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(54) METHOD AND APPARATUS FOR CONFIGURING A WLAN

(76) Inventor: **Gregory A. Dunko**, Cary, NC (US)

Correspondence Address:
COATS & BENNETT/SONY ERICSSON
1400 CRESCENT GREEN
SUITE 300
CARY, NC 27511 (US)

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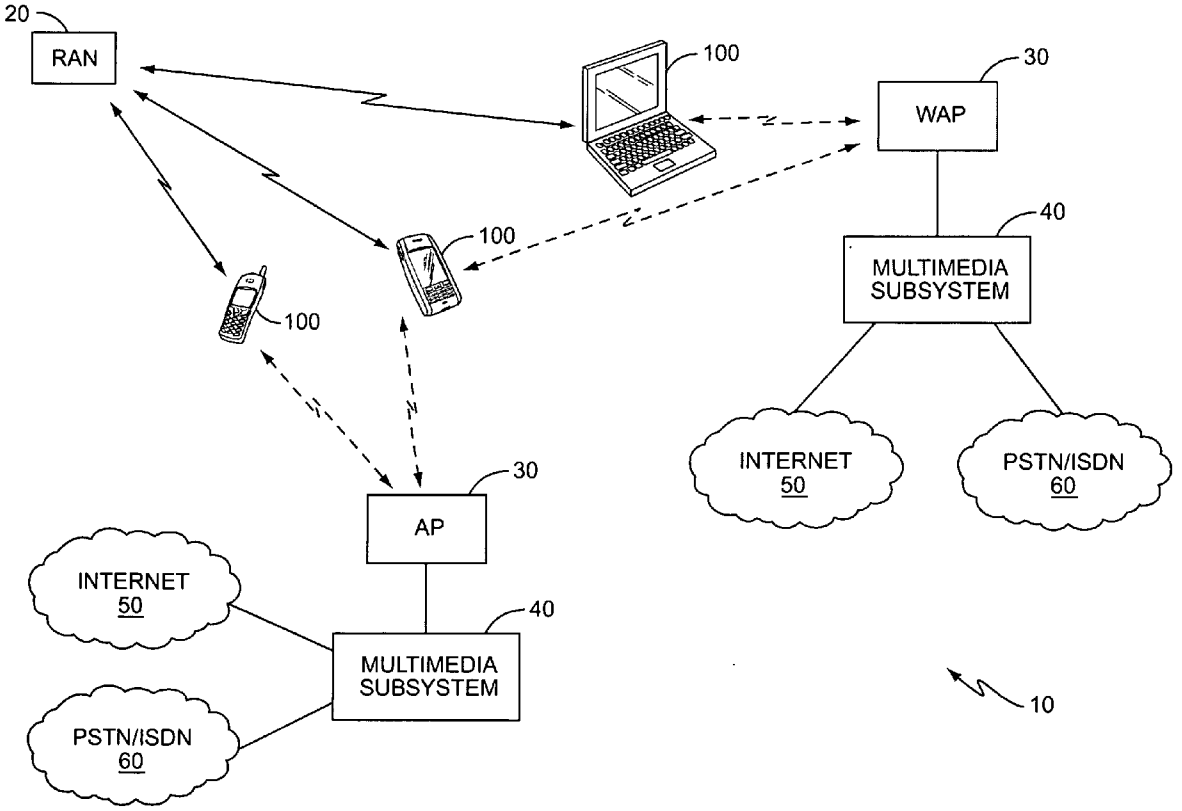
(57) **ABSTRACT**

A method and apparatus for adapting a wireless terminal to different short-range wireless network requirements based on a region of operation associated with a location of the wireless terminal as described herein. The wireless terminal determines a region of operation associated with the location of the wireless terminal. Exemplary regions of operation may include a country or a group of countries. Based on the determined region of operation, a controller in the wireless terminal configures a short-range wireless transceiver in the wireless terminal to operate within one or more operating parameters.



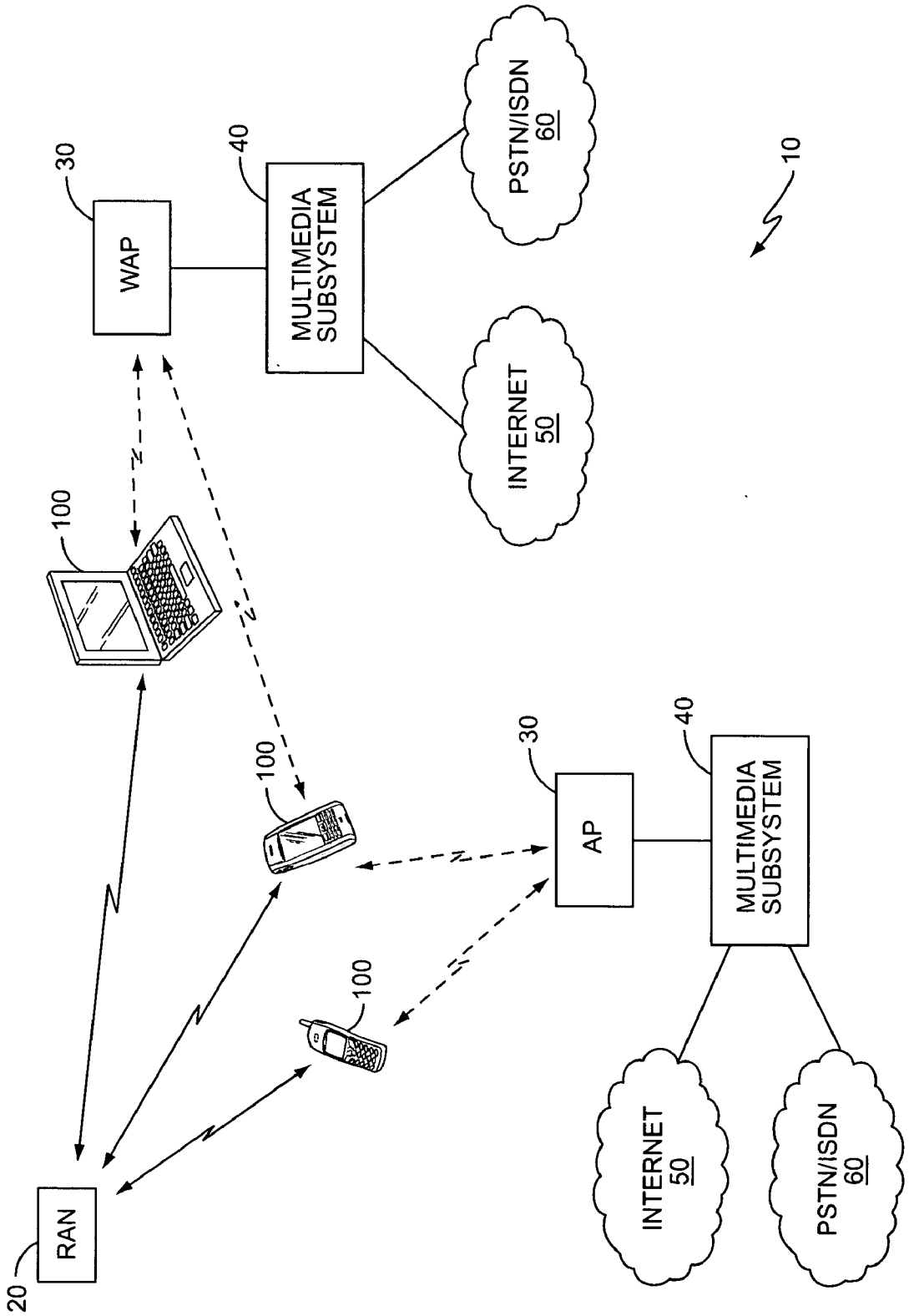

10
30
WAP
40
MULTIMEDIA SUBSYSTEM
PSTN/ISDN 60
INTERNET 50
100
100
100
30
AP
40
MULTIMEDIA SUBSYSTEM
INTERNET 50
PSTN/ISDN 60
20
RAN

FIG. 1

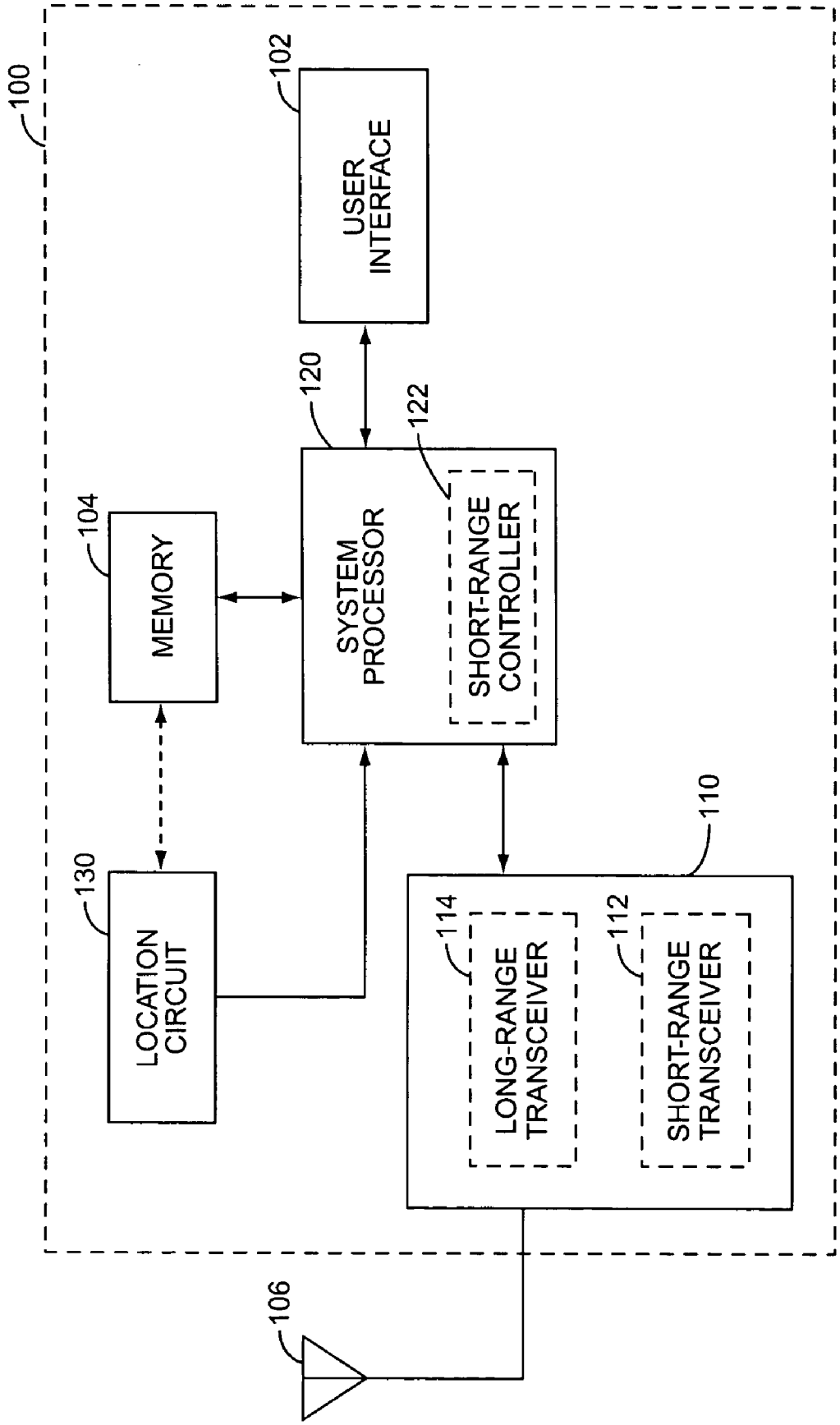

100
102
USER INTERFACE
120
122
SYSTEM PROCESSOR
SHORT-RANGE CONTROLLER
104
MEMORY
130
LOCATION CIRCUIT
110
114
LONG-RANGE TRANSCEIVER
112
SHORT-RANGE TRANSCEIVER
106

FIG. 2

REGION	FREQUENCY BAND (GHz)
UNITED STATES	2.412 - 2.462
	5.15 - 5.25
	5.25 - 5.35
	5.725 - 5.825
FRANCE	2.457 - 2.472
MEXICO	2.412 - 2.447
	2.452 - 2.462
EUROPE ETSI	2.412 - 2.472
	5.470 - 5.725
	5.25 - 5.35
CHINA	2.412 - 2.462
JAPAN	2.412 - 2.484
	18-20

FIG. 3

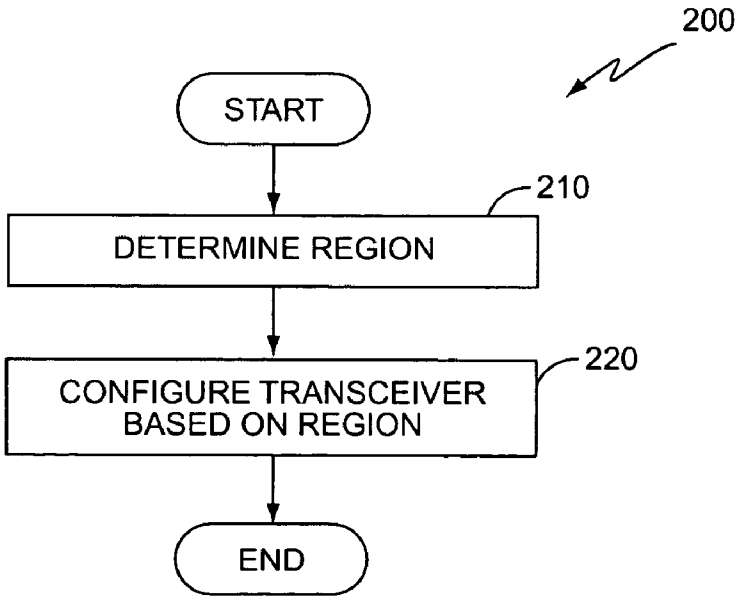


FIG. 4

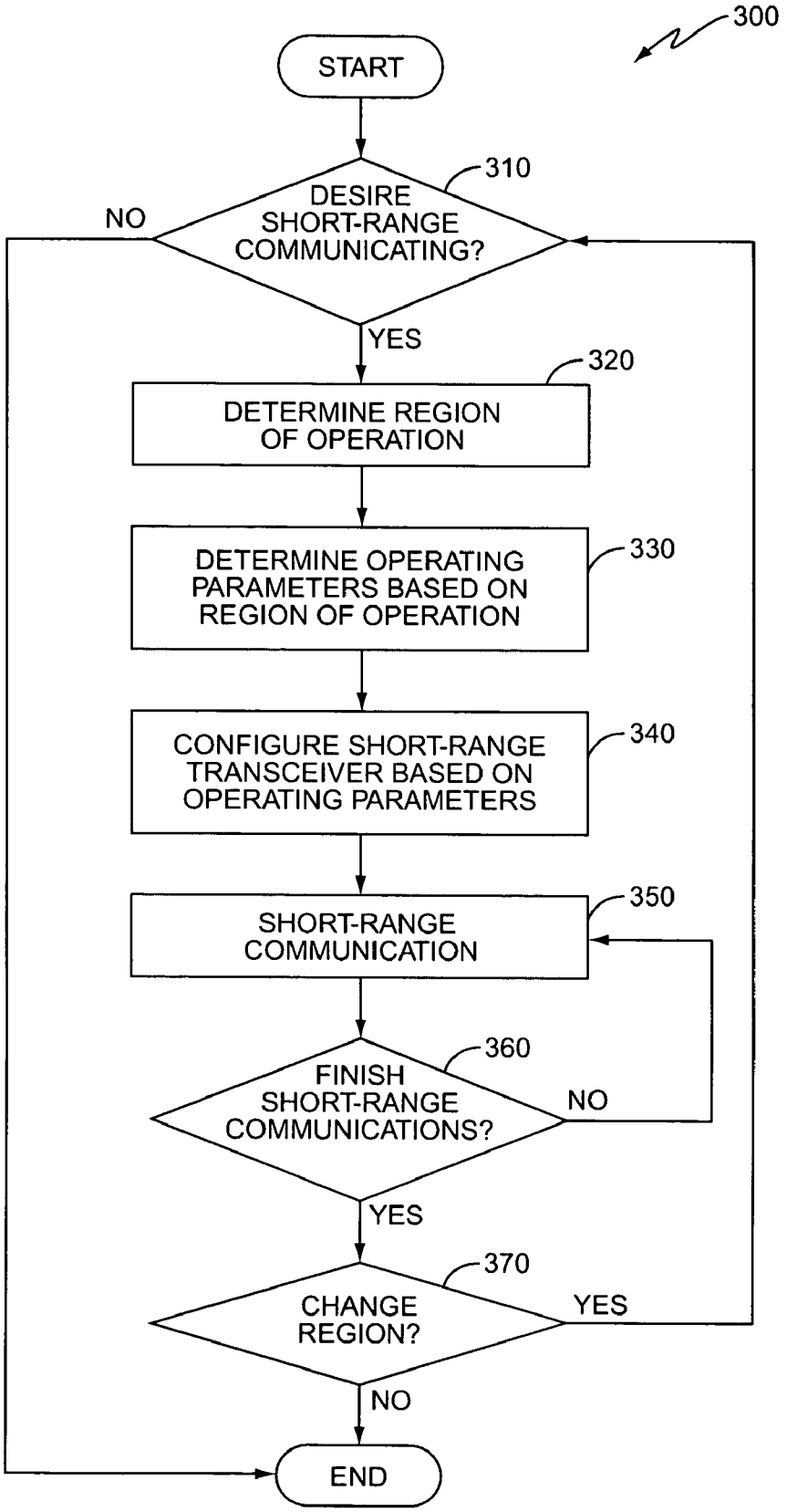

300
START
310
DESIRE SHORT-RANGE COMMUNICATING?
NO
YES
320
DETERMINE REGION OF OPERATION
330
DETERMINE OPERATING PARAMETERS BASED ON REGION OF OPERATION
340
CONFIGURE SHORT-RANGE TRANSCEIVER BASED ON OPERATING PARAMETERS
350
SHORT-RANGE COMMUNICATION
360
FINISH SHORT-RANGE COMMUNICATIONS?
NO
YES
370
CHANGE REGION?
YES
NO
END

FIG. 5

METHOD AND APPARATUS FOR CONFIGURING A WLAN

BACKGROUND OF THE INVENTION

[0001] The present invention relates generally to a short-range wireless network, and more particularly to the operation of wireless local area networks (WLANs) in different regions around the globe.

[0002] Short-range wireless networks, i.e., WLANs, use unlicensed frequency bands to communicate information over short distances. Such frequency bands include but are not limited to 2.4-2.4835 GHz, 5.15-5.25 GHz, 5.25-5.35 GHz, and 5.725-5.825 GHz. Due to the lack of an international standard, different regions of the globe use different frequency bands or portions of frequency bands for the same short-range wireless applications. For example, the United States may use a 2.412-2.462 GHz frequency band for WLAN applications, while France may use a 2.457-2.472 GHz frequency band. Further, while the United States and Europe both use the 5.25-5.35 GHz frequency band for WLAN applications, the United States allows this frequency band to be used for both indoor and outdoor applications, while Europe restricts this band to indoor applications.

[0003] As the popularity of WLAN and other short-range wireless networks continues to increase, the likelihood of a user traveling through different regions with different short-range network requirements necessarily increases. However, conventional wireless terminals are typically configured with specific operating parameters that correspond only to a specific region. Therefore, conventional wireless terminals will not operate properly in other regions across the globe that require different operating parameters.

SUMMARY OF THE INVENTION

[0004] The present invention comprises a method and apparatus that adapts a wireless terminal to different short-range wireless network requirements in different regions across the globe. In particular, a wireless terminal according to the present invention determines its current regional location. For example, the wireless terminal may determine the country associated with the location of the wireless terminal. Based on the determined region of operation, a controller in the wireless terminal configures the wireless terminal's short-range wireless transceiver to operate within one or more operating parameters, such as a defined WLAN frequency spectrum.

BRIEF DESCRIPTION OF THE DRAWINGS

[0005] **FIG. 1** illustrates an exemplary wireless system.

[0006] **FIG. 2** illustrates a block diagram of one exemplary wireless terminal according to the present invention.

[0007] **FIG. 3** illustrates one exemplary table of operating parameters for multiple regions of operation.

[0008] **FIG. 4** illustrates one exemplary method of the present invention.

[0009] **FIG. 5** illustrates another exemplary method of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0010] **FIG. 1** illustrates an exemplary wireless system **10** that includes at least one Radio Access Network (RAN) **20** and at least one Wireless Access Point (WAP) **30** that interfaces with one or more wireless terminals **100** over a long-range network and a short-range network, respectively. **FIG. 1** illustrates a limited number of RANs **20**, WAPs **30**, and wireless terminals **100** for clarity. However, those skilled in the art will appreciate that wireless system **10** may include any number of RANs **20**, WAPs **30**, and/or wireless terminals **100**.

[0011] RAN **20** communicates with wireless terminals **100** via a long-range wireless network, such as a cellular network, according to any known means. As understood by those skilled in the art, RAN **20** and wireless terminals **100** may communicate any known type of information, such as voice, data, or a combination of voice and data. Further, RAN **20** and wireless terminals **100** may communicate this information according to any known communication standard, including but not limited to the standards known generally as GSM (Global System for Mobile Communications), GPRS (General Packet Radio Service), TIA/EIA-136, cdmaOne, cdma2000, UMTS (Universal Mobile Telecommunications System), and Wideband CDMA (Code Division Multiple Access).

[0012] Each WAP **30** provides short-range wireless communication links (e.g., WLAN links) to one or more wireless terminals **100**. Short-range wireless networks enable a wireless terminal **100** to interface with a multi-media subsystem **40** via WAP **30**. As a result, the wireless terminal **100** may exchange information with various multi-media elements, such as the Internet **50**, a PSTN/ISDN **60**, etc., without requiring a wire interface between the wireless terminal **100** and the multi-media subsystem **40**. As a result, a user may browse the Internet **50**, check email, establish a voice over IP call, etc., from any region that supports short-range wireless networks.

[0013] **FIG. 2** illustrates a block diagram of one exemplary wireless terminal **100** according to the present invention. As used herein, the term "wireless terminal" represents any wireless device capable of wireless communication. A non-limiting list of wireless terminals includes a cellular radiotelephone with or without a multi-line display; a Personal Communication System (PCS) terminal that may combine a cellular radiotelephone with data processing, facsimile, and data communication capabilities; a Personal Digital Assistant (PDA) that can include a radiotelephone, pager, Internet/intranet access, web browser, organizer, calendar, and/or a global positioning system (GPS) receiver; and a laptop and/or palmtop receiver or other appliance capable of long-range and short-range wireless communication.

[0014] Wireless terminal **100** includes a user interface **102**, memory **104**, antenna **106**, transceiver **110**, system processor **120**, and location circuit **130**. User interface **102** enables the user to interact with and control wireless terminal **100**. The user interface **102** may include a display, one or more user input devices, such as a keypad, joystick, etc., a microphone, and/or a speaker.

[0015] Antenna **106**, coupled to transceiver **110**, receives and transmits wireless signals to RAN **20** and/or WAP **30**. Transceiver **110** preferably includes baseband processing circuits to process signals received by the transceiver **110**. Alternatively, baseband processing circuits may be incorporated in the system processor **120**.

[0016] As shown in **FIG. 2**, transceiver **110** includes a long-range transceiver **114** and a short-range transceiver **112**. Long-range transceiver **114** represents a fully functional cellular radio transceiver that operates according to any known cellular standard, including the standards known generally as the GSM, GPRS, TIA/EIA-136, cdmaOne, cdma2000, UMTS, and Wideband CDMA. Short-range transceiver **112** transmits and receives wireless signals between wireless terminal **100** and WAP **30** or other wireless port over a short distance, e.g., less than 1000 feet. For example, short-range transceiver **112** may comprise a WLAN transceiver that operates according to IEEE 802.11 standards to enable wireless terminal **100** to interface with multi-media subsystem **40** via WAP **30**. While **FIG. 1** shows a single antenna **106** for both transceivers **112**, **114**, it will be appreciated by those skilled in the art that antenna **106** may comprise one or more antennas for each of the short-range transceiver **112** and the long-range transceiver **114**.

[0017] System processor **120** performs various processing tasks, including controlling the overall operation of wireless terminal **100** according to programs stored in memory **104**. The system processor **120** may be implemented in hardware, firmware, software, or a combination thereof, and may comprise a single microprocessor or multiple microprocessors. The microprocessors may be general purpose microprocessors, digital signal processors, or other special purpose processors. Functions performed by system processor **120** may include signal processing, image processing, and control of the overall operation of wireless terminal **100**. In accordance with the present invention, and as discussed in greater detail below, system processor **120** may include a short-range controller **122**. While **FIG. 2** illustrates a specific short-range controller integrated with system processor **120**, those skilled in the art will appreciate that the function of short-range controller **122** may be incorporated with the other functions of system processor **120**. Further, those skilled in the art will appreciate that short-range controller **122** may be implemented independently from system processor **120**.

[0018] Memory **104** may include both random access memory (RAM) and read-only memory (ROM). Computer program instructions and data required for operation of wireless terminal **100** may be stored in non-volatile memory, such as EPROM, EEPROM, and/or flash memory, which may be implemented as discrete devices, stacked devices, or integrated with system processor **120**.

[0019] In accordance with the present invention, short-range controller **122** configures short-range transceiver **112** to operate within one or more operating parameters corresponding to a region of operation associated with a location of wireless terminal **100**. Therefore, as a wireless terminal **100** moves from one region to another region, short-range controller **122** modifies the configuration of the short-range transceiver **112** to conform to the requirements of the current region of operation.

[0020] Wireless terminal **100** may determine the region of operation according to any known means. In one exemplary embodiment, the wireless terminal **100** may extract location information from control information broadcast to the wireless terminal **100** via the long-range wireless network. As understood by those skilled in the art, when a wireless terminal **100** enters a cellular network, RAN **20** broadcasts control information to the wireless terminal **100**. Wireless terminal **100** may use this control information to identify the network, identify a region of operation, establish a connection within the network, etc. For example, in a GPRS network, the broadcast control information includes a Mobile Country Code (MCC) and a Mobile Network Code (MNC). Based on the MCC/MNC information, the wireless terminal **100** may determine the identity and location of the network. For example, an MCC/MNC=310/150 translates to Cingular® in the United States.

[0021] Wireless terminal **100** typically uses the MCC/MNC information to determine if wireless terminal **100** is subject to roaming charges, long distance charges, and/or various other fees associated with a user's particular cellular service plan. However, according to the present invention, wireless terminal **100** may also use this broadcast control information to identify a region of operation associated with a location of wireless terminal **100** for short-range wireless activities. To that end, in one exemplary embodiment, wireless terminal **100** may include a location circuit **130** as shown in **FIG. 2**. While **FIG. 2** illustrates a location circuit **130** separate from the system processor **120**, those skilled in the art will appreciate that location circuit **130** may be incorporated with system processor **120**.

[0022] After receiving the broadcast control information at long-range transceiver **114**, system processor **120** provides this information to location circuit **130**. Location circuit **130** uses the MCC and/or MNC information to determine the current region of operation associated with the location of the wireless terminal **100**. Table **1** below lists several MCCs and their corresponding regions.

TABLE 1

Mobile Country Codes

MCC	Region of Operation
310–316	United States
240	Sweden
461	China
440, 441	Japan
208	France
262	Germany
214	Spain

[0023] The above discusses how location circuit **130** may use the broadcast control information to determine a region of operation associated with the location of wireless terminal **100**. However, the present invention may use other means to determine the region of operation. For example, according to another embodiment, location circuit **130** may comprise a GPS (Global Positioning System) that determines a location of the wireless terminal **100** according to any conventional means. Alternatively, an external device may provide wireless terminal **100** with coordinates corresponding to its location. In any event, location circuit **130** processes the location information to identify the region of operation.

[0024] Based on the region of operation associated with the location of wireless terminal **100**, location circuit **130** determines the appropriate operating parameters, such as transmission frequency band, transmission power, etc., for short-range transceiver **112**. Location circuit **130** may use any means to identify the particular operating parameters

appropriate for the current region of operation. For example, location circuit **130** may request operating parameter information from an external source, such as RAN **20**, based on the determined region of operation. Alternatively, location circuit **130** may access a look-up table stored in memory **104** to determine the appropriate operating parameters. **FIG. 3** illustrates one exemplary look-up table that associates particular frequency bands with specific countries/regions. Those skilled in the art will appreciate that this table is for illustrative purposes only. Other look-up tables that include different and/or additional operating parameters, i.e., transmit power, bit rate, etc., may also be used.

[**0025**] As shown in **FIG. 3**, if location circuit **130** determines that wireless terminal **100** is operating in France, for example, then location circuit **130** determines that the short-range transceiver must operate within the 2.457-2.472 GHz frequency band. As another example, if location circuit **130** determines that wireless terminal **100** is operating in Mexico, then location circuit **130** determines that the short-range transceiver must operate within the 2.412-2.447 GHz frequency band for indoor transmissions, or within the 2.452-2.462 GHz frequency band for both indoor and outdoor transmissions. In any event, short-range controller **122** configures the short-range transceiver **112** to operate within the operating parameters identified by location circuit **130**.

[**0026**] The above discusses specific devices that may be used to configure the operating parameters of a short-range transceiver **112** corresponding to a current region of operation. However, those skilled in the art will appreciate that the present invention is not limited to these specific devices. The present invention may be implemented in any hardware, software, or combination of hardware and software that implements the general process **200** of the present invention, illustrated in **FIG. 4**. In particular, the present invention may be implemented in any hardware and/or software system that first determines the region of operation associated with the location of wireless terminal **100** (block **210**) and then configures the short-range transceiver **112** to operate according to one or more operating parameters corresponding to the determined region of operation (block **220**).

[**0027**] **FIG. 5** illustrates another exemplary process **300** for a specific embodiment of the general process **200**. This exemplary process is for illustrative purposes only and is not intended to be limiting. When wireless terminal **100** desires to participate in short-range communications (block **310**), such as WLAN communications, location circuit **130** determines the region of operation associated with the location of the wireless terminal **100** (block **320**). For example, long-range transceiver **114** may receive and provide the MCC to location circuit **130**. Based on the location information, location circuit **130** determines the appropriate operating parameters for short-range transceiver **112** (block **330**). For example, location circuit **130** may use a look-up table stored in memory **104** to determine the appropriate operating parameters.

[**0028**] Short-range controller **122** then configures the short-range transceiver **112** based on the determined operating parameters (block **340**). Once configured, short-range transceiver **112** may communicate within the short-range wireless network **32** (block **350**). For example, short-range transceiver **112** may communicate with WAP **30** to enable the user to browse the Internet or check email. This process continues until the short-range communications are terminated (block **360**). Further, if the region changes (block **370**), the short-range controller **122** reconfigures the short-range wireless transceiver as necessary (blocks **310-360**).

[**0029**] The above invention is described in terms of a wireless terminal **100** having a short-range transceiver **112** that communicates within a short-range wireless network and a long-range transceiver **114** that communicates within a long-range wireless network. It will be appreciated by those skilled in the art that the short-range wireless network may comprise any known short-range wireless network, such as a WLAN complying with any of the 802.11 standards, a HiperLAN network, a Bluetooth® network, an infrared network, etc.

[**0030**] Further it will be appreciated that location circuit **130** may determine a location or current region of operation according to any known means. As such, location circuit **130** may determine the region of operation using an MCC or any other country/region information broadcast by a RAN **20** in a long-range wireless network. Further, location circuit **130** may determine the region of operation using a GPS or other position determining means.

[**0031**] The present invention may, of course, be carried out in other ways than those specifically set forth herein without departing from essential characteristics of the invention. The present embodiments are to be considered in all respects as illustrative and not restrictive, and all changes coming within the meaning and equivalency range of the appended claims are intended to be embraced therein.

What is claimed is:

1. A method of configuring a short-range wireless transceiver in a wireless terminal for operation in a short-range wireless network, the method comprising:

determining a region of operation associated with a location of the wireless terminal; and

configuring the short-range wireless transceiver to operate according to one or more operating parameters corresponding to the region of operation.

2. The method of claim 1 wherein configuring the short-range wireless transceiver comprises configuring the short-range wireless transceiver to operate within a predetermined frequency band corresponding to the region of operation.

3. The method of claim 2 wherein configuring the short-range wireless transceiver to operate within the predetermined frequency band comprises configuring the short-range wireless transceiver to operate within at least one of a 2.4 GHz and a 5 GHz frequency band.

4. The method of claim 1 further comprising receiving location information via a cellular transceiver, wherein determining the region of operation comprises determining the region of operation corresponding to the location information.

5. The method of claim 4 wherein the location information comprises a mobile country code.

6. The method of claim 1 wherein determining the region of operation comprises processing location coordinates provided by a location circuit to determine the region of operation.

7. The method of claim 6 wherein the location coordinates comprise global positioning system coordinates.

8. The method of claim 1 further comprising using a look-up table to determine the one or more operating parameters corresponding to the region of operation.

9. The method of claim 1 further comprising receiving the one or more operating parameters via a long-range wireless interface based on the region of operation.

10. The method of claim 1 wherein configuring the short-range wireless transceiver comprises configuring the short-range wireless transceiver to operate within a predetermined transmit power range corresponding to the region of operation.

11. The method of claim 1 wherein the short-range wireless network comprises a wireless local area network.

12. A wireless terminal comprising:

a short-range transceiver configured to transmit and receive wireless signals within a short-range wireless network; and

a controller to configure the short-range transceiver to operate within one or more operating parameters corresponding to a region of operation associated with a location of the wireless terminal.

13. The wireless terminal of claim 12 wherein the one or more operating parameters comprise at least one of a frequency band and a transmit power.

14. The wireless terminal of claim 12 wherein the region of operation includes at least one country.

15. The wireless terminal of claim 12 further comprising a cellular transceiver configured to receive control information corresponding to the location of the wireless terminal.

16. The wireless terminal of claim 15 further comprising a location circuit configured to determine the region of operation based on the received control information.

17. The wireless terminal of claim 15 wherein the received control information includes a mobile country code.

18. The wireless terminal of claim 15 wherein the cellular transceiver further receives the one or more operating parameters via a cellular network corresponding to the region of operation.

19. The wireless terminal of claim 12 further comprising a global positioning system circuit to determine location information corresponding to the location of the wireless terminal.

20. The wireless terminal of claim 12 further comprising memory to store a parameter table that cross-references different regions of operation with one or more different operating parameters.

21. The wireless terminal of claim 20 wherein the controller is further configured to look up the one or more operating parameters in the parameter table based on the determined region of operation.

22. The wireless terminal of claim 12 wherein the short-range wireless network includes at least one of a wireless local area network, an ad hoc network, and a Hiper local area network.

23. The wireless terminal of claim 12 wherein the wireless terminal comprises a cellular telephone.

24. A cellular telephone comprising:

a cellular transceiver configured to transmit and receive cellular signals within a cellular network;

a short-range wireless transceiver configured to transmit and receive wireless signals within a short-range wireless network; and

a controller to configure the short-range wireless transceiver to operate within one or more operating parameters based on control information received by the cellular transceiver.

25. The cellular telephone of claim 24 wherein the control information includes a mobile country code that identifies a region of operation associated with a location of the wireless terminal.

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