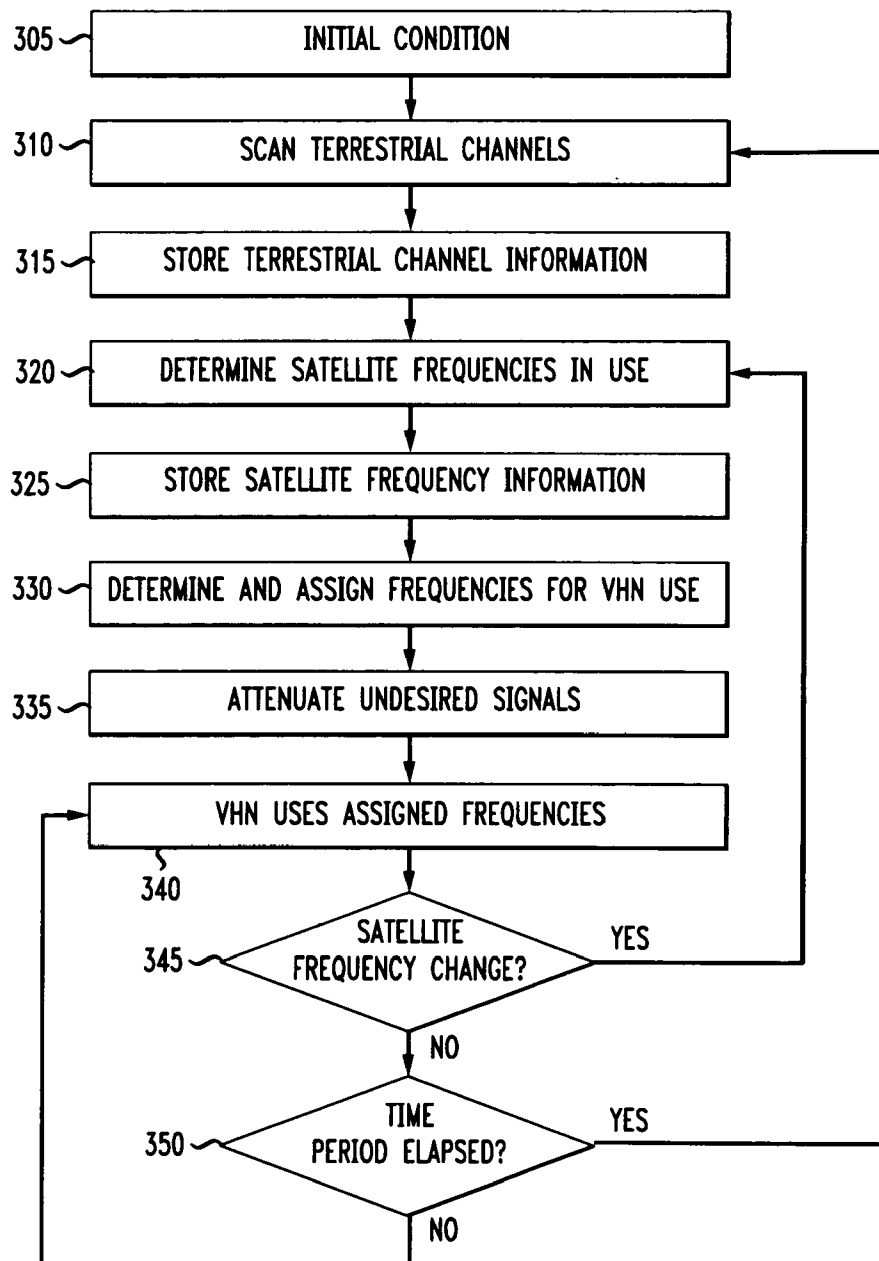
FIG. 3 300

FIG. 4(A)

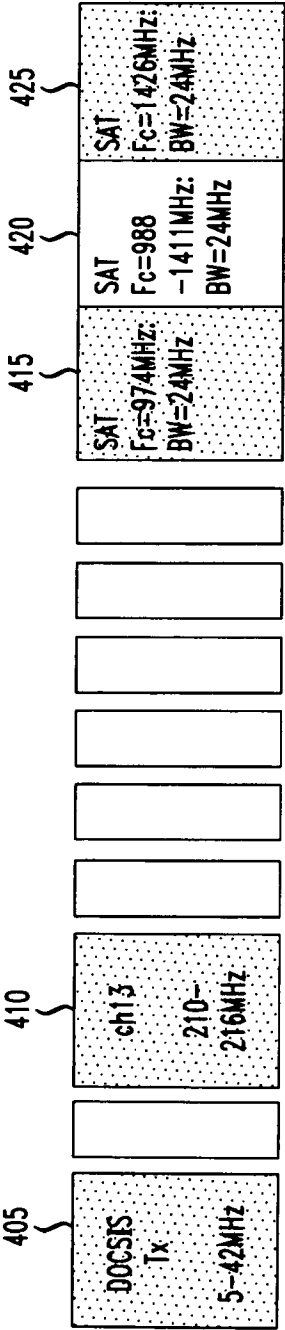


FIG. 4(B)

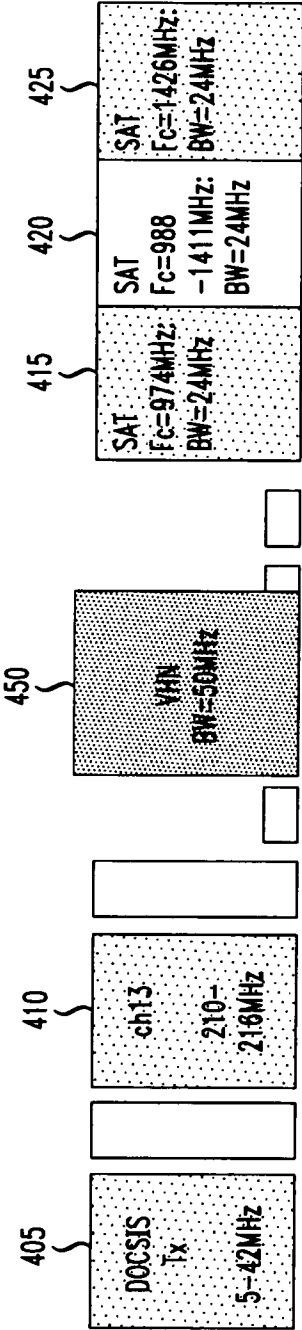


FIG. 4(C)

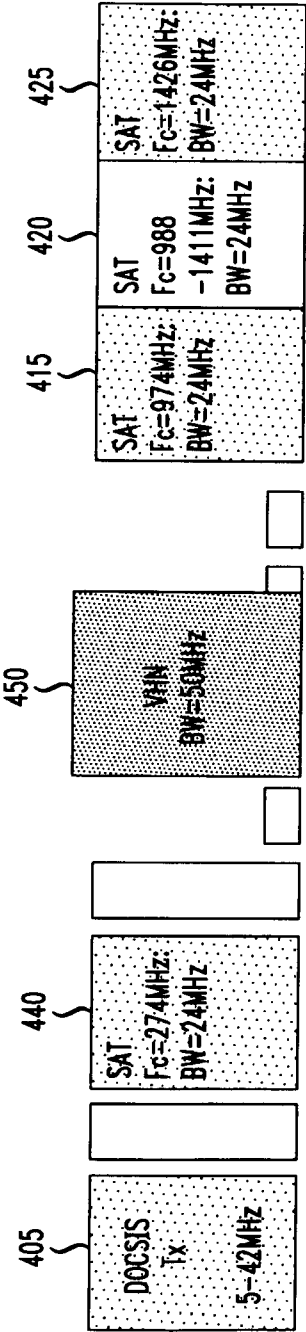
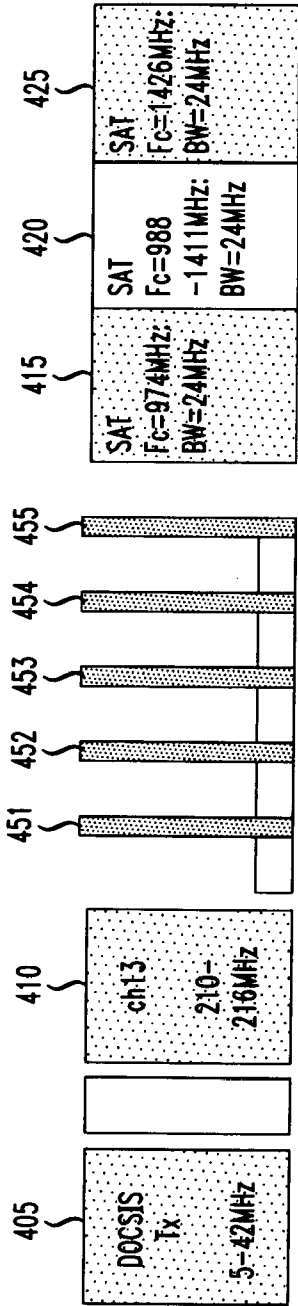


FIG. 4(D)



INTERNATIONAL SEARCH REPORT

International application No

PCT/US2009/000255

A. CLASSIFICATION OF SUBJECT MATTER

INV. H04L12/28 H04M11/06 H04N7/173

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)

H04L H04M H04N

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 practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 6 637 030 B1 (KLEIN DEAN A [US]) 21 October 2003 (2003-10-21) the whole document	1-18
Y	US 6 622 304 B1 (CARHART THOMAS W [US]) 16 September 2003 (2003-09-16) the whole document	1-18
Y	US 2004/081298 A1 (STRAUSS STEVEN E [US]) 29 April 2004 (2004-04-29) the whole document	1-18
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