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(54) **Title**: A SYSTEM AND METHOD FOR OPTIMIZING SCANNING FROM A MULTI-BAND COMMUNICATIONS DEVICE

(57) **Abstract**: Systems and methods for optimizing scanning from a multi-band communications device. A multi-band communications device scans for identifiers from one or more base stations. The multi-band communications device determines whether the received base station identifiers are associated with an access point (AP) on a list of APs. The multi-band communications device connects to the AP when the received base station identifiers are associated with the AP. The terms "base station" and "access point" encompass transmit and receive sites that provide communications using various technologies that may include Wi-Fi and cellular.

A SYSTEM AND METHOD FOR OPTIMIZING SCANNING FROM A MULTI-BAND COMMUNICATIONS DEVICE

RELATED APPLICATIONS

[0001] This application claims the priority benefit of U.S. Application 12/972,914, filed December 20, 2010, which is incorporated herein in its entirety for all purposes.

BACKGROUND

[0002] Wireless communication services are being provided over an ever expanding number of protocols and technologies. The various technologies provide choices to users in terms of costs and features that can be leveraged to suit the users' needs at particular points in time.

[0003] For example, high speed data (HSD) service providers typically offer subscribers a gateway device that provides wired connectivity to a fiber, coax or mobile medium and a Wi-Fi access point (AP) for connectivity within the home or business. When the Wi-Fi device moves out of range of one AP, it may send out probes to locate other APs that may be within range.

[0004] Multi-band communications devices, such as smart phones, typically include a wireless carrier transceiver for communicating over a first wireless network and a second transceiver for communicating over a second wireless network. Currently, the second wireless network is typically a Wi-Fi network that utilizes a system of APs. However, other multi-band arrangements are possible.

[0005] In some multi-band mobile devices, the second transceiver, such as a Wi-Fi transceiver, may be turned on (or placed in an idle mode) by the user. For example, when a Wi-Fi transceiver is on, the multi-band mobile device actively scans for APs and may associate with an AP (providing that the multi-band mobile device can provide the authentication information when required by the AP). However, in an environment in which APs are numerous, or in a situation where the multi-band mobile device is moving in and out of range of a number of APs, the Wi-Fi transceiver may be constantly scanning for Wi-Fi APs. Under these conditions, the Wi-Fi transceiver may consume a significant portion of the energy stored in the batteries of the multi-band mobile device.

[0006] One approach to saving battery life is to turn the second transceiver off. However, using this alternative precludes the use of channels accessible to the second transceiver as an alternative path for communications that by default will be provided over the wireless carrier transceiver.

SUMMARY

[0007] Embodiments herein are directed to systems and methods for optimizing the scanning activities of a multi-band communications device. In an embodiment, the communications device receives a list of access points (APs). Each AP on the list is associated with one or more wireless carrier base stations. The communications device scans for base station signals using a first circuit (for example, a first receiver or a transceiver) of the communications device and determines whether the received base station signals are associated with an AP on the list of APs. The communications device scans and connects to the AP when an attribute of the received base station (for example, signal strength, base station identifier, or location) is associated with the AP on the list of APs using a second circuit (for example, a second receiver or a transceiver) of the communications device.

[0008] In another embodiment, when the multi-band communications device detects that it is in proximity to the base stations associated with a favorite AP, the multi-band communications device turns the second circuit on and permits scanning. When the multi-band communications device detects that it is not in range of the base stations associated with a favorite AP, the multi-band communications device turns the second circuit off or switches it to an idle mode, thereby reducing demand on the battery that powers the multi-band communications device.

[0009] In another embodiment, the second circuit is a Wi-Fi transceiver and the APs are Wi-Fi APs.

[0010] In another embodiment, the user configures the multi-band communications device to create favorites lists of base stations and APs. In another embodiment, the configuration of the multi-band communications device is performed by a cellular service provider, by the operator of the APs, or by a third party. In yet another embodiment, the multi-band communications device populates the favorites list with base station identifiers associated with a particular AP and stores them in memory.

DESCRIPTION OF THE DRAWINGS

[0011] **FIG. 1** is a block diagram illustrating elements of an access point.

[0012] **FIG. 2** is a block diagram illustrating a multi-band communications device according to an embodiment.

[0013] **FIG. 3** is a process flow diagram illustrating the operation of a multi-band communications device to obtain location information of a selected access point according to an embodiment.

[0014] **FIGS. 4** and **5** are process flow diagrams illustrating the operation of a multi-band communications device utilizing AP location information to control a Wi-Fi transceiver in a multi-band communications device according to an embodiment.

DETAILED DESCRIPTION

[0015] As used herein, the term "base station" refers to a device or system of devices that communicates with a first circuit (for example, a first receiver or a transceiver) in a multi-band communications device. The term "access point" or "AP" encompasses a device or system of devices that communicates with a second circuit (for example, a second receiver or a transceiver) in a multi-band communications device. A Wi-Fi AP provides a point of connection for Wi-Fi devices such as laptop computers, notebook computers, PDAs, VoIP phones and dual network (cellular plus Wi-Fi) phones.

[0016] To illustrate the various embodiments herein, a multi-band communications device having a cellular transceiver and a Wi-Fi transceiver is described. However, the use of such a multi-band communications device is not meant as a limitation. A multi-band communications device may have any number of circuits (for example, receivers and/or transceivers) that are capable of establishing communications over multiple networks that utilize the same or different protocols. In addition, the circuits may be implemented as discrete structures or may be implemented as a single structure that is configurable to operate as a plurality of transceivers. Further, the multi-band features of a multi-band communications device may be implemented in hardware and/or software.

[0017] As used in the exemplary embodiments set forth below, the term "authentication" encompasses passing authentication credentials to a Wi-Fi access point that identifies a user of a Wi-Fi device as authorized to access the Wi-Fi AP. For example, the authentication credentials may include the MAC address of the Wi-Fi device and the SSID of the subscriber's network. An AP and a Wi-Fi device authenticate via authentication request frames sent by the Wi-Fi device and authentication response frames sent by the AP in response to the request. If a Wi-Fi device and an AP are configured to use a shared key, the exchange of authorization frames will include the Wi-Fi device using the shared key to encrypt challenge text. The AP will use the same key to decrypt the challenge text to verify that the Wi-Fi device has possession of the correct key.

[0018] As used herein, the term "association" encompasses a process by which an AP and a Wi-Fi device establish a link for sending and receiving data. The term "reassociation" encompasses a process by which a Wi-Fi device that is associated with an AP seeks to associate with a different AP. The association (or reassociation) of a Wi-Fi device and an AP may be initiated by a Wi-Fi device sending an association request frame (or, if appropriate, a reassociation request frame) that may include the MAC address and supported data rates of the Wi-Fi device and if, appropriate the security credentials required by the AP. . The access point may respond by sending a response frame containing an association ID along with other information regarding the access point.

[0019] As used herein, the term “security credentials” encompasses a subscriber’s security protocol (for example, Wired Equivalent Privacy or WEP, and Wi-Fi Protected Access or WPA) and a security key consistent with the protocol used.

[0020] As used herein, the term “idle mode” encompasses a state of receiver or transceiver of a multi-band communications device in which power may be applied to the receiver or transceiver of the multi-band communications device but the receiver or transceiver is not performing one or more if its functions that consume power.

[0021] **FIG. 1** is a block diagram illustrating a configuration of an access point.

[0022] An access point (AP) **100** comprises a service provider network interface **105** that connects an HSD service provider network to wireless devices, such as multi-band communications device **120**, through one or more AP transceivers **130**. The AP transceiver **130** transmits and receives data over a wireless link **160** to and from wireless devices. In an embodiment, the wireless link **160** may be an 802.11x compliant link (sometimes referred to herein as a “Wi-Fi” link).

[0023] The interface **105** and selected functions of AP transceiver **130** may be implemented in hardware, firmware or software. Other functions of transceiver **130** may be implemented in RF (Radio Frequency) circuitry as will be understood by one skilled in the art.

[0024] In an embodiment, the AP transceiver **130** modulates the data to produce an RF signal of the wireless link **160**. In an embodiment of the present invention, the AP transceiver **130** transmits at one of a plurality of power levels, as determined by a power management application implemented by the software **145**. By way of illustration and not by way of limitation, the transmit power of the AP transceiver **130** may be increased when the home gateway **100** is providing services to roaming Wi-Fi devices as further described below. In another embodiment, the transmit power is limited according to applicable laws of the jurisdiction in which the home gateway **100** is operated.

[0025] AP transceiver **130** is further operable to receive signals from a Wi-Fi device over wireless link **160**. In this instance, the transceiver **130** receives an RF signal and demodulates the RF signal to obtain a base-band signal to recapture a packet of data.

[0026] The software **145** also permits a subscriber to register with a designated SSID and security credentials in association with a Wi-Fi device's unique MAC address.

[0027] Internet access has advanced from the early dialup system to take advantage of improving wired and wireless technologies. High capacity data networks are currently offered over cable, fiber connections, and wireless networks. For example, cellular systems operate 3G and 4G networks that utilize new and efficient protocols, such as Worldwide Interoperability for Microwave Access (WiMAX) and Long-Term Evolution (LTE) among others to provide increased bandwidth and coverage.

[0028] **FIG. 2** is a block diagram illustrating a multi-band communications device according to an embodiment.

[0029] A multi-band communications device **200** may include a processor **201** coupled to an internal memory **202**, to a display **203** and to a SIM **221** or similar removable memory unit. Additionally, the computing device **200** may have a cellular antenna **204** for sending and receiving electromagnetic radiation that is connected to a cellular transceiver **205** coupled to the processor **201**. In some implementations, the transceiver **205** and portions of the processor **201** and memory **202** may be used for multi-network communications. The multi-band communications device **200** may also include a key pad **206** or miniature keyboard and menu selection buttons or rocker switches **207** for receiving user inputs. The multi-band communications device **200** may also include a GPS navigation device **220** coupled to the processor and used to determine the location coordinates of the multi-band communications device **200**. Additionally, the display **203** may be a touch-sensitive device that may be configured to receive user inputs.

[0030] A wireless transceiver **230** provides wireless communications via wireless antenna **232**. By way of illustration and not by way of limitation, the wireless transceiver may be compliant with 802.11x standards.

[0031] The processor **201** may be any programmable microprocessor, microcomputer or multiple processor chip or chips that can be configured by software instructions (applications) to perform a variety of functions, including the functions of the various embodiments described herein. In an embodiment, the multi-band communications device **200** may include multiple processors **201**, such as one processor dedicated to cellular and/or wireless communication functions and one processor dedicated to running other applications.

[0032] Typically, software applications may be stored in the internal memory **202** before they are accessed and loaded into the processor **201**. In an embodiment, the processor **201** may include or have access to an internal memory **202** sufficient to store the application software instructions. The memory may also include an operating system **222**.

[0033] In an embodiment, the wireless transceiver **230** is responsive to software commands. In this embodiment, the wireless transceiver **230** may be turned on or off or placed in an idle mode, either by direct commands from a user of the multi-band communications device **200** or in response to commands issued by an application, such as scanning application **224**. In another embodiment, the cellular transceiver **205** is responsive to software commands. In this embodiment, the cellular transceiver **205** may be turned on or off or placed in an idle mode, either by direct commands from a user of the multi-band communications device **200** or in response to commands issued by an application, such as scanning application **224**.

[0034] The internal memory of the processor may include a secure memory (not illustrated) which is not directly accessible by users or applications and that is capable of recording MDINs and SIM IDs as described in the various embodiments. As part of the processor, such a secure memory may not be replaced or accessed without damaging or replacing the processor.

[0035] Additionally, the internal memory **202** may be a volatile or nonvolatile memory, such as flash memory, or a mixture of both. For the purposes of this description, a general reference to memory refers to all memory accessible by the processor **201**, including internal memory **202**, removable memory plugged into the computing device, and memory within the processor **201** itself, including the secure memory.

[0036] In an embodiment, additional memory chips (e.g., a Secure Data (SD) card) may be plugged into the multi-band communications device **200** and coupled to the processor **201.**

[0037] **FIG. 3** is a process flow diagram illustrating the operation of a multi-band communications device to obtain location information of a selected access point according to an embodiment.

[0038] In an embodiment, the configuration of the scanning application **224** is accessible to the user of the multi-band communications device **200**. A user of a multi-band communications device **200** selects an AP to add to a favorites list (block **302**). In an embodiment, the favorites list is maintained in a memory **202** of the multi-band communications device **200**. At the AP location, the multi-band communications device **200** receives base station identifiers of base stations located proximate to the AP location (block **304**) via cellular transceiver**205**. The base station identifiers may be stored in association with the selected AP (block **306**). Collectively, the base station identifiers may be referred to herein as AP location information. The identification of a selected AP may be SSID or by a name assigned to it by the user of the multi-band communications device **200**.

[0039] As previously noted, the scanning application **224** may also be configured by a service provider or a third party. In this embodiment, a multi-band communications device provides location information of the multi-band communications device to a datastore via a network. The datastore provides a list of APs based on the location information of the communications device. Each of the listed APs is associated with one or more base stations proximate to the AP. The datastore may be operated by a third party, as for example, a provider of cellular services and/or Wi-Fi services.

[0040] In another embodiment, the multi-band communications device discovers and populates its internal database or a network database with the list of APs and base station identifiers (for example, BSID for Base Station ID or Preamble). For example, while connected to a Wi-Fi AP, the multi-band communications device may listen to the neighboring base stations, log their identifiers and associate them with Wi-Fi APs that are within range of the device. Optionally, the user of the multi-band communications device may be asked whether to save the association of the discovered AP and the base station identifiers. If the associations are saved (either automatically or by assent of the user), subsequently the multi-band communications device will only look for an AP that is in an area covered by a base station whose identifier is associated with that AP..

[0041] In an embodiment, a measure of signal strength of each base station for which a base station identifier is received is also stored in association with the AP identifying information and the base station identifier and, when so stored, becomes an element of the AP location information.

[0042] **FIGS. 4** and **5** are process flow diagrams illustrating the operation of a multi-band communications device utilizing AP location information to control a Wi-Fi transceiver in a multi-band communications device according to an embodiment.

[0043] In the process illustrated in **FIG. 4**, the Wi-Fi transceiver (**FIG. 2**, **230**) is initially in the "OFF" or idle mode and the cellular transceiver (**FIG. 2**, **205**) is in the "ON" mode.

[0044] In an embodiment, a processor (**FIG. 2**, **201**) of the multi-band communications device (**FIG. 2**, **200**) executes instructions that cause it to monitor the base station identifiers received by the wireless transceiver (**FIG. 2**, **230**) at a point in time (block **402**). A determination is made whether the received base station identifiers match the base station identifiers associated with an AP stored in memory (**FIG. 2**, **202**) (block **404**).

[0045] If the received base station identifiers do not match the base station identifiers associated with an AP (that is, the result of block **404** is "No"), the Wi-Fi receiver remains in off or idle mode (block **406**) and the process returns to monitoring base station identifiers (block **402**). If the received base station identifiers match the base station identifiers associated with an AP (that is, the result of block **404** is "Yes"), the Wi-Fi transceiver is instructed to enter the "ON" mode (block **408**). A loop count is initialized to zero (block **412**). The Wi-Fi transceiver scans for an AP on the list of favorite APs (block **414**). A determination is made whether an AP signal is above a threshold (block **416**). If no AP signal above the threshold is detected (that is, the result of block **416** is "NO"), the loop count is incremented by one (block **420**). A determination is made whether the loop count exceeds a pre-selected number (block **422**). If the loop count does not exceed a pre-selected number (that is, the result of block **416** is "NO"), the process returns to scanning for APs (block **414**). If the loop count exceeds a pre-selected number (that is, the result of block **416** is "YES"), the Wi-Fi receiver is turned off or placed in an idle mode (block **424**). The process may return to block **402** to scan for base station IDs or, optionally may enter a delay loop (block **426**) before returning to block **402**. The optional delay loop permits a multi-band communications device that is moving to scan for base station IDs at a different physical location so as to potentially identify different base stations and to obtain a different list of associated APs.

[0046] Returning to block **416**, if an AP signal is detected (that is, the result of block **416** is "YES"), the Wi-Fi transceiver associates with one of the APs on the AP list (block **418**). The selection of the AP may be made based on criteria that are provided to the scanning application (**FIG. 2**, **224**). For example, if the signals of two or more APs are above the threshold, the AP with the highest signal level may be selected or the AP may be selected based on a position in the list of associated APs or based on its SSID or other criteria.

[0047] When the Wi-Fi transceiver associates with one of the APs on the AP list, the cellular transceiver is then turned off or placed in an idle mode **420.** The process then moves to block **502** of **FIG. 5.**

[0048] In the process illustrated in **FIG. 5**, the Wi-Fi transceiver (**FIG. 2**, **230**) is initially in the "ON" mode and the cellular transceiver (**FIG. 2**, **205**) is in the "OFF" or idle mode. The Wi-Fi transceiver in the multi-band communications device monitors the AP signal (block **502**). The Wi-Fi transceiver in the multi-band communications device determines whether the AP signal is below a threshold (block **504**). If the AP signal is not below a threshold, (that is, the result of block **504** is "No"), the monitoring of the AP signal continues (block **502**).

[0049] If the AP signal is below a threshold, (that is, the result of block **504** is "Yes"), the cellular transceiver is turned on (block **506**). A loop count is initialized at zero (block **508**). A processor (**FIG. 2**, **201**) of the multi-band communications device (**FIG. 2**, **200**) executes instructions that cause it to monitor the base station identifiers received by the wireless transceiver (**FIG. 2**, **230**) at a point in time (block **510**). A determination is made whether the received base station identifiers match the base station identifiers associated with an AP stored in memory (**FIG. 2**, **202**) (block **512**).

[0050] If the received base station identifiers do not match the base station identifiers associated with an AP (that is, the result of block **512** is "No"), the Wi-Fi transceiver is instructed to enter the "OFF" or idle mode (block **524**). The process may return to block **402** to scan for base station IDs or, optionally may enter a delay loop (block **526**) before returning to block **402**. The optional delay loop permits a multi-band communications device that is moving to scan for base station IDs at a different physical location so as to potentially identify different base stations and to obtain a different list of associated APs.

[0051] Returning to block **512**, if the received base station identifiers match the base station identifiers associated with an AP (that is, the result of block **512** is "Yes"), the Wi-Fi transceiver may then scan for an AP on the list of favorite APs (block **514**). A determination is made whether an AP signal is above a threshold (block **516**). If no AP signal above the threshold is detected (that is, the result of block **516** is "NO"), the loop count is incremented by one (block **520**). A determination is made whether the loop count exceeds a pre-selected number (block **522**). If the loop count does not exceed a pre-selected number (that is, the result of block **522** is "NO"), the process returns to scanning for APs (block **514**). If the loop count exceeds a pre-selected number (that is, the result of block **516** is "YES"), the Wi-Fi receiver is turned off or placed in an idle mode (block

524). The process may return to block **402** to scan for base station IDs or, optionally may enter a delay loop (block **526**) before returning to block **402**. The optional delay loop permits a multi-band communications device that is moving to scan for base station IDs at a different physical location so as to potentially identify different base stations and to obtain a different list of associated APs.

[0052] Returning to block **516**, if an AP signal is detected (that is, the result of block **516** is "YES"), the Wi-Fi transceiver associates with one of the APs on the AP list (block **518**). The selection of the AP may be made based on criteria that are provided to the scanning application (**FIG. 2**, **224**). For example, if the signals of two or more APs are above the threshold, the AP with the highest signal level may be selected or the AP may be selected based on a position in the list of associated APs, SSID or other criteria.

[0053] When the Wi-Fi transceiver associates with one of the APs on the AP list, the cellular transceiver is then turned off or placed in an idle mode **520.** The process then moves to block **502** of **FIG. 5.**

[0054] In an embodiment, a measure of signal strength of each base station for which a base station identifier is received is also stored in association with the AP identifying information and the base station identifier and, when so stored, becomes an element of the AP location information.

[0055] In this embodiment, the processor (**FIG. 2**, **201**) utilizes the signal strength measures in making a determination whether the received base station identifiers match the base station identifiers associated with an AP stored in memory (**FIG. 2**, **202**) (blocks **404** and **512**). In order for a match to be deemed to have occurred (that is, the results of blocks **404** and **512** to be "Yes"), the received signal strengths of each of the base stations for which a base station identifier is received must also be within a threshold value of the signal strength values stored in memory (**FIG. 2**, **202**).

[0056] In another embodiment, the processor (**FIG. 2**, **201**) monitors the signal strengths of the base stations for which a base station identifier is stored in memory. A change in the received signal strengths of these base stations is measured over time to determine when a multi-band communications device (**FIG. 2**, **200**) is approaching an AP on the favorites list. In this embodiment, the processor (**FIG. 2**, **201**) may issue an alert (for example a tone or electronic voice message) indicating the proximity of a favorite AP.

[0057] The foregoing method descriptions and the process flow diagrams are provided merely as illustrative examples and are not intended to require or imply that the steps of the various embodiments must be performed in the order presented. As will be appreciated by one of skill in the art, the order of steps in the foregoing embodiments may be performed in any order. Further, words such as "thereafter," "then," "next," etc. are not intended to limit the order of the steps; these words are simply used to guide the reader through the description of the methods.

[0058] The foregoing method descriptions and the process flow diagrams are provided merely as illustrative examples and are not intended to require or imply that the blocks of the various embodiments must be performed in the order presented. As will be appreciated by one of skill in the art the order of blocks in the foregoing embodiments may be performed in any order. Words such as "thereafter," "then," "next," etc. are not intended to limit the order of the blocks; these words are simply used to guide the reader through the description of the methods. Further, any reference to claim elements in the singular, for example, using the articles "a," "an," or "the," is not to be construed as limiting the element to the singular.

[0059] The various illustrative logical blocks, modules, circuits, and algorithm steps described in connection with the embodiments disclosed herein may be implemented as electronic hardware, computer software, or combinations of both. To clearly illustrate this interchangeability of hardware and software, various illustrative components, blocks, modules, circuits, and steps have been described above generally in terms of their functionality. Whether such functionality is implemented as hardware or software depends upon the particular application and design constraints imposed on the overall system. Skilled artisans may implement the described functionality in varying ways for each particular application, but such implementation decisions should not be interpreted as causing a departure from the scope of the present invention. Functionality of various logical blocks may be performed by other logical blocks or circuits. Additionally, functionality of various logical blocks may be performed by additional logical blocks or circuits that are not separately illustrated.

[0060] The hardware used to implement the various illustrative logics, logical blocks, modules, and circuits described in connection with the aspects disclosed herein may be implemented or performed with a general purpose processor, a digital signal processor (DSP), an application specific integrated circuit (ASIC), a field programmable gate array (FPGA) or other programmable logic device, discrete gate or transistor logic, discrete hardware components, or any combination thereof designed to perform the functions described herein. A general-purpose processor may be a microprocessor, but, in the alternative, the processor may be any conventional processor, controller, microcontroller, or state machine. A processor may also be implemented as a combination of computing devices, e.g., a combination of a DSP and a microprocessor, a plurality of microprocessors, one or more microprocessors in conjunction with a DSP core, or any other such configuration. Alternatively, some blocks or methods may be performed by circuitry that is specific to a given function.

[0061] In one or more exemplary aspects, the functions described may be implemented in hardware, software, firmware, or any combination thereof. If implemented in software, the functions may be stored on or transmitted over as one or more instructions or code on a computer-readable medium. The blocks of a method or algorithm disclosed herein may be embodied in a processor-executable software module, which may reside on a computer-readable medium. Computer-readable media include both computer storage media and communication media including any medium that facilitates transfer of a computer program from one place to another. A storage media may be any available media that may be accessed by a computer. By way of example, and not limitation, such computer-readable media may comprise RAM, ROM, EEPROM, CD-ROM or other optical disk storage, magnetic disk storage or other magnetic storage devices, or any other medium that may be used to carry or store desired program code in the form of instructions or data structures and that may be accessed by a computer. Also, any connection is properly termed a computer-readable medium. For example, if the software is transmitted from a website, server, or other remote source using a coaxial cable, fiber optic cable, twisted pair, digital subscriber line (DSL), or wireless technologies such as infrared, radio, and microwave, then the coaxial cable, fiber optic cable, twisted pair, DSL, or wireless technologies such as infrared, radio, and microwave are included in the definition of medium. Disk and disc, as used herein, include compact disc (CD), laser disc, optical disc, digital versatile disc (DVD), floppy disk, and blu-ray disc where disks usually reproduce data magnetically, while discs reproduce data optically with lasers. Combinations of the above should also be included within the scope of computer-readable media. Additionally, the operations of a method or algorithm may reside as one or any combination or set of codes and/or instructions on a machine readable medium and/or computer-readable medium, which may be incorporated into a computer program product.

[0062] The preceding description of the disclosed embodiments is provided to enable any person skilled in the art to make or use the present invention. Various modifications to these embodiments will be readily apparent to those skilled in the art, and the generic principles defined herein may be applied to other embodiments without departing from the scope of the invention. Thus, the present invention is not intended to be limited to the embodiments shown herein but is to be accorded the widest scope consistent with the following claims and the principles and novel features disclosed herein.

WHAT IS CLAIMED IS:

1. A method for locating a communication access point using a communications device comprising:

receiving a list of access points (APs);

associating each AP on the list of APs with one or more base stations;

scanning for base station identifiers using a first circuit of the communications device;

determining whether the received base station identifiers are associated with an AP on the list of APs;

connecting to the AP when the received base station identifiers are associated with the AP on the list of APs using a second circuit of the communications device.

2. The method of claim 1 further comprising:

turning off power to the first circuit or placing the first circuit in an idle mode when connecting to the AP.

3. The method of claim 1 further comprising:

turning on power to the second circuit when the received base station identifiers are associated with the AP.

4. The method of claim 1 further comprising:

determining a signal power level of the AP using the second circuit;

comparing the signal power level to a threshold;

turning on power to the first circuit;

turning off power to the second circuit or placing the second circuit in an idle mode when the signal is below the threshold; and

returning to scanning for base station identifiers using the first circuit.

5. The method of claim 1 further comprising:

determining a signal power level of each received base station signal using the first circuit;

determining from the signal power level of each received base station signal when the communications device is approaching the access point; and

issuing an alert when the communications device is approaching the access point.

6. The method of claim 1, wherein the communications device is a mobile device.

7. The method of claim 6, wherein the mobile device is selected from the group consisting of a cellphone, a smart phone, and a personal data assistant.

8. The method of claim 1 wherein the AP is selected from the group consisting of a Wi-Fi AP and a cellular AP.

9. The method of claim 1, wherein receiving a list of APs and associating each AP on the list of APs with one or more base stations comprises:

scanning for base station identifiers using the first circuit of the communications device when in proximity to a desired AP;

associating the received base station identifiers with the desired AP; and

saving the desired AP in association with the received base station identifiers to a memory of the communications device.

10. The method of claim 1, wherein receiving a list of APs and associating each AP on the list of APs with one or more base stations comprises:

providing location information of the communications device to a datastore via a network;

receiving from the datastore the list of APs, wherein each listed AP is associated with one or more base stations proximate to the AP.

11. A communications device comprising:

a first circuit;

a second circuit; and

a processor comprising software instructions that cause the communications device to perform functions comprising:

instructing the first circuit to scan for identifiers from one or more base stations;

determining whether the received base station identifiers are associated with an AP on a list of APs;

connecting to the AP when the received base station identifiers are associated with the AP using the second circuit.

12. The communications device of claim 11, wherein the processor further comprises software instructions that cause the communications device to perform functions comprising:

turning off power to the first circuit or placing the first circuit in an idle mode when connecting to the AP.

13. The communications device of claim 11, wherein the processor further comprises software instructions that cause the communications device to perform functions comprising:

turning on power to the second circuit when the received base station identifiers are associated with the AP.

14. The communications device of claim 11, wherein the processor further comprises software instructions that cause the communications device to perform functions comprising:

determining a signal power level of the AP using the second circuit;

comparing the signal power level to a threshold;

turning on power to the first circuit and turning off power to the second circuit or placing the second circuit in an idle mode when the signal is below the threshold; and

returning to scanning for first identifiers using the first circuit.

15. The communications device of claim 11, wherein the processor further comprises software instructions that cause the communications device to perform functions comprising:

determining a signal power level of each received base station signal using the first circuit;

determining from the signal power level of each received base station signal when the communications device is approaching the access point; and

issuing an alert when the communications device is approaching the access point.

16. The communications device of claim 11, wherein the communications device is a smartphone.

17. The communications device of claim 11 wherein the one or more base stations are selected from the group consisting of a Wi-Fi base station and a cellular base station.

18. The communications device of claim 11 wherein the AP is selected from the group consisting of a Wi-Fi AP and a cellular AP.

19. The communications device of claim 11, wherein the processor further comprises software instructions that cause the communications device to perform functions comprising:

instructing the first circuit to scan for identifiers from one or more base stations;

associating the received base station identifiers with the desired AP; and

saving the desired AP in association with the received base station identifiers to a memory of the communications device.

20. The communications device of claim 11, wherein the processor further comprises software instructions that cause the communications device to perform functions comprising:

providing location information of the communications device to a datastore via a network;

receiving from the datastore the list of APs, wherein each listed AP is associated with one or more base stations proximate to the AP.

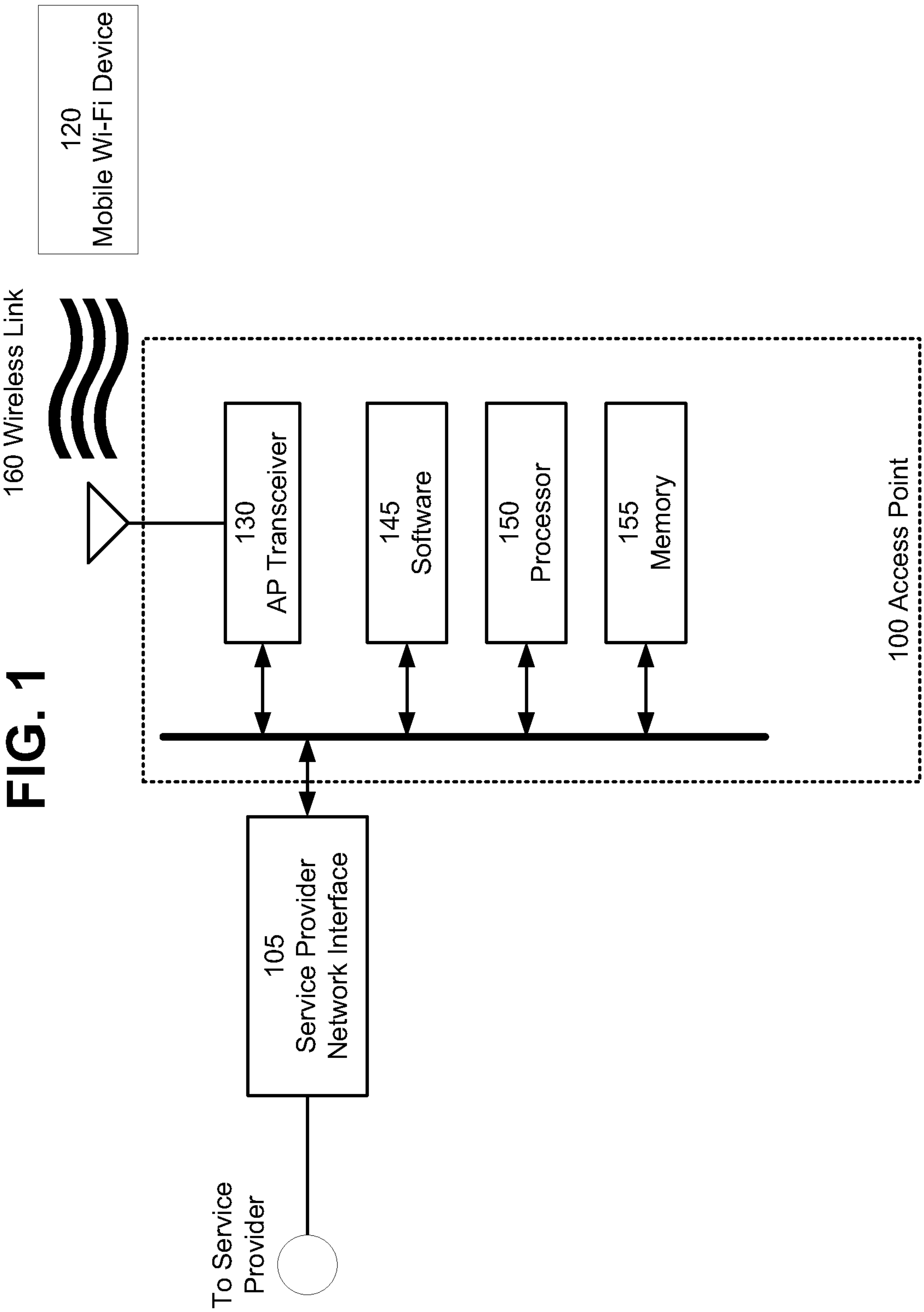

120
Mobile Wi-Fi Device
160 Wireless Link
130
AP Transceiver
145
Software
150
Processor
155
Memory
100 Access Point
105
Service Provider
Network Interface
To Service
Provider

FIG. 1

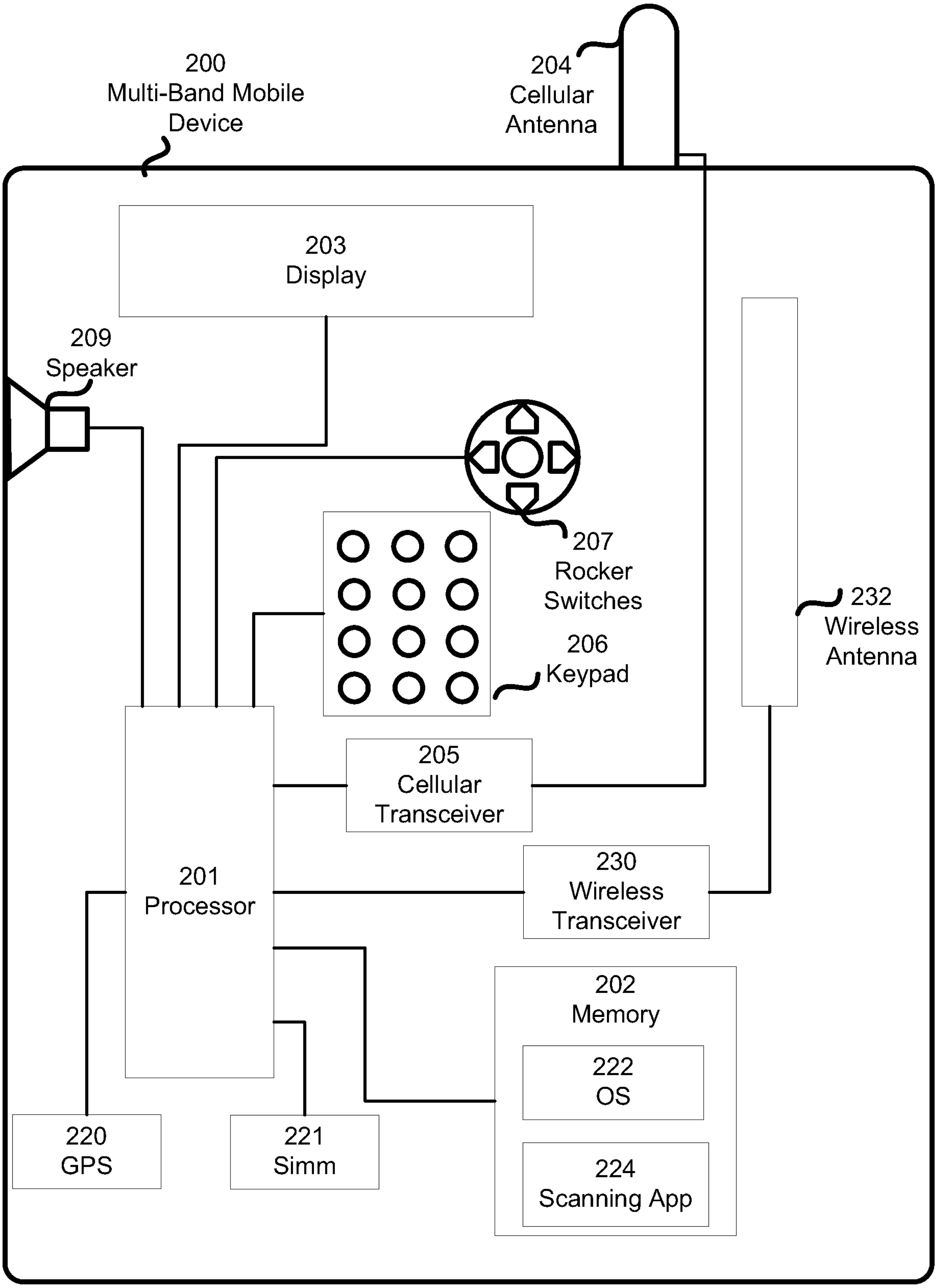

200
Multi-Band Mobile
Device
204
Cellular
Antenna
203
Display
209
Speaker
207
Rocker
Switches
206
Keypad
232
Wireless
Antenna
205
Cellular
Transceiver
201
Processor
230
Wireless
Transceiver
202
Memory
222
OS
224
Scanning App
220
GPS
221
Simm

FIG. 2

FIG. 3

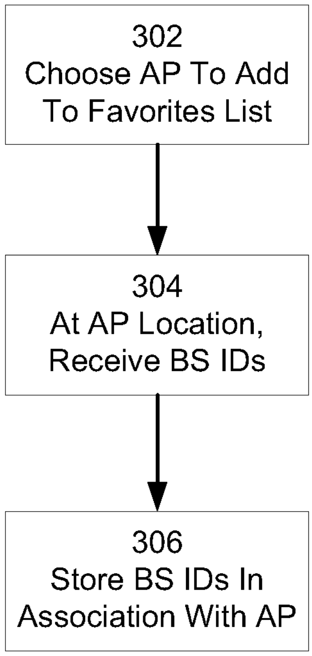
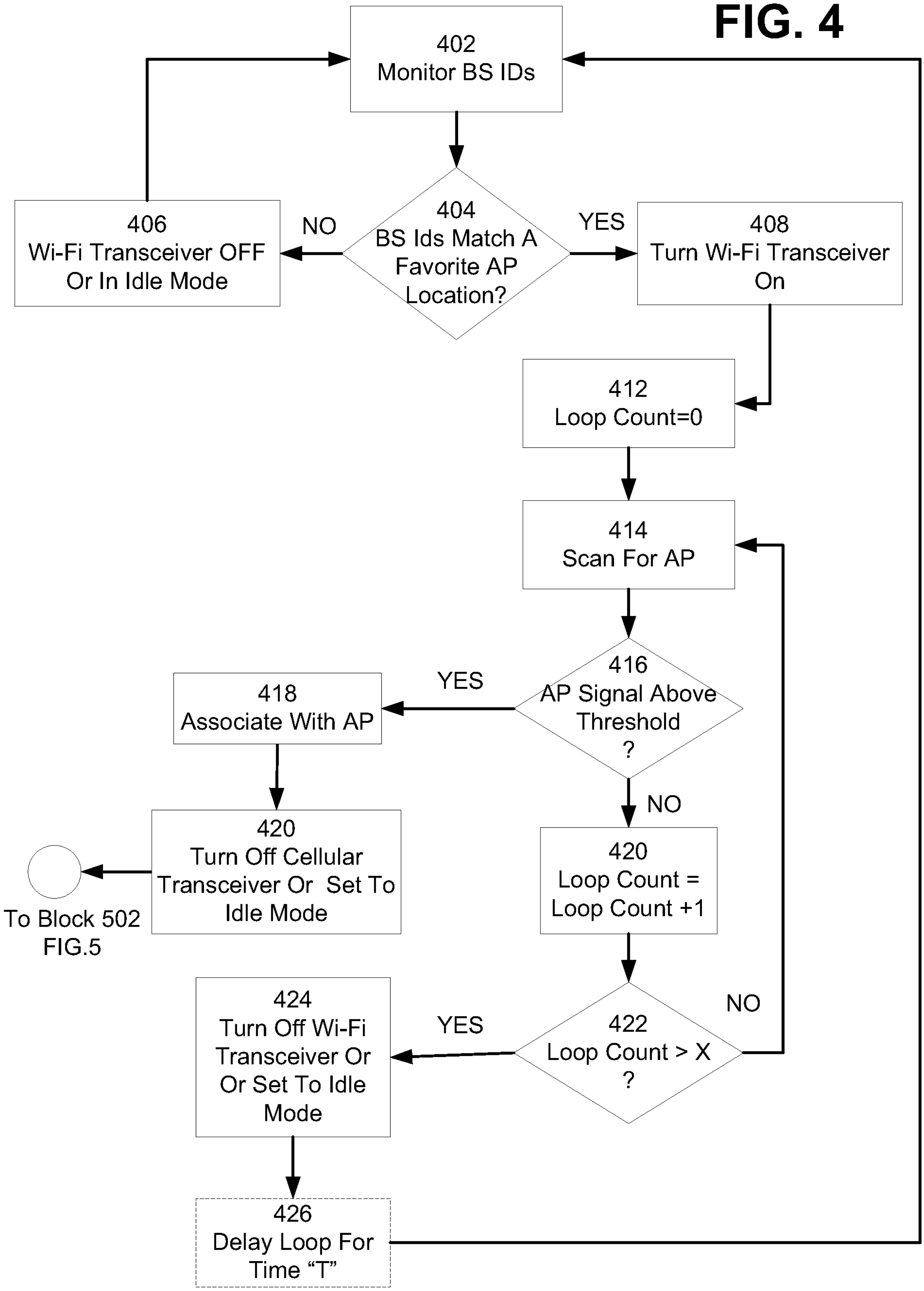

302
Choose AP To Add To Favorites List
304
At AP Location, Receive BS IDs
306
Store BS IDs In Association With AP

FIG. 4


402
Monitor BS IDs
404
BS Ids Match A
Favorite AP
Location?
NO
YES
406
Wi-Fi Transceiver OFF
Or In Idle Mode
408
Turn Wi-Fi Transceiver
On
412
Loop Count=0
414
Scan For AP
416
AP Signal Above
Threshold
?
YES
NO
418
Associate With AP
420
Turn Off Cellular
Transceiver Or Set To
Idle Mode
To Block 502
FIG.5
420
Loop Count =
Loop Count +1
422
Loop Count > X
?
YES
NO
424
Turn Off Wi-Fi
Transceiver Or
Or Set To Idle
Mode
426
Delay Loop For
Time "T"

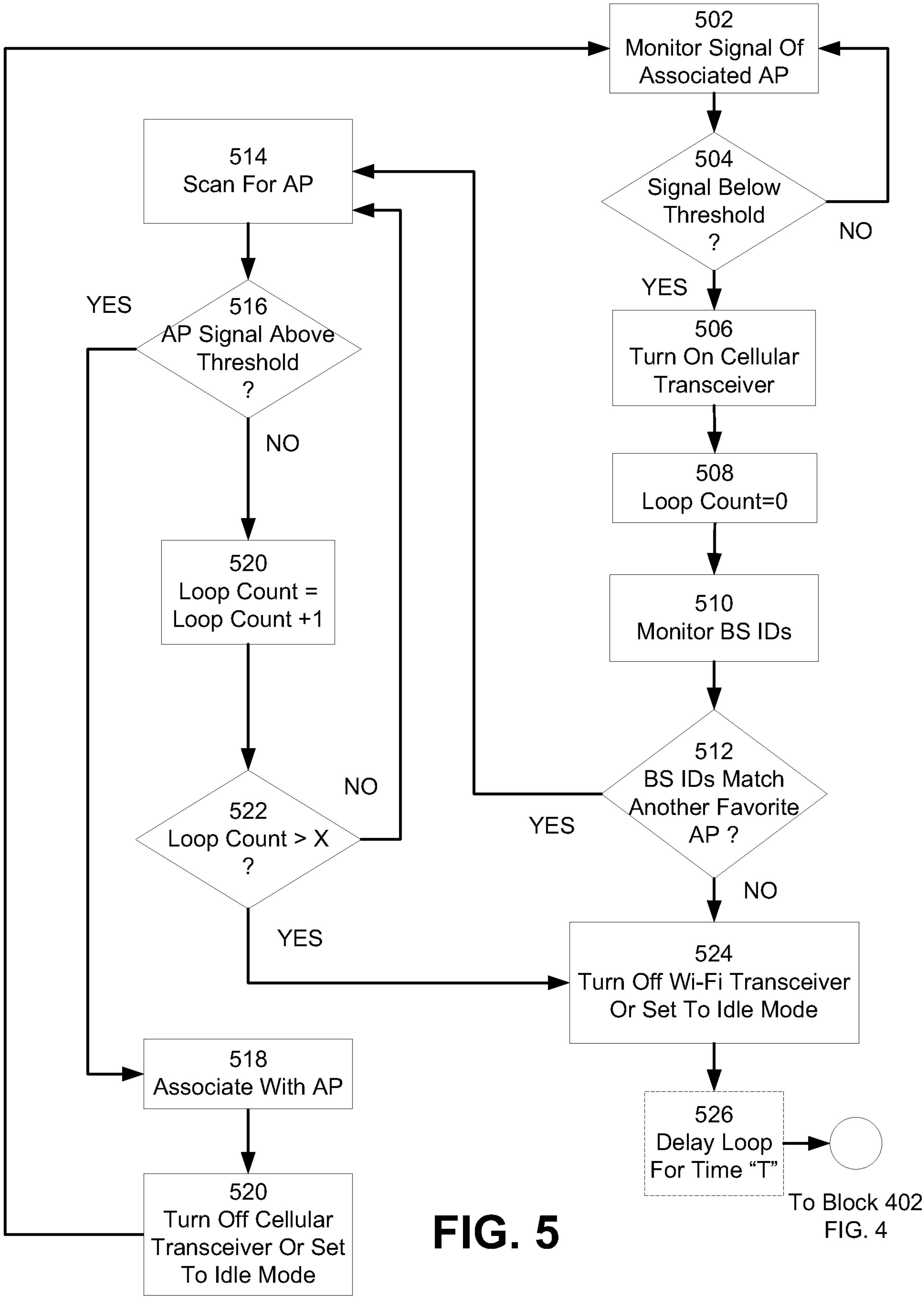

502
Monitor Signal Of Associated AP
504
Signal Below Threshold ?
NO
YES
506
Turn On Cellular Transceiver
508
Loop Count=0
510
Monitor BS IDs
512
BS IDs Match Another Favorite AP ?
YES
NO
514
Scan For AP
516
AP Signal Above Threshold ?
YES
NO
520
Loop Count = Loop Count +1
522
Loop Count > X ?
NO
YES
524
Turn Off Wi-Fi Transceiver Or Set To Idle Mode
526
Delay Loop For Time "T"
To Block 402 FIG. 4
518
Associate With AP
520
Turn Off Cellular Transceiver Or Set To Idle Mode

FIG. 5