(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
14 August 2014 (14.08.2014)

WIPO | PCT

(10) International Publication Number
WO 2014/124169 A1

(51) International Patent Classification:
G10L 19/018 (2013.01)

(21) International Application Number:
PCT/US2014/015149

(22) International Filing Date:
6 February 2014 (06.02.2014)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:

61/761,577	6 February 2013 (06.02.2013)	US
61/838,766	24 June 2013 (24.06.2013)	US
13/933,013	1 July 2013 (01.07.2013)	US

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(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

(54) Title: ENCODING AND DECODING AN AUDIO WATERMARK

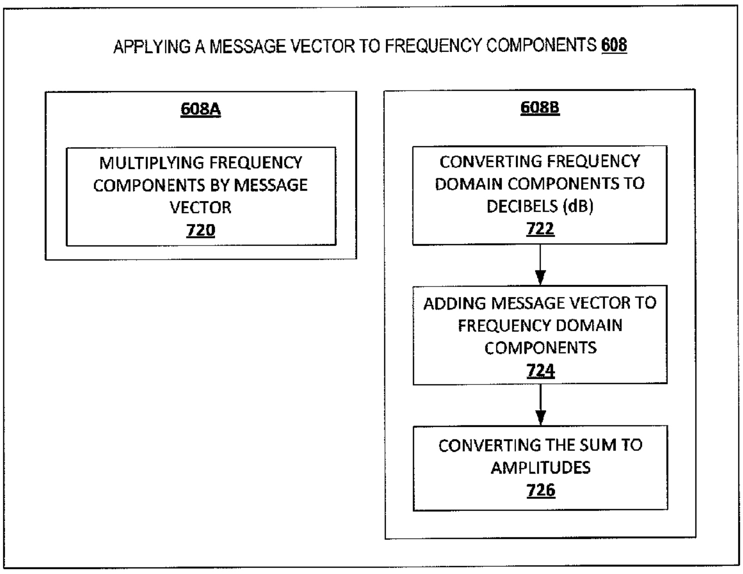

FIG. 7

(57) **Abstract**: Embodiments of the invention are directed to systems, methods and computer program products for providing targeted location-based communications. An exemplary apparatus is configured to receive an encoded signal, decode the encoded signal such that embedded data is retrieved, send the embedded data a remote server; and receive a message based at least partially on sending the embedded data. Another exemplary apparatus is configured to provide the encoded signal by receiving data input, receiving a host signal, embedding the data input within the host signal such that an encoded signal is generated, and transmitting the encoded signal. A third exemplary apparatus is configured to provide the targeted communications by storing one or more messages associated with an entity, receiving data, selecting at least one of the one or more messages based at least partially on the data received, and sending the at least one of the one or more messages selected.

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ENCODING AND DECODING AN AUDIO WATERMARK

CLAIM OF PRIORITY UNDER 35 U.S.C. § 119

[0001] This Non-provisional Patent Application claims priority to U.S. Provisional Patent Application Serial Number 61/761,577, filed February 6, 2013, entitled "TARGETING LOCATION-BASED COMMUNICATIONS", and to U.S. Provisional Patent Application Serial Number 61/838,766, filed June 24, 2013, entitled "TARGETING LOCATION-BASED COMMUNICATIONS", both of which are assigned to the assignee hereof and hereby expressly incorporated by reference herein.

BACKGROUND

[0002] Typically, businesses have no way to identify consumers that are within their business location or to provide targeted communications to consumers who are present in the location. This limits the business to alternative means for providing consumers with relevant information as they frequent these locations. For example, merchants typically utilize mailing services to provide consumers with coupons, special in-store deals or sales ads. These methods fail to provide real-time location-specific communications, such as promotional offers, to consumers.

BRIEF SUMMARY

[0003] Embodiments of the invention are directed to systems, methods, and computer program products for providing location-based communications. Data input and a host signal are sent to an encoding device for encoding. The encoding device embeds the data input within a host signal to generate an encoded or watermarked signal. The embedded data is masked by the host signal, usually comprising an audio signal, and transmitted in conjunction with the audio signal throughout a merchant area by a broadcasting device. The encoded signal is received by a user's mobile device, which decodes the encoded signal and sends the embedded data or a signal based on the embedded data to a server application. The server application may look up the embedded data or otherwise determine at least one message to send to the mobile device based on the embedded data. For example, the server application may use a lookup table to determine a message corresponding with the embedded data. The server application then sends the message(s) to the mobile device for presentation to a user.

[0004] According to some embodiments of the invention, a system for creating an audio watermark signal by encoding a message comprising data, the message encoded with a host signal in the audible frequency range includes at least one encoding device comprising a processing device to receive the host signal and data to be encoded; read a frame from the host signal; transform the frame from the time domain to the frequency domain; apply at least one message vector to a plurality of frequency components of the frame, wherein the at least one message vector comprises a randomly generated signal having an equal number of positive components and negative components, the positive components each having substantially the same amplitude and the negative components each having substantially the same amplitude, the amplitude of the positive components and the amplitude of the negative components having substantially the same absolute value; and transform the frame from the frequency domain to the time domain.

[0005] In some embodiments, the processing device is further to append the frame to a previously encoded frame.

[0006] In some embodiments, applying at least one message vector to a plurality of components of the frame comprises applying a one bit message vector to some of the plurality of frequency components of the frame to encode a one; and applying a zero bit message vector to others of the plurality of frequency components of the frame to encode a zero. In some such embodiments, the zero bit message vector is the one bit message vector multiplied by negative one. In some of these embodiments, substantially all or all bits of the data are encoded such that they might be decoded by considering one frame of the audio watermark signal.

[0007] In some embodiments, applying at least one message vector to a plurality of components of the frame comprises multiplying the frequency components by the at least one message vector.

[0008] In some embodiments, applying at least one message vector to a plurality of components of the frame comprises converting the components to decibels; adding the message vector to the converted components resulting in a sum; and converting the sum to a plurality of amplitudes.

[0009] According to embodiments of the invention, a computer program product for providing communications to users present in at least one location of a plurality of locations includes a non-transitory computer-readable medium comprising a set of codes for causing a computer to receive the host signal and data to be encoded; read a frame from the host signal; transform the frame from the time domain to the frequency domain; apply at least one message vector to a plurality of frequency components of the frame, wherein the at least one message vector comprises a randomly generated signal having an equal number of positive components and negative components, the positive components each having substantially the same amplitude and the negative components each having substantially the same amplitude, the amplitude of the positive components and the amplitude of the negative components having substantially the same absolute value; and transform the frame from the frequency domain to the time domain.

[0010] According to embodiments of the invention, a method for creating an audio watermark signal by encoding a message comprising data, the message encoded with a host signal in the audible frequency range includes receiving the host signal and data to be encoded; reading a frame from the host signal; transforming the frame from the time domain to the frequency domain; applying at least one message vector to a plurality of frequency components of the frame, wherein the at least one message vector comprises a randomly generated signal having an equal number of positive components and negative components, the positive components each having substantially the same amplitude and the negative components each having substantially the same amplitude, the amplitude of the positive components and the amplitude of the negative components having substantially the same absolute value; and transforming the frame from the frequency domain to the time domain.

[0011] According to embodiments of the invention, a system for decoding an audio watermark signal in the audible frequency range, the system comprising a processing device to receive the audio watermark signal; read a frame from the audio watermark signal; transform the frame from the time domain to the frequency domain; convert the frame to decibels; apply at least one message vector to a plurality of frequency components of the frame, wherein the at least one message vector comprises a randomly generated signal having an equal number of positive components and negative components, the positive components each having substantially the same amplitude and the negative components each having substantially the same amplitude, the amplitude of the positive components and the amplitude of the negative components having substantially the same absolute value; average the amplitudes of the plurality of frequency components for which the at least one message vector was applied; and determine, based on the amplitude averaging, the encoded data.

[0012] In some embodiments, determining comprises determining whether the average amplitude is greater than or less than zero; assigning a one bit to the data when the average amplitude is greater than zero; and assigning a zero bit to the data when the average amplitude is less than zero. In some embodiments, determining determining that the average amplitude is greater than a predetermined threshold based at least in part on the absolute value of the components of the at least one message vector; and assigning a one bit to the data.

[0013] In some embodiments, determining comprises determining that the average amplitude is less than a predetermined threshold based at least in part on the absolute value of the components of the at least one message vector; and assigning a zero bit to the data.

[0014] In some embodiments, applying comprises multiplying the at least one message vector by the plurality of frequency components of the frame.

[0015] According to embodiments of the invention, a system for creating an audio watermark signal by encoding a message comprising data, the message encoded in the ultrasonic frequency range, the system comprising at least one encoding device comprising a processing device to receive the data to be encoded; generate at least one message vector, wherein the at least one message vector comprises a randomly generated signal having an equal number of positive components and negative components, the positive components each having substantially the same amplitude and the negative components each having substantially the same amplitude, the amplitude of the positive components and the amplitude of the negative components having substantially the same absolute value; determine that the data to be encoded comprises a one bit; determine which components correspond to negative values and set them to zero; generate a sine wave signal for each component that corresponds to positive values; add all the sine waves, thereby creating an audio watermark signal.

[0016] In some such embodiments, the processing device is further to determine that the data to be encoded comprises a zero bit; multiply the at least one message vector by negative one; determine which components correspond to negative values and set them to zero; generate a sine wave signal for each component that corresponds to positive values; add all the sine waves, thereby creating an audio watermark signal.

[0017] In other such embodiments, the processing device is further to determine that the data to be encoded comprises a zero bit; determine which components correspond to positive values and set them to zero; multiply the at least one message vector by negative one, thereby resulting in the message vector having only positive value components; generate a sine wave signal for each component that corresponds to positive values; add all the sine waves, thereby creating an audio watermark signal.

[0018] According to embodiments of the invention, a system for decoding an audio watermark signal in the ultrasonic frequency range includes processing device to receive the audio watermark signal; read a frame from the audio watermark signal; transform the frame from the time domain to the frequency domain; convert the frame to decibels; apply at least one message vector to a plurality of frequency components of the frame, wherein the at least one message vector comprises a randomly generated signal having an equal number of positive components and negative components, the positive components each having substantially the same amplitude and the negative components each having substantially the same amplitude, the amplitude of the positive components and the amplitude of the negative components having substantially the same absolute value; average the amplitudes of the plurality of frequency components for which the at least one message vector was applied; and determine, based on the amplitude averaging, the encoded data.

[0019] In some embodiments, determining comprises determining whether the average amplitude is greater than or less than zero; assigning a one bit to the data when the average amplitude is greater than zero; and assigning a zero bit to the data when the average amplitude is less than zero. In some embodiments, determining includes determining that the average amplitude is greater than a predetermined threshold based at least in part on the absolute value of the components of the at least one message vector; and assigning a one bit to the data. In some embodiments, determining includes determining that the average amplitude is less than a predetermined threshold based at least in part on the absolute value of the components of the at least one message vector; and assigning a zero bit to the data. In some embodiments, applying comprises multiplying the at least one message vector by the plurality of frequency components of the frame.

[0020] Additionally, the system may include a content management apparatus that enables the user to configure or control the content of the one or more message. In some embodiments, the user may create, edit, modify, manage, or delete content via a plurality of devices.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021] Having thus described embodiments of the invention in general terms, reference will now be made to the accompanying drawings, where:

FIG. 1 is a diagram illustrating a targeted location-based communication system environment, in accordance with embodiments of the present invention;

FIG. 2 is a diagram illustrating a targeted location-based communication system environment, in accordance with embodiments of the present invention;

FIG. 3 is a diagram illustrating a targeted location-based communication system environment, in accordance with embodiments of the present invention;

FIG. 4 is a flowchart illustrating a general process flow for targeting location-based communications, in accordance with embodiments of the present invention;

FIG. 5 is a flowchart illustrating a general process flow for providing an encoded signal, in accordance with embodiments of the present invention;

FIG. 6 is a flowchart illustrating a general process flow for encoding a signal, in accordance with embodiments of the present invention;

FIG. 7 is a flowchart illustrating a general process flow for applying a message vector, in accordance with embodiments of the present invention;

FIG. 8 is a flowchart illustrating a general process flow for targeting location-based communications, in accordance with embodiments of the present invention;

FIG. 9 is a flowchart illustrating a general process flow for decoding a signal, in accordance with embodiments of the present invention;

FIG. 10 is a flowchart illustrating a general process flow for providing targeted location-based communications, in accordance with embodiments of the present invention;

FIG. 11 is a diagram illustrating a key sequence, in accordance with embodiments of the present invention;

FIG. 12 is a diagram illustrating a key sequence, in accordance with embodiments of the present invention;

FIG. 13 is a diagram illustrating embedding multiple bits, in accordance with embodiments of the present invention;

FIG. 14 is a diagram illustrating a sample frame of a host signal, in accordance with embodiments of the present invention;

FIG. 15 is a diagram illustrating a watermarked frame, in accordance with embodiments of the present invention;

FIG. 16 is a diagram illustrating recovering a message, in accordance with embodiments of the present invention;

FIG. 17 is a diagram illustrating recovering a message, in accordance with embodiments of the present invention;

FIG. 18 is a diagram illustrating recovering a message, in accordance with embodiments of the present invention;

FIG. 19 is a diagram illustrating a layered spread spectrum, in accordance with embodiments of the present invention;

FIG. 20 is a diagram illustrating an exemplary 10-Bit watermark signal, in accordance with embodiments of the present invention;

FIG. 21 is a flowchart of a process flow for encoding a data signal over ultrasonic frequencies, in accordance with embodiments of the present invention;

FIG. 22A is a diagram illustrating an exemplary 1-Bit watermarked frame, in accordance with embodiments of the present invention;

FIG. 22B is a diagram illustrating an exemplary 0-Bit watermarked frame, in accordance with embodiments of the present invention;

FIG. 23A is a diagram illustrating the multiplication of a watermarked signal with the 1-Bit secret key sequence, in accordance with embodiments of the present invention;

FIG. 23B is a diagram illustrating the multiplication of a watermarked signal with the 0-Bit secret key sequence, in accordance with embodiments of the present invention;

FIG. 24 is a diagram illustrating the recovery of the multiplied watermarked signal, in accordance with embodiments of the present invention;

FIG. 25 is a diagram illustrating the resulting average key sequence values of the multiplied watermarked signal, in accordance with embodiments of the present invention;

FIG. 26 is a diagram illustrating the relationships between elements of the communication system, in accordance with embodiments of the present invention;

FIG. 27 is a diagram illustrating an entity-controlled communication system, in accordance with embodiments of the present invention;

FIG. 28 is a flowchart illustrating an exemplary process for an entity-controlled communication system, in accordance with embodiments of the present invention;

FIG. 29 is a diagram illustrating an exemplary use case for an entity-controlled communication system, in accordance with embodiments of the present invention;

FIG. 30 is a diagram illustrating a retailer-controlled communication system, in accordance with embodiments of the present invention;

FIG. 31 is a flowchart illustrating an exemplary process for a retailer-controlled communication system, in accordance with embodiments of the present invention;

FIG. 32 is a diagram illustrating an exemplary use case for a retailer-controlled communication system, in accordance with embodiments of the present invention;

FIG. 33 is a diagram illustrating a third-party-controlled communication system, in accordance with embodiments of the present invention;

FIG. 34 is a flowchart illustrating an exemplary process for a third-party-controlled communication system, in accordance with embodiments of the present invention;

FIG. 35 is a diagram illustrating an exemplary use case for a third-party-controlled communication system, in accordance with embodiments of the present invention;

FIG. 36 is a user interface for managing a campaign, in accordance with embodiments of the present invention;

FIG. 37 is a user interface for selecting a campaign type, in accordance with embodiments of the present invention;

FIG. 38 is a user interface for creating a campaign, in accordance with embodiments of the present invention;

FIG. 39 is a user interface for viewing and sorting an overview of analytics of managed campaigns, in accordance with embodiments of the present invention;

FIG. 40 is a user interface for viewing information related to watermarking technologies and how they may be applied in a retail setting, in accordance with embodiments of the present invention; and

FIG. 41 is a user interface for scheduling a campaign, in accordance with embodiments of the present invention;

DETAILED DESCRIPTION OF EMBODIMENTS OF THE INVENTION

[0022] Embodiments of the present invention now may be described more fully hereinafter with reference to the accompanying drawings, in which some, but not all, embodiments of the invention are shown. Indeed, the invention may be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure may satisfy applicable legal requirements. Like numbers refer to like elements throughout.

[0023] As used herein, the terms "messages" and "communications" may be used interchangeably throughout the specification. It should also be noted that the term "entity" may refer to the terms "merchant" and "business" may be used interchangeably throughout the specification. As used herein, an entity may refer to a "user" of a mobile device, which may embody a merchant, a retailer, a business owner, a customer, a shopper, a marketer, an advertiser, a person, group of persons, organization, group of organizations, and/or group of organizations and persons.

[0024] Embodiments of the invention are directed to systems, methods, and computer program products for targeting location-based communications. The invention enables an entity to provide an encoded signal that is received and decoded by a mobile device. As an example, a host signal (a musical track originating from a program server, for example) may be embedded with data to generate an encoded signal. The encoded signal is then transmitted or broadcasted and then received by a mobile device. The mobile device is used to decode the signal and retrieve the data embedded therein. The embedded data or another signal based on the embedded data may be sent to an application server, where it is matched with one or more messages. The message(s) are then communicated to the mobile device, which may present a display based on the message(s). As used herein, the encoded portion of the signal may be referred to as a "watermark" and the encoded signal may be referred to as a "watermarked signal."

[0025] Referring now to the referenced figures, a system for providing location-based targeted offers and/or other information is provided. While the method for providing location-based targeted offers and/or other information may include a plurality of different steps, one exemplary embodiment includes the steps of generating an encoded signal by embedding data within an audio signal, transmitting the encoded signal such that it is received by a mobile device, using the mobile device and/or an application therein to decode the encoded signal and retrieve the embedded data, using the mobile device and/or an application therein to send the embedded data or another signal based on the embedded data to an application server such that it is matched with one or more corresponding messages, and sending the message(s) to the user's mobile device, where the user **102** may be presented an offer or other information.

[0026] Referring now to FIG. 1, a targeted location-based communication system environment **100**, in accordance with one embodiment of the present invention, is illustrated. As shown, the communication system **108** is capable of sending and/or receiving information from the application server **106**. Likewise, the application server **106** is capable of sending and/or receiving information from the mobile device **104**. This communication may occur across the network **101**. The network **101** may be a global area network (GAN), such as the Internet, a wide area network (WAN), a local area network (LAN), or any other type of network or combination of networks. The network **101** may provide for wireline, wireless, or a combination wireline and wireless communication between devices on the network. The communication system **108** may connect with a broadcasting device **111** for broadcasting an audible signal within a location, such as a merchant's business location. In one embodiment, the broadcasting device **111** may be or include a playback device, such as playback device **210** shown in FIG. 2. In some embodiments, the audible signal is an encoded signal that includes embedded data. The encoded signal may be generated by an encoding device **209** shown in FIG. 2 and may include digital watermarking or ultrasonic technologies. Specifically, the encoding device **209** is capable of embedding data within a host signal, such as a musical track. This encoded signal can then be transmitted by the broadcasting device **111** without interfering with a listener's listening experience. The encoded signal can then be received by the mobile device **104**, which is capable of decoding the signal to retrieve the embedded data. In other embodiments, the communication system **108** is not connected with the broadcasting device **111**, but rather, the broadcasting device **111** is connected to a program server, such as program server **207** of FIG. 2, and in yet other embodiments, the communication system **108** is operatively connected with the program server **207** and/or the playback device **209** of FIG. 2, which is connected to the broadcasting device **111**.

[0027] The embedded data may be a decoded version of a watermarked message and/or signal. The mobile device **104** may then send the embedded data and/or another signal based on the embedded data to the application server **106** and/or elsewhere. The embedded data may be transmitted in response to the mobile device **104** decoding the encoded signal to identify and/or retrieve the embedded data contained in the encoded signal. In other words, the embedded data (or other received data) may include instructions for the mobile device **104** to forward some or all the embedded data or another signal based at least in part on some or all the embedded data to an application server **106** and/or elsewhere. In other embodiments, an application running on the mobile device **104** may include instructions for the mobile device **104** to forward some or all the embedded data or another signal based at least in part on some or all the embedded data to an application server **106** and/or elsewhere.

[0028] The application server **106** may include a processing device **134** that receives the embedded data transmitted by the mobile device **104**. As used herein, the term “processing device” generally includes circuitry used for implementing the communication and/or logic functions of the particular system. For example, a processing device may include a digital signal processor device, a microprocessor device, and various analog-to-digital converters, digital-to-analog converters, and other support circuits and/or combinations of the foregoing. Control and signal processing functions of the system are allocated between these processing devices according to their respective capabilities. The processing device **134** may include functionality to operate one or more software programs based on computer readable instructions **140** thereof, which may be stored in a memory device **136**.

[0029] The application server **106** may further include a communication device **132** that is operatively coupled to the processing device **134**. The communication device **132** is capable of sending communications to the mobile device **104** in response to the processing device **134** receiving the embedded data or other signal from the mobile device **104**. The processing device **134** uses the communication device **132** to communicate with the network **101** and other devices on the network **101**, such as, but not limited to, the communication system **108** and the mobile device **104**. The communication device **132** generally comprises a modem, server, or other device for communicating with other devices on the network **101**.

[0030] The processing device **134** is also operatively coupled to the memory device **136**. The memory device **136** may house computer readable instructions **140** which may include a server application **142**. In some embodiments, the memory device **136** includes data storage **138** for storing data related to the targeted location-based system environment **100** including, but not limited to, data used by the server application **142**, or information provided by the user **102**, mobile device **104**, and/or communication system **108**. For example, the data storage **138** may store all communications (including one or more message) received from a business. The server application **142** may then send the stored communications to a user **102** within the respective business location.

[0031] The application server **106** may be operatively coupled over a network **101** to the mobile device **104**, and, in some embodiments, to the communication system **108**. The communication system **108** may include an end system and/or interface used by a business, such as a computer terminal. The communication system **108** may also include and/or be connected with communication and/or broadcasting devices, such as a speaker system or broadcasting device **111**. It should also be noted, in some embodiments the mobile device **104** may be interchanged with other end consumer systems, such as a computer. In this way, the application server **106** can send information to and receive information from the mobile device **104** and the communication system **108** to provide targeted location-based communications to a user **102**. FIG. 1 illustrates only one example of an embodiment of a targeted location-based communication system environment **100**, and it will be appreciated that in other embodiments one or more of the systems, devices, or servers may be combined into a single system, device, or server, or be made up of multiple systems, devices, or servers.

[0032] In the embodiment illustrated in FIG. 1, the server application **142** enables the user **102** to interact with the system. First, the server application **142** enables a user **102** to receive information based on his/her geographic location proximate to a business, via the mobile device **104**. Next, the server application **142** enables a business to manually input communications, via the communication system **108**, related to offers and/or other information they wish to provide the user **102**. The server application **142** may be capable of gathering communications from a website using numerous techniques such as web scraping. For example, a business may post a communication, such as a weekly sales ad, on its business website and the server application **142** can capture the weekly sales ad through web scraping. Once captured, the website communication may be stored and used to create a response message for communication to a user.

[0033] Alternatively, or in conjunction, an entity, such as a merchant, may manually configure or control communications using an interface, such as a communication system **108** interface, provided over network **101** using the server application **142** and/or using application

162. The server application **142** may also be configured or controlled by a user **102** associated with a third party, such as an advertising agency, a marketing agency, or an application provider, who is responsible for managing a business's mobile marketing efforts. The communication system **108** may be utilized for transmitting messages (information, offers, advertisements, or the like) to potential customers' mobile devices **104** within a predetermined distance of a physical business establishment. Furthermore, the communication system **108** may enable the user **102** to configure or control one or more physical business establishments substantially simultaneously. For instance, the user **102** may configure the communication system **108** one time and have the changes take effect across multiple retail locations. To configure or control the content of the offer, message, or the like, the present invention may include a content management platform via which the retailer, the entity, or a third party may upload or edit unique content, images, text, or the like and distribute the content across one or more program servers **207**.

[0034] In some embodiments, the server application **142** of the application server **106** enables or allows the user **102** to communicate, using the mobile device **104**, the user's presence in a location based on the embedded information decoded by the mobile application **122**. The communication sent from the mobile device **104** may be sent in response to user input indicating a desire to send the communication based on the decoded embedded data, and in many embodiments, the communication is sent automatically, that is, in response to the mobile device **104** decoding the embedded data from the encoded signal. In some embodiments, the mobile device **104** may send a communication in response to decoding the embedded data in the form of text communications (*e.g.*, SMS format), voice communications, direct or indirect wireless network connection with the application server **106**, and/or the like. In many embodiments, the user **102** may receive, in response to the sent communication, a response including a message in the form of an email, text, pop-up notification, or the like that is tailored to the embedded data and/or other signal based on the embedded data. The message may also be tailored to the user **102** based on information associated with the user **102**. For example, the merchant may possess a database of information associated with their frequent shoppers. When a frequent shopper enters a predetermined range of a retail location configured in the communication system **108**, the communication system **108** may transmit via the network **101** to the frequent shopper's mobile device **104** a special offer exclusive to the retailer's most frequent shoppers. The information associated with the user **102** may be stored by the apparatus in the application server

106 or elsewhere. All in all, tailoring the message based on embedded data, user information, purchase history, demographic information, location information, or the like may also enable the merchant, the entity, or the third party to precisely target specific segments of customers.

[0035] The response may be a message that has been chosen by a merchant, business or other entity associated with the location of the user **102**. This message may be chosen by the entity using the communication system **108** as an interface and stored, for example, in the data storage **138** of the application server **106**. The response message may be presented to the user **102** through an interface on the mobile device **104**.

[0036] Response messages or communications are provided to users **102** based on the proximate position of the user's mobile device **104** with respect to a business. In this way, the user **102** may receive more beneficial offers through the targeted location-based communication system **100** than through other offer programs. Thus, the offers provided through the targeted location-based communication system **100** may be or include special offers that are provided only to users **102** through the system **100** and are not provided to the customer population at large.

[0037] An entity, such as a business, may use the communication system **108** to provide the server application **142** with information and/or data for inclusion in one or more response messages. In some embodiment, the response message may be an offer for a product. The server application **142** may then store in the application server **106** or elsewhere the data related to a message from the business such as, but not limited to the product, the message details, the expiration date for the offer, and the like. In this way, the server application **142** may have access to all messages available from all businesses utilizing the targeted location-based communication system **100**, in a database. Thus, the application **142** may respond to received embedded data or other signals from many different businesses and/or business locations by using the embedded data to determine appropriate response messages to send each of the mobile devices, such as mobile device **104**, initiating communication with the application server **106**.

[0038] The server application **142** may provide computer readable instructions **140** to the processing device **134** to match a message or communication stored in the data storage **138** (which may have previously been, for example, received from a communication system **108** and stored in the data storage **138** of the application server **106**) with a mobile device **104** of a user **102** based on the user's **102** location, more specifically, based on embedded data provided by the user's **102** mobile device **104**. The server application **142** sends the response messages or communications to a user **102,** using a network **101,** to the user's mobile device **104**.

[0039] The server application **142** may initiate a response message or communication to a user **102** based on one factor or a combination of factors. For example, application server **106** may consider not only the embedded data but also may consider other factors such as the time of day, the day of the week, and the like in making a determination regarding the appropriate response message for the user **102**. The communication may be an offer for products that the user **102** may be interested in. The user **102** may have an interest in communications related to breakfast, lunch, or dinner specials based on the time of day in which the user **102** frequents a restaurant. To this extent a user entering a restaurant during one of these times may receive an encoded signal embodied by the music being played within the restaurant. The user's mobile device **104** may then decode the encoded signal and send the embedded data or other signal to the application server **106**. In response, the user **102** may receive a special offer on his or her mobile device **104**. In some embodiments, the offer may correspond to a merchant in proximity to where the user **102** is currently located.

[0040] The communication system **108** generally includes a communication device **152**, a processing device **154**, and a memory device **156**. The processing device **154** is operatively coupled to communication device **152**, and the memory device **156**. The communication system **108** may include an input device such as a keyboard device to receive information from an individual associated with the communication system. The communication system **108** may additionally include a reader device including, but not limited to, a magnetic strip reader, a barcode scanner, a radio frequency (RF) reader, a character recognition device, a magnetic ink reader, a processor for interpreting codes presented over an electrical or optical medium, a biometric reader, a wireless receiving device, and/or the like. In some embodiments, the reading device receives information that may be used to communicate instructions via the communication device **152** over a network **101**, to other systems such as, but not limited to the application server **106** and/or other systems. The communication device **152** generally comprises a modem, server, or other device for communicating with other devices on the network **101**.

[0041] The communication system **108** includes computer readable instructions **160** stored in the memory device **156**, which in one embodiment includes an application **162**. A communication system **108** may also refer to any device used to provide information, messages and/or communications to be sent to a user **102**, including but not limited to, specifying embedded data, or transmitting signals. In some embodiments, the communication system **108** may refer only to a plurality of components. For example, the communication system **108** may refer to a user device, or a user device and a merchant device interacting with one another to send and receive communications.

[0042] In some embodiments, the communication system **108** may serve as an interface between a merchant and the application server **106** to enable a merchant to specify one or more communications that may ultimately be received by users (*e.g.*, using a mobile device) in particular locations. In some embodiments, the communication system **108** may serve as an interface between a merchant and the program server **207**, encoding device **209** and/or playback device **210** (all of FIG. 2) to enable the merchant to change the data to be embedded in the host signal, thereby changing the communication (*i.e.*, the watermarked signal) ultimately received by a user at a particular location. In yet other embodiments, the communication system **108** may serve as an interface between a merchant and both the application server **106** and the program server **207**, encoding device **209** playback device **210** and/or broadcasting device **111**.

[0043] In embodiments where the communication system **108** interfaces with the program server **207**, encoding device **209** playback device **210** and/or broadcasting device **111**, the communication system **108** may enable the merchant to manage (*i.e.*, change or edit) the data that is to be embedded within a host signal. The embedded data may be a number which corresponds to a specific offer which the merchant wants to send to users within a respective business location. The merchant can alter the offer that is sent by changing the number that is embedded within the host signal. For example, during morning hours a restaurant can specify to embed a number "1" within the host signal where the number "1" corresponds to an offer for a breakfast special. Likewise, during the afternoon the restaurant can specify to embed a number "2" within the host signal where the number "2" corresponds to an offer for lunch specials.

[0044] In some embodiments, the communication system **108** is or includes an interactive computer terminal that is configured to initiate, communicate, process, and/or facilitate sending one or more communications to a user **102**. A communication system **108** could be or include any device that may be used to communicate with a user **102** or the application server **106**, such as, but not limited to, a digital sign, a magnetic-based payment device (e.g., a credit card, debit card, etc.), a personal identification number (PIN) payment device, a contactless payment device (e.g., a key fob), a radio frequency identification device (RFID) and the like, a computer, (e.g., a personal computer, tablet computer, desktop computer, server, laptop, etc.), a mobile device (e.g., a smartphone, cellular phone, personal digital assistant (PDA) device, music-playback device, personal GPS device, etc.), a merchant terminal, a self-service machine (e.g., vending machine, self-checkout machine, etc.), a public and/or business kiosk (e.g., an Internet kiosk, ticketing kiosk, bill pay kiosk, etc.), a gaming device (e.g., Nintendo Wii®, PlayStation Portable®, etc.), and/or various combinations of the foregoing.

[0045] In some embodiments, the communication system **108** may be operated in a public place (e.g., on a street corner, at the doorstep of a private residence, in an open market, at a public rest stop, etc.). In other embodiments, the communication system **108** is additionally or alternatively operated in a place of business (e.g., in a retail store, post office, banking center, grocery store, factory floor, etc.). In accordance with some embodiments, the communication system **108** may not be operated by the user of the communication system **108**. In some embodiments, the communication system **108** is operated by a mobile business operator or a POS operator (e.g., merchant, vendor, salesperson, etc.). In yet other embodiments, the communication system **108** is owned by the entity offering the communication system **108** providing functionality in accordance with embodiments of the invention described herein.

[0046] The communication system's **108** application **162** enables the communication system **108** to be linked to the application server **106** to communicate, over the network **101**, information related to messages to be transmitted to users. In this way, the application **162** associated with the communication system **108** may provide the application server **142** with various communications such as an appropriate geographic proximity offer match for the user **102**. In one example, the user **102** enters a business establishment, the user's mobile device **104** receives an encoded signal, decodes the signal, and sends embedded data retrieved by decoding the signal to the application server **106**, and receives a message sent from the application server **106** in response to the embedded data.

[0047] The application **162** associated with the communication system **108** may also receive information from the application server **106**. The application **162** in the communication system **108** typically receives an audio signal from the application **142**, such that the application **162** associated with the communication system **108** may transmit or initiate transmission of the signal to the user **102**. In this regard, the application server **106** and/or communication system **108** perform one or more functions similar to the functions performed by the program server **207** discussed below with reference to FIG. 2.

[0048] FIG. 1 also illustrates a mobile device **104**. The mobile device **104** may include a communication device **112**, a processing device **114**, and a memory device **116**. The processing device **114** is operatively coupled to the communication device **112** and the memory device **116**. The processing device **114** uses the communication device **112** to communicate with the network **101** and other devices on the network **101**, such as, but not limited to, the application server **106**. The communication device **112** generally has a modem, server, or other device for communicating with other devices on the network **101**.

[0049] The mobile device **104** may have computer readable instructions **120** stored in the memory device **116**, which in one embodiment includes the user application **122**. Application **122** may cause the processing device **114** to receive and decode an encoded signal, and send embedded data or another signal to the application server **106** as discussed elsewhere herein in greater detail. The mobile device **104** may also include data storage **118** located in the memory device **116**. The data storage **118** may be used to store information related to a received signal, decoded signal, embedded data, received communications and/or the like. A “mobile device” **104** may or include any mobile communication device, such as a cellular telecommunications device (i.e., a cell phone or mobile phone), personal digital assistant (PDA), a mobile Internet accessing device, or other mobile device including, but not limited to portable digital assistants (PDAs), pagers, mobile televisions, gaming devices, laptop computers, cameras, video recorders, audio/video player, radio, GPS devices, any combination of the aforementioned, or the like. Although only a single mobile device **104** is depicted in FIG. 1, the targeted location-based communication system environment **100** may contain numerous mobile devices similar to mobile device **104** and carried by a plurality of users **102**.

[0050] Referring now to FIG. 2, a targeted location-based communication system environment **200** is shown, in accordance with embodiments of the invention. As illustrated, the targeted location-based communication system environment **200** is capable of broadcasting an encoded signal at a given location. The targeted location-based communication system may include a program server **207** for housing various media content including audio and video files that may be used as hosts for encoding a watermark, thereby resulting in an encoded signal or watermarked signal. The program server **207** may be included within the communication system **108** (FIG. 1) so that an entity may manipulate a playlist for a location.

[0051] The program server **207** generally includes a communication device **204**, a processing device **206**, and a memory device **208**. The processing device **206** is operatively coupled to the communication device **204** and the memory device **208**. The processing device **206** uses the communication device **204** to communicate with the network **101** and other devices on the network **101**, such as, but not limited to, the encoding device **209**. The encoding device **209** may be included as a part of the communication system **108** as seen in FIG. 1. The communication device **204** generally comprises a modem, server, or other device for communicating with other devices on the network **101**.

[0052] As further illustrated in FIG. 2, the program server **207** includes computer readable instructions **212** stored in the memory device **208**, which in one embodiment includes a program server application **214**. In some embodiments, the memory device **208** includes data storage **211** for storing data related to the targeted location-based system environment **200**. For example, the program server **207** may store a plurality of host signals in the data storage **211** of the program server **207**. One or more host signals may be sent from the program server **207** to an encoding device **209** using the communication device **204**. The host signal may be an audio file such as a musical track or voice communication.

[0053] The encoding device **209** may include a communication device **272**, a processing device **274**, and a memory device **276**. The processing device **274** is operatively coupled to the communication device **272** and the memory device **276**. The processing device **274** uses the communication device **272** to communicate with the network **101** and other devices on the network **101**, such as, but not limited to, the program server **207** (and thus the communication system **108**), application server **107** and/or the playback device **210**. The communication device **272** generally comprises a modem, server, or other device for communicating with other devices on the network **101**. As further illustrated in FIG. 6, the encoding device **209** may include computer readable instructions **280** stored in the memory device **276**, which in one embodiment includes an encoding application **282**.

[0054] At the encoding device **209**, the host signal may be received using the communication device **272**. The encoding device **209** may then use software, embodied by the application **282**, to embed data within the host signal resulting in an encoded signal. The process of embedding data within the host signal may include converting the data to be embedded to a signal and masking the data signal with the host signal such that an encoded signal, including both the data signal that is representative of embedded data and the host signal, is generated. In an embodiment where the host signal is an audio file, the encoded signal may be saved as a new audio file and stored within the data storage **278** of the encoding device **209**. The encoded signal may then be sent to a playback device **210** and broadcast at a location may be initiated by the playback device **210**. The playback device **210** typically includes an electronic circuit designed for receiving, processing, and/or playing an audio signal (either audible or non-audible by humans), a preamplifier, an amplifier, and a speaker. In other embodiments, the playback device **210** may be any mobile communication device, such as a cellular telecommunications device (*i.e.,* a cell phone or mobile phone), personal digital assistant (PDA), a mobile Internet accessing device, or other mobile device including, but not limited to portable digital assistants (PDAs), pagers, mobile televisions, gaming devices, laptop computers, cameras, video recorders, audio/video player, radio, any combination of the aforementioned, or the like.

[0055] The playback device **210** may also be or include hardware and/or software to open the media file including the encoded signal or process the encoded signal in order to initiate broadcast of the encoded signal using a broadcasting device **111**. One or more of the program server **207**, the encoding device **209** and/or the playback device **210** may be housed within a single device or may be a combination of two or more devices working in collaboration. In one embodiment, for example, a single box houses the program server **207**, the encoding device **209** and the playback device **210**. In some embodiments, for example, the program server **207** and its components discussed above perform one or more of the functions discussed in association with one or both the encoding device **209** and the playback device **210**.

[0056] As illustrated by FIG. 3, in other embodiments, the playback device **210** may store a plurality of host signals in the data storage **318** of the playback device **210**. In some embodiments, storing a plurality of host signals includes storing one or more audio files. Also, either in addition to the audio files stored at the playback device **210** or instead of storing the audio files at the playback device **210**, one or more audio files may be stored in the program server **207** and sent to the playback device **210**. At least one host signal can be sent from the playback device **210** to an encoding device **209**. The host signal may be an audio file such as a musical track or voice communication. The audio file may be a file that is identical to a master track. In one embodiment, the host signal is sent by the playback device **210** to the encoding device **209** as an audio file. In an alternative embodiment, the host signal is sent from the playback device **210** to the encoding device **209** by broadcasting the host signal and recording the broadcasted audio using the encoding device **209**. In various embodiments, the audio file being sent and/or received may be either an analog or digital signal and may be transmitted via the network 101, a satellite network, a Wi-Fi network, a Bluetooth network, a wired or wireless communications network, or the like. Furthermore, the playback device may be configured to convert an analog signal to digital signal or a digital signal to an analog signal via a conversion process or a conversion circuit. For example, an audio file can be sent from the program server **207** to the playback device **210** in a digital file format and converted to an analog file format at the playback device **210**. Likewise, the host signals being sent and/or received may be either an analog or digital signal. For example, a host signal can be sent from the playback device **210** in a digital file format and converted to an analog file format at the encoding device **209**.

[0057] In various embodiments, the playback device **210** may include a communication device **312**, a processing device **314**, and a memory device **316**. The processing device **314** is operatively coupled to the communication device **312** and the memory device **316**. The processing device **314** uses the communication device **312** to communicate with the network **101** and other devices on the network **101**, such as, but not limited to, the program server **207** and/or the encoding device **209**. The communication device **312** generally includes a modem, server, or other device for communicating with other devices on the network **101**. The playback device **210** includes computer readable instructions **320** stored in the memory device **316**, which in one embodiment includes application **302**.

[0058] At the encoding device **209**, the host signal may be received using the communication device **272**. The encoding device **209** may receive the host signal as an audio file, signal representing the audio file or by recording the host signal as it is being broadcasted. The encoding device **209** may then use software, embodied by the application **282**, to process the host signal and embed data within the host signal. The encoded signal may then be sent to a broadcasting device **111** for broadcasting within a location. The encoded signal being sent and/or received may be either an analog or digital signal. The broadcasting device may be an amplifier or speaker system capable of broadcasting an audio signal.

[0059] Referring now to FIG. 4, a method for targeting location based communications is illustrated, in accordance with embodiments of the invention. At step **402** data input and a host signal are sent and received for encoding. In the embodiment illustrated in FIG. 2, the data input and host signal are sent by the program server **207** and received by the encoding device **209**. At step **404** the encoding device **209** embeds the data input within the host signal to generate an encoded signal. At step **406** the encoded signal is transmitted to a device that is capable of broadcasting the encoded signal within a respective location. In some embodiments, the encoding device **209** may dually function as a broadcasting device and broadcast the encoded signal. At step **408** the encoded signal is broadcasted, by the broadcasting device **111**, within a respective location and received by a mobile device **104**. At step **410** the mobile device **104** decodes the encoded signal to retrieve the embedded data input. The embedded data is then sent by the mobile device **104** and received by a second device, such as the application server **106**, at step **412**. At step **414**, a message, based at least partially on the embedded data, is sent by the application server **106** to the mobile device **104**.

[0060] Referring now to FIG. 5, a method **500** for providing an encoded signal is illustrated, in accordance with embodiments of the invention. In an exemplary embodiment, the method comprises a first step **502** for receiving an input of data. After data has been received, the method may include generating a data signal based at least partially on the data input. Additionally, an audio signal may be received at step **504**. The signal corresponding to the data input may then be embedded within the audio signal to render a single encoded signal at step **506**. Subsequently, the encoded signal may be transmitted to a device at step **508** for identifying users to receive messages with certain content. It should be noted that method **500** may be executed by one or more devices within the targeted location-based communication system **100**, **200** and/or **300**, such as the application server **106**, the communication system **108**, the program server **207**, the encoding device **209** and/or the playback device **210**.

[0061] Method **500** may be implemented, for example, by one or more of the components illustrated in FIGs. 2 and 3. As a specific example, one or more steps of method **500** may be implemented by the application server **106**, program server **207** and/or playback device **210**. Further exemplary implementations are discussed at length above with reference to FIGs. 2 and 3.

[0062] In an exemplary embodiment, the method **500** may be executed by the encoding device **209**. In such embodiments, the encoding device **209** is associated with an application **282** contained therein. The application **282** is configured to execute computer readable instructions **280** for encoding signals. The computer readable instructions **280** associated with the application **282** may vary depending upon the method step that is being executed. For example, at event **502** the system is configured to receive data input. In such an embodiment, the application **282** is configured to execute several computer readable instructions **280** for receiving data input. In one embodiment, upon receiving data input, the system is configured to generate a data signal based at least partially on the data input. The data input may be data in which a user wishes to embed within a host signal. A data signal may be generated using a signal generator. As such the received data is input into a signal generator such that a data signal representative of the data input is generated in response. It should be noted that the data signal may be generated independent of any information being provided about the host signal. In an alternative embodiment, the data input does not have to be converted to a data signal prior to being embedded in the host signal. In such an embodiment, the data is represented by a randomly generated key-sequence that is embedded in the host signal. In another example, at event **204** the system is configured to receive a host signal. In such an embodiment, the encoding device **209** is associated with an application **282** that is configured to execute several computer readable instructions **280** for receiving host signals, such as songs, public address announcements and the like.

[0063] The encoding device **209** may rely on software and/or hardware as a means for encoding signals. For example, the encoding device may rely on software and/or hardware as a means for receiving data input or host signals. The encoding device **209** may include electronic circuitry such as, but not limited to, some combination of diodes, transistors, gates and/or other logical components that encode the data within the host signal. In an instance that the method **500** is executed by an alternative device within the system, the alternative device may comprise a similar electronic circuitry to aid in encoding data within a host signal.

[0064] In one embodiment, the encoding device **209** is equipped with additional hardware to aid in encoding signals. For example, the encoding device **209** may comprise near-field communication systems, such as Bluetooth and/or other wireless technology that aids in encoding signals. To this extent, the encoding device **209** may use the wireless technology as a means for receiving host signals and/or transmitting an encoded signal. Other hardware to aid in encoding signals may include microphone hardware associated with the encoding device **209**. The microphone hardware may be used as a means for receiving a host signal. For example, in one embodiment, the microphone hardware associated with the encoding device **209** is capable of receiving and recording signals or data that needs to be embedded within a host signal. In another example, the encoding device **209** may comprise a keyboard for inputting data into the encoding device **209**. For example, in one embodiment, the keyboard hardware associated with the encoding device **209** is capable of allowing an individual to manually input data into the encoding device **209**. The data input received may be numbers, words, phrases, letters, alphanumeric combinations, and the like.

[0065] Additionally, the encoding device **209** may rely on software as a means for receiving data input or host signals. In some embodiments, the encoding device **209** may rely on a combination of hardware and software as a means for receiving signals. Data can be received by the encoding device **209** using hardware and embedded within the received signals using software associated with the encoding device **209**. The data input or host signals may be directly uploaded to the encoding device **209** or sent via text communication, voice communications and the like. In one embodiment, the encoding device **209** is configured to automatically upload advertisements associated with a particular business entity. In one embodiment, the encoding device **209** is configured to receive host signals and store them in memory **276** for later use. For example, in one embodiment, the host signal is received by sending an .mp3 version of the signal to the encoding device **209**. It should be noted that the host signal does not have to be limited to an .mp3 audio format, but may also be embodied by other forms of audio including, but not limited to, .wav, .wma, .raw, .m4a, and the like. As such, in an exemplary embodiment, the host signal is a musical track.

[0066] At event **506**, an encoded signal is generated by embedding data within the host signal. In one embodiment, the encoded signal is a watermark spread across audible frequencies. The targeted location-based communications system **100**, **200**, and/or **300** is capable of masking the watermark to avoid detection by humans. The watermark may be adjusted based on the characteristics of a host signal. To this extent, each signal must be individually watermarked. In one embodiment, the host signal is an audio signal such as a musical track, and encoding a signal comprises the encoding device **209** having access to a key sequence that is predetermined by the targeted location-based communication system **100**, **200**, and/or **300**. The encoding device **209** may be the application server **106**, the communication system **108**, a standalone device, part of another device or component, or another device within the system capable of embedding data within a signal. The key sequence may be stored directly in the memory **276** of encoding device **209** or stored elsewhere and accessible to the communication device **272** associated with the encoding device **209**.

[0067] The key sequence may be randomly generated by a pseudo-random key sequence generator. The embedded data may be expressed in binary and two key sequences may be generated. A first key sequence is generated to express a 1-Bit, and a second key sequence is generated to express a 0-Bit. In one embodiment, the second key sequence generated to express a 0-Bit is a mirror image or the inverse of the first key sequence generated to express a 1-Bit. In some embodiments, the key is not randomly generated, but rather, is ordered. For example, a first key includes alternating values, *e.g.*, a positive value, a negative value, a positive value, a negative value and so on. In this example, this first key corresponds to a "1" bit". A second key corresponds to the "0" bit, and in this example, would typically be the inverse of the first key, *e.g.*, negative, positive, negative, positive and so on.

[0068] Embedding data within the host signal may comprise amplifying/boosting and/or cutting by a positive and/or negative delta value associated with the key sequence to generate a watermarked signal. In one embodiment, a spread spectrum watermark process may be used to embed data within the host signal. In such an embodiment, data input and the host signal are passed to an encoding device **209** such that a watermarked track is generated. The encoding device **209** may be or include an application contained within the encoding device **209**. In some embodiments, the encoding process requires information about the host signal for proper masking of the data input to occur. In such embodiments, the encoding device **209** may analyze the host signal to produce a unique watermark that is well-masked.

[0069] At event **508** the system is configured to transmit the encoded signal. The method may be executed by various system components such as the application server **106**. In one embodiment, the method is executed by the encoding device **209**. In such an embodiment, the encoding device **209** is associated with an application **282** contained therein. The application **282** is configured to execute several computer readable instructions **280** for transmitting an encoded signal. The encoding device **209** may rely on software and/or hardware as a means for transmitting an encoded signal. In such an embodiment the encoding device **209** may transmit the encoded signal using the communication device **272** associated with the encoding device **209**. The encoded signal may be transmitted to a playback device or broadcasting device as described above with reference to FIGs. 2 and/or 3.

[0070] Some of the steps of method **500** may be further explained with reference to FIG. 15, which is discussed at length below. As illustrated in FIG. 15, in some embodiments, encoding the signal includes using a layered spread spectrum. In such embodiments, individual bits are transmitted across various frequencies throughout the spectrum. Specifically, multiple bits are transmitted simultaneously using multiple key sequences. Each key sequence may correspond to a bit being reported to an application. As such, the signal may be invariant over time. The frequency spectrum may be divided into twelve (12) bins represented by the amplitudes shown in the illustrated embodiment. Likewise the key sequence may also have twelve (12) components, as illustrated in the figures. It should be noted that while the illustrated embodiments have a key sequence with twelve (12) components, in other embodiments, the key sequence may have any number of components. As illustrated in FIG. 19, the layered spread spectrum may have twenty (20) frequency bins for transmitting encoded information. The key sequences for a single bit may only correspond to certain frequency bins. For example, the key sequence for Bit 1 may only correspond to the first, fifth, ninth, thirteenth, and seventeenth frequency bins, from bottom to top, respectively. In an example where two bits are being transmitted the bits may alternate frequencies. The first key sequence may be applied to all the odd number bits, and the second key sequence may be applied to all the even number bits. In one embodiment, key sequences may only operate on the frequency bins to which they are assigned. This feature may aid in increasing the accuracy during decoding because an increased number of frequency bins corresponds to an increased accuracy during encoding.

[0071] Referring now to FIG. 6, another method **600** for providing an encoded signal is illustrated. In some embodiments, method **600** may be a more detailed version of the method **500** described with reference to FIG. 5. Method **600** may include reading a frame from an audio signal input at step **602**. In an exemplary embodiment, the audio signal is received in the time domain; thus a predetermined amount of samples and/or frames may be read. For example, a sixty (60) second audio signal may be received. The sixty (60) second audio signal may be divided in ten (10) frames such that ten (10) – six-second frames are received. The audio input may be pulse-code modulation (PCM) data. In one embodiment, the audio input is an analog signal represented in digital form.

[0072] At event **604**, a frame is padded by appending zeros to the end of a frame. The number of zeroes added to the end of a frame may depend on the length of the message vector. At event **606**, the audio signal including the additional trailing zeros is transformed from the time domain to the frequency domain. The audio signal may be transformed using an algorithm such as a Fast Fourier Transform (FFT). Other algorithms may be used to transform a signal, including, but not limited to, the discrete cosine transformation algorithm (DCT).

[0073] At event **608**, a message vector is applied to the frequency components. The message vector may be generated based on a random key sequence and one or more message bits. To this extent, the message vector may be constructed from the key sequence and message bits. As illustrated in FIG. 7, event **608** may include step **608A** or **608B**. Steps **608A** and/or **608B** may be used to apply a message vector to a plurality of frequency components. In one embodiment, represented by event **720**, applying a message to a plurality of frequency components comprises the frequency components being multiplied by a message vector, where the message vector may comprise or be based on bits corresponding to the received input data. In an alternate embodiment, applying a message to a plurality of frequency components comprises converting the frequency components to decibels (dB) (step **722**), adding the message vector to the frequency components (step **724**), and converting the sum of the message vector and frequency components to amplitudes (step **726**).

[0074] Now referring back to FIG. 6, at event **610**, the signal frame is transformed back to the time domain. The signal frame may be transformed back to the time domain using the inverse of the algorithm used to transform the signal to the frequency domain. For example, an audio signal transformed to the frequency domain using FFT is transformed back to the time domain using the inverse Fast Fourier Transformation (iFFT). The prior referenced method steps are repeated for each sample in the time domain such that, at event **612**, each newly watermarked frame is appended to a previously watermarked frame. In one embodiment, the watermarked frames may be appended such that the frames overlap with respect to the trailing zeros appended to the end of each frame sample. This is commonly known as the "overlap-add" method. In another embodiment, rather than appending zeros to the end of the frame, the frame may be prepended with samples taken from the end of a previous frame. When combining the processed frames, these samples may be simply discarded. This is commonly known as the “overlap-save” method.

[0075] In one embodiment where FFT is used, the length of the FFT corresponds to one less than the transaction length plus the length of the secret key. The transaction length may be chosen to result in optimal computational performance. For example, reducing the transaction length may result in lower memory storage requirements, while increasing the transaction length may result in less floating-point operations for a given input. After choosing a value for the transaction length the message vector may be adjusted to match the FFT length. When multiplying the frequency components by the message vector, at event **608**, it may be applied such that symmetry rules of real-input FFT are maintained. To this extent, the vector may be multiplied by the first half of the frequency components. The other half of the frequency components may then be set according to the symmetry rules of the real-input FFT, by taking the complex conjugates of the first half. In some embodiments, when calculating the message vector, multiplication or convolution may be used in either the time domain or the frequency domain.

[0076] Referring now to FIG. 8, a method **800** for providing targeted location-based communications is provided, in accordance with embodiments of the present invention. In an exemplary embodiment, the method includes receiving an encoded signal at step **802**. After the signal has been received, embedded data may be obtained by decoding the encoded signal, as shown in step **804**. The embedded data may then be sent to a server as shown at step **806**. At least partially in response to sending the embedded data, a message is subsequently received at step **808**.

[0077] Method **800** may be executed by a number of devices. In an exemplary embodiment, the method is executed by a mobile device **104**. As such, the method is described herein with reference to the mobile device **104**. It should be noted, that while the mobile device **104** is the primary example used herein, the method **800** is also executable by other devices. Thus, as used herein, the term “mobile device” **104** may be interchanged with any other device capable of executing the method steps. Although the method is described with references to only a single mobile device **104**, the targeted location-based communication system environment **100**, **200** and/or **300** may execute the method **800** using multiple mobile devices **104**.

[0078] In one embodiment, the mobile device **104** receives a plurality of different signals, including an encoded signal. As previously mentioned, at event **802** an encoded signal is received. The signals received by the mobile device **104** may fall within a predefined frequency range that is established by at least one component within the targeted location-based communication system environment **100**, **200** and/or **300**. The mobile device **104** is configured to receive both audible and inaudible signals. In an exemplary embodiment, the signal received is a signal that is within the audible human frequency range. To this extent, the signal received may include frequencies within the range 20Hz – 20kHz. For example, in one embodiment, the encoded signal received is an audible music signal. The signal is generally perceptible by the human ear and can also be received by the mobile device **104**. In an alternative embodiment, an inaudible signal is received. The inaudible signal is not perceivable by the human ear but the mobile device **104** may be configured to receive the inaudible signal. To this extent, the inaudible signal received may range from values less than 20Hz or greater than 20kHz. In one embodiment, the signal received is a combination of both an audible signal and an inaudible signal. For example, the embedded data may be converted to an inaudible that is transmitted in conjunction with an audible signal to a device.

[0079] In some embodiments, the mobile device **104** is associated with a computer application **122** contained therein. The application **122** is configured to execute several computer readable instructions **120** for receiving signals, more specifically the application **122** is configured to execute several computer readable instructions **120** for receiving encoded signals. The mobile device **104** may solely rely on software as a means for receiving signals. Signals may be received directly or indirectly by the mobile device **104**. In particular, a mobile device **104** configured to directly receive signals is capable of receiving a signal in response to an action. In one embodiment, the action requires opening an application **122** associated with a particular business or entity. For example, the user **102** carrying a mobile device **104** enters a business establishment such as a grocery store. The user **102** then opens an application **122** that has been provided by the business establishment on the user's mobile device **104**. In response to opening the application the mobile device **104** immediately beings to monitor to receive signals being transmitted within the business establishment. Signals can be received as soon as they are detected by the mobile device **104**. In an alternative embodiment, the mobile device **104** is configured to indirectly receive signals. The mobile device **104** may be capable of receiving a signal without the user **102** directly opening or accessing an application on the mobile device **104**. In one embodiment, the application **122** is configured to run as a background process on the mobile device **104**. Upon entering the business establishment, the mobile device **104** is configured to automatically monitor to receive signals being transmitted within the business establishment. Signals can be received by the mobile device **104** as soon as they are detected by the mobile device **104**. Additionally the mobile device **104** may comprise music recognition software to aid in receiving signals. To this extent, the music recognition software is capable of determining what type of signals are being transmitted and only receive a predetermined signal type. For example, in one embodiment, the system is configured to only receive audio signals. As such, the music recognition software is capable of detecting that a particular signal is an audio signal and bypassing all other detected signals from being received.

[0080] In contrast, the mobile device **104** may solely rely on hardware as a means for receiving signals. In one embodiment, the mobile device **104** is equipped with additional hardware to aid in receiving signals. For example, the mobile device **104** may comprise hardware such as Bluetooth and/or other wireless technology that aids in receiving signals. Other hardware to aid in receiving signals includes microphone hardware associated with the mobile device **104**. For example, in one embodiment, the microphone hardware associated with the mobile device **104** is capable of receiving and the memory device **116** is capable of recording signals that are transmitted within a particular area where the mobile device **104** is located. In some embodiments, the mobile device **104** may rely on both a combination of hardware and software as a means for receiving signals.

[0081] As previously mentioned, at event **802** an encoded signal is received. In an exemplary embodiment, the encoded signal is a host signal that has been embedded with data. In some embodiments, the data is transformed into a signal such that the data signal can be masked by the host signal and collectively transmitted to the mobile device **104** as an encoded signal. To this extent, upon receiving the encoded signal, the mobile device **104** is configured to decode the encoded signal and retrieve the embedded data contained therein, as illustrated by event **804**.

[0082] In the illustrated embodiment, the mobile device **104** is associated with an application **122** contained therein. The application **122** is configured to execute several computer readable instructions **120** for decoding signals, more specifically the application **122** is configured to execute several computer readable instructions **120** for retrieving embedded data that is contained within an encoded signal. As such, the mobile device **104** may rely on software as a means for decoding signals. Signals may be decoded directly or indirectly by the mobile device **104**. In particular, a mobile device **104** configured to directly decode signals is capable of decoding a signal in response to an action, such as receiving an encoded signal on the mobile device **104**. In one embodiment, the action requires opening an application **122** associated with a particular business or entity. For example, the user **102** enters a business establishment such as a grocery store. The user **102** then opens an application **122** that has been provided by the business establishment on his or her mobile device **104**. In response to opening the application, the mobile device **104** immediately beings to monitor to receive signals being transmitted within the business establishment. Signals can be decoded as soon as they are detected by the mobile device **104**. In an alternative embodiment, a mobile device **104** configured to indirectly decode signals is capable of decoding a signal albeit of any additional actions being executed by the user **102** or the mobile device **104**. In other embodiments, the application **122** is configured to run as a background process on the mobile device **104**. It may not be necessary for the user **102** to open a particular application prior to being able to decode a signal. Additionally the mobile device **104** may comprise music recognition software to aid in decoding signals. To this extent, the music recognition software is capable of determining what types of signals are being transmitted such that the mobile device **104** only decodes a predetermined signal type. For example, in one embodiment, the system is configured to only decode audio signals. As such, the music recognition software is capable of detecting that a particular signal is an audio signal and bypassing all other detected signals from being decoded.

[0083] In one embodiment, decoding an encoded signal comprises the mobile device **104** having access to a key sequence that is predetermined by the targeted location-based communication system **100**, **200** and/or **300**. The key sequence may be stored directly in the memory **600** of the mobile device **104** or stored elsewhere and accessible by the communication device **312** associated with the mobile device **104**.

[0084] In one embodiment, the key sequence is chosen by randomly alternating a static delta value (δ) in the positive and/or negative direction. For example, as illustrated in FIG. 11, the key sequence for embedding a 1-Bit may be + δ, + δ, - δ, + δ, + δ, - δ, + δ, - δ, + δ, - δ, - δ, - δ. In one embodiment, the second key sequence generated to express a 0-Bit is a mirror image or the inverse of the first key sequence generated to express a 1-Bit.

[0085] Likewise, as illustrated in FIG. 12, the key sequence for embedding a 0-Bit is the inverse of the key sequence generated to embed a 1-Bit. For example, the key sequence for embedding a 0-Bit may be - δ, - δ, + δ, - δ, - δ, + δ, - δ, + δ, - δ, + δ, + δ, + δ. In one embodiment, multiple bits are embedded within a host signal.

[0086] For example, as illustrated in FIG. 13, the key sequence may be adjusted at regular intervals according to the bit sequence. The bit sequence may be provided at a rate of 1 bit per every millisecond. In an alternate embodiment, the bit sequence may be provided at a faster and/or slower rate according to predetermined criteria. In the example illustrated in FIG. 13, the key sequence corresponding to the bit sequence 1, 0, 1, 1, 0, 1, 1, 1, 0, 1, 1, 0, 1, 1, 0, 1, 1 for embedding 17 bits may be as follows:

1: + δ, + δ, - δ, + δ, + δ, - δ, + δ, - δ, + δ, - δ, - δ, - δ
0: - δ, - δ, + δ, - δ, - δ, + δ, - δ, + δ, - δ, + δ, + δ, + δ
1: + δ, + δ, - δ, + δ, + δ, - δ, + δ, - δ, + δ, - δ, - δ, - δ
1: + δ, + δ, - δ, + δ, + δ, - δ, + δ, - δ, + δ, - δ, - δ, - δ
0: - δ, - δ, + δ, - δ, - δ, + δ, - δ, + δ, - δ, + δ, + δ, + δ
1: + δ, + δ, - δ, + δ, + δ, - δ, + δ, - δ, + δ, - δ, - δ, - δ
1: + δ, + δ, - δ, + δ, + δ, - δ, + δ, - δ, + δ, - δ, - δ, - δ
1: + δ, + δ, - δ, + δ, + δ, - δ, + δ, - δ, + δ, - δ, - δ, - δ
0: - δ, - δ, + δ, - δ, - δ, + δ, - δ, + δ, - δ, + δ, + δ, + δ
1: + δ, + δ, - δ, + δ, + δ, - δ, + δ, - δ, + δ, - δ, - δ, - δ
1: + δ, + δ, - δ, + δ, + δ, - δ, + δ, - δ, + δ, - δ, - δ, - δ
0: - δ, - δ, + δ, - δ, - δ, + δ, - δ, + δ, - δ, + δ, + δ, + δ
1: + δ, + δ, - δ, + δ, + δ, - δ, + δ, - δ, + δ, - δ, - δ, - δ
1: + δ, + δ, - δ, + δ, + δ, - δ, + δ, - δ, + δ, - δ, - δ, - δ
0: - δ, - δ, + δ, - δ, - δ, + δ, - δ, + δ, - δ, + δ, + δ, + δ
1: + δ, + δ, - δ, + δ, + δ, - δ, + δ, - δ, + δ, - δ, - δ, - δ
1: + δ, + δ, - δ, + δ, + δ, - δ, + δ, - δ, + δ, - δ, - δ, - δ

To this extent, the key sequence is flipped or inversed each time the bit sequence alternated from a “1” to a “0” or from a “0” to a “1.”

[0087] In one embodiment, embedding data within the host signal may comprise amplifying/boosting and/or cutting by a positive and/or negative delta value associated with the key sequence to generate a watermarked signal. To this extent, the encoding device **209** may add or subtract different amplitudes to or from the host signal. The amplitude may be equal to a positive or negative delta value.

[0088] Now referring to FIG. 14, FIG. 14 illustrates a sample frame of an original signal which may be received by the system. The original signal may function as a host signal capable of masking embedded data. The host signal may be any original signal that has not been previously altered. In an alternative embodiment, the host signal is a signal that has been previously altered but is still capable of hosting further embedding data. The vertical axis of FIG. 14 represents the amplitude or gain of the host signal and the horizontal axis of FIG. 14 represents the time frame or frequency of the host signal.

[0089] Now referring to FIG. 15, in some embodiments, the original/host signal may be received in the time domain and converted to the frequency domain. In such an embodiment, data may be embedded within the host signal at different frequency levels or ranges. The frequency levels may be associated with several “frequency bins” which each represent a different frequency range. To this extent, data corresponding to a single bit may be spread across several frequencies when being embedded within the host signal. FIG. 15 illustrates an extracted portion of the host signal that corresponds to a single bit, which may be referred to as Bit 1 throughout the specification. As illustrated in FIG. 19, the embedded data may include four (4) Bits. In various embodiments the data could include fewer or substantially more bits. Referring back to FIG.15 and continuing the 4 bit example represented by FIG. 19, Bit 1 is representative of a bit which is equivalent to the value of “1” (1-Bit) where components corresponding to the 1-Bit are spread across twelve (12) frequency bins (1, 5, 9, 13, 17, 21, 25, 29, 33, 37, 41 and 45).

[0090] The amplitude levels associated with the host/original signal are boosted by a + δ value or cut by a – δ value with respect to the key sequence for embedding a 1-Bit. Single amplitudes within the key sequence correspond to a single frequency bin within the host signal. This technique generates a watermarked signal having one or more values that have been boosted and/or cut based on the key sequence of the bit being embedded. For example, the amplitude associated with the first and fifth frequency bins of the host signal are boosted by + δ. The amplitude associated with the ninth frequency bin of the host signal is cut by – δ and so forth until each of the amplitudes within the host signal has been boosted or cut by a positive of negative δ value, respectively.

[0091] In such an embodiment, retrieving the embedded data from within the watermarked or encoded signal or “decoding the encoded signal” comprises multiplying the encoded signal by a first key sequence, as illustrated in FIG. 16. In order to retrieve the embedded data corresponding to Bit 1, the frequency bins which Bit 1 are spread across must be multiplied by the first key sequence. Multiplying a signal by the key sequence may comprise multiplying the amplitude of an individual frequency bin by the corresponding amplitude of the key sequence. For example, in the illustrated embodiment, the watermarked signal corresponding to the frequency bins of Bit 1 is multiplied by the secret key sequence. For example, the first amplitude (+δ) of the key-sequence is multiplied by the amplitude associated with the first frequency bin, the second amplitude of the key-sequence (+δ) is multiplied by the amplitude associated with the fifth frequency bin, and so forth. In an alternate embodiment, the amplitude values in each frequency bin of the watermarked signal may be converted to decibels prior to multiplication by the key sequence. In some embodiments, there may be a single key sequence which may be transformed into either a 1-Bit message vector or a 0-Bit message vector. The 1-Bit message vector may be equal to the key sequence. The 0-Bit message vector may be the inverse of the key sequence (i.e. the key sequence multiplied by negative one).

[0092] As illustrated in FIG. 17, multiplying the watermarked signal by the key sequence causes the values of the amplitudes to shift in the same direction with respect to the positive and/or negative δ value. For example, if a positive δ value was applied to the host signal then the watermarked signal is shifted in the positive direction with respect to the x-axis (horizontal axis) after being multiplied by the key sequence. Likewise, if a negative δ value was applied to the host signal then the watermarked signal is shifted in the negative direction with respect to the x-axis after being multiplied by the key sequence. The amplitudes of the signal can then be averaged to obtain a value “r”, where r is approximately equal to +δ if the value of the embedded bit is “1”, as illustrated in FIG. 18. In an instance that the value of the embedded bit is “0” then r is approximately equal to -δ. In alternate embodiments, a decision rule is used to determine whether or not the embedded data is representative of a 1-Bit or a 0-Bit, the decision rule may be a signal average greater than zero is a 1-Bit and a signal average less than zero is a 0-Bit. For example, if signal average is greater than zero then the system determines that the signal is representative of a 1-Bit. Likewise, if the signal average is less than zero then the system determines that the signal is representative of a 0-Bit. It should be noted that, in an exemplary embodiment, the decision rule is applied to one frame (in time) of the signal, thus a decision is not made for the entire signal at once, instead the system determines whether or not a portion of the signal is representative of a 1-Bit or a 0-Bit, thus multiple bits may be embedded within a single signal. For example, the system may determine whether the frequency bins corresponding to Bit 1 (e.g. frequency bins 1, 5, 9, 13, 17, 21, 25, 29, 33, 37, 41 and 45) are representative of a 1-Bit or a 0-Bit.

[0093] Referring now to FIG. 9, a method **900** for decoding an encoded signal may comprise reading a frame from an audio signal input **902**. In an exemplary embodiment, the audio signal is received in the time domain, thus a predetermined number of samples and/or frames may be read. The audio input may be received using hardware such as a microphone. It should be noted that a sample and/or frame of a signal may be defined as any portion of the signal that is less than the whole signal itself. At event **904**, the audio signal is transformed from the time domain to the frequency domain using Fast Fourier Transformation (FFT). The audio signal is then converted to decibels at event **906**. At event **908**, the system computes bit estimators. This computation may be represented by $r_i = \sum (k_i \text{ x } d)_j$ where . The notation "k_i" is representative of the key sequence for Bit "I," "d" is representative of the vector of frequency components in decibels, and the summation is applied to the one or more components represented by the notation "j."

[0094] After retrieving a series of 1-Bits and 0-Bits, the bits can collectively represent the embedded data masked by the host signal. The embedded data may represent numbers, words, phrases, letters, alphanumeric combinations, and the like. At event **806**, after retrieving the embedded data, the embedded data is sent to a separate entity such as the application server **106**. The embedded data may be sent via text, SMS, email, voice communications, text communications, Bluetooth, RFID, and the like.

[0095] In one embodiment, the mobile device may receive a message, at event **808**, in response to sending the embedded data. The message may be received via text, SMS, email, voice communications, text communications, Bluetooth, RFID, and the like. The message could contain an offer from a particular business, an advertisement, coupons, vouchers, and the like. In one embodiment, the message may be time-sensitive. For example, the message may contain an offer that expires if not used the day it is received. In another embodiment, the message may be a form of visual indicia, such as a QR code, that can be presented to the merchant at a point-of-sale device and redeemed for a special offer. Receiving a message may be solely based on the embedded data. For example, the embedded data may indicate the location of the user **102**, more specifically the business establishment in which the user **102** is located. To this extent, the embedded data can be matched with one or more messages stored in the application server **106** that are indicated to be sent to a user. In another embodiment, receiving a message may be based on one or more rules or secondary factors specified by the business or entity providing the communications. These one or more factors may include, but not be limited to, time frame (e.g. day of week, month, time of day, etc.), location, and the like. For example, the mobile device **104** may receive a message based on the embedded data and the fact that it is lunchtime, or in combination with the application of the mobile device.

[0096] Referring now to FIG. 10, a method **1000** for providing targeted location-based communications is illustrated, in accordance with one embodiment of the present invention. In an exemplary embodiment, the method first comprises a step **1002** for storing one or more messages associated with an entity. Additionally, the system is configured to receive data from a device, as illustrated at step **1004**. At block **1006**, at least one of the one or more messages stored are then selected based at least partially on the data received at step **1004**. The system may then send at least one of the one or more messages selected to a separate entity, such as a mobile device **104**, at block **1008**.

[0097] The one or more messages sent to the separate entity may reflect offers, advertisements, and/or other information which an entity (a merchant, a retailer, a business, or the like) wants to communicate to the user **102**. In one embodiment, messages are received from the communication system **108** and stored in the memory device **136** of the application server **106**, more specifically the data storage **138** of the application server **106**. The messages may be stored in a data table that is referenced by a pointer or a unique identifier. The pointer may correspond to the embedded data that is retrieved by the mobile device **104**. In such an embodiment, upon receiving data, the application server **106** may use the data to reference a data table where messages are stored. In this way, the application server **106** can match a user **102** with communications which the associated entity and/or business want to send the user **102**. The pointer may be an integer that corresponds to a message in the database. The pointer may also correspond to a merchant name for which one or more offers are available. For example, a user **102** carrying a mobile device **104** may be shopping at Merchant A, and the mobile device **104** may receive an encoded signal that is transmitted within the area. The mobile device **104** may then decode the encoded signal to retrieve embedded data and send the embedded data to the application server **106**. The application server **106** may then use the data as a key to access a table and send the user **102** a message that is particular to the user **102** and the user's current location, and received by the mobile device **104**.

[0098] A key sequence may be used in embedding an audio signal. FIG. 11 provides a diagram which illustrates the key sequence for embedding a 1-Bit as part of the audio signal. As illustrated the key sequence for a 1-Bit may be a randomly chosen sequence which alternates positive and negative delta (δ) values. For example, as illustrated in FIG. 11, the key sequence for embedding a 1-Bit may be "+ δ, + δ, - δ, + δ, + δ, - δ, + δ, - δ, + δ, - δ, - δ, - δ." As stated above, one key sequence may be used to encode or decode either a 1-Bit message vector or a 0-Bit message vector. In other embodiments, multiple keys may be used in a layered spread spectrum method of encoding and decoding. For example, a first key sequence may be associated with Bit 1, a second key sequence may be associated with Bit 2, a third key sequence may be associated with Bit 3, and so on.

[0099] FIGs. 12-19 illustrate various method or process steps discussed in greater detail above. More specifically, FIG. 12 provides a diagram which illustrates the key sequence for embedding a 0-bit. As illustrated the key sequence for embedding a 0-bit may the mirror image of the key sequence for embedding a 1-bit. For example, as illustrated in FIG. 11, the key sequence for embedding a 1-Bit may be "- δ, - δ, + δ, - δ, - δ, + δ, - δ, + δ, - δ, + δ, + δ, + δ." FIG. 13 provides a diagram which illustrates embedding multiple bits. As illustrated the bit sequence may be alternated at regular intervals based upon which bit is being embedded. FIG. 14 provides a diagram which illustrates a sample frame of an original/host signal. As illustrated the amplitude of the signal may vary at different intervals. FIG. 15 provides a diagram which illustrates a watermarked frame for a 1-bit. As illustrated in FIG. 15, the amplitude levels associated with the host/original signal are boosted by a + δ value or cut by a – δ value with respect to the key sequence for embedding a 1-Bit. As represented in FIG. 15, single amplitudes within the key sequence correspond to single amplitudes within the host signal. FIG. 16 provides a diagram which illustrates the process for recovering a message or embedded data from the watermarked signal. As illustrated the embedded data from within the watermarked and/or encoded signal comprises multiplying the encoded signal by a first key sequence associated with the 1-bit. FIG. 17 provides a diagram which further illustrates the process for recovering a message or embedded data from the watermarked signal. As illustrated in FIG. 17, multiplying the watermarked signal by the key sequence causes the values of the amplitudes to shift in the same direction with respect to the positive and/or negative δ value. FIG. 18 provides a diagram which further illustrates the process for recovering a message or embedded data from the watermarked signal. As illustrated in FIG. 17, multiplying the watermarked signal by the key sequence causes the values of the amplitudes to shift in the same direction with respect to the positive and/or negative δ value.

[00100] FIG. 19 provides a diagram which illustrates a layered spread spectrum according to various embodiments of the invention. As illustrated in FIG. 19, the layered spread spectrum may have twenty (20) frequency bins for transmitting encoded information. The key sequences for a single bit may only correspond to certain frequency bins. For example, the key sequence for "Bit 1" may only correspond to the first, fifth, ninth, thirteenth, and seventeenth frequency bins, from top to bottom, respectively, and a different key sequence for "Bit 2" may only correspond to the second, sixth, tenth, fourteenth, and eighteenth frequency bins, from top to bottom, respectively. Hence, the value of "Bit 1", for example, depends on the signal corresponding to the first, fifth, ninth, thirteenth, and seventeenth frequency bins, from top to bottom, respectively. For any particular instant in time or frame (in time) of the signal, the system should be able to determine the value of each of Bits 1-4, in this example. As previously noted, an exemplary embodiment may utilize more frequency bins than illustrated in the figures and may encode/decode more bits that illustrated in the figures.

[00101] In some embodiments, instead of encoding all data bits of a data signal at a first period in time of the host signal, the data bits of the data signal are encoded in groups of bits. For example, for a data signal having twenty data bits, a first group of data bits including bits 1-5 are encoded across the desired set of frequency bins. As the host signal progresses in time to a second period, a second set of data bits including bits 6-10 of the data signal are encoded across the same set of frequency bins as the first group of data bits had been during the first period. Similarly, as the host signal progresses in time to a third period, a third set of data bits including bits 11-15 of the data signal are encoded across the same set of frequency bins as the first and second groups had been during the first and second periods, respectively. Finally, as the host signal progresses in time to a fourth period, a fourth set of data bits including bits 16-20 of the

data signal are encoded across the same set of frequency bins as the first, second and third groups had been during the first, second and third periods, respectively. In different embodiments, the sets of frequency bins may be different and/or may overlap only partially for different groups of bits and time periods. For example, the first group of bits may be encoded over a first bin of frequencies ranging from 10kHz to 11kHz, the second group of bits may be encoded over a second bin of frequencies ranging from 11kHz to 12kHz, the third group of bits may be encoded over a third bin of frequencies ranging from 12kHz to 13kHz and the fourth group of bits may be encoded over a fourth bin of frequencies ranging from 14kHz to 15kHz. In another example, one or more of the frequency bins may overlap, such as the first group of bits being encoded over the range of 10kHz to 11kHz and the second group of bits being encoded over the range of 10.5kHz to 11.5kHz.

[00102] As shown in FIG. 20, an example 10 bit watermark signal is shown. Bits 1-5 are the group 1 bits and bits 6-10 are the group 2 bits. As shown, the watermark is encoded across the ultrasonic spectrum from 20kHz to 22kHz. During time period 1, the group 1 bits are encoded across frequency bins within the range of 20kHz to 21kHz. During time period 2, the group 2 bits are encoded across bins from the ranges 21kHz to 21.5kHz and 20kHz to 20.5kHz. Then the pattern repeats with the third time period so that the group 1 bits are encoded again. This encoding/decoding scheme may be implemented in either an audible-range implementation or an ultrasonic watermark as discussed below.

[00103] Referring now to FIGs. 21-25, alternative methods for encoding and decoding a data signal are discussed (collectively referred to herein as the “ultrasonic watermarking” methods). These methods involve the ultrasonic sound spectrum, namely, frequencies that are outside the human audible hearing range. Ultrasonic frequencies are generally considered to be those above about 20kHz, and in most embodiments of the invention, ultrasonic frequencies are considered to range from about 20kHz to about 22kHz. In contrast to the audible-range encoding and decoding methods discussed above, in general the ultrasonic watermarking methods do not require a host signal for encoding/decoding a data signal.

[00104] Referring to FIG. 21, a flowchart illustrates a method **2100** for encoding a data signal over ultrasonic frequencies. The first step, represented by block **2110** is to select a key sequence. The key sequence is selected at random and has an equal number of positive key

sequence values as negative key sequence values. The key sequence is selected as discussed in detail above with reference to FIG. 11.

[00105] The next step, represented by block **2120** is to determine which frequency bins correspond to negative key sequence values and set them to zero. The next step, represented by block **2130** is to generate a sine wave signal for each of the frequency bins that correspond to positive key sequence values, or are “boosted.” Thus, a sine wave is generated for each of the frequency bins that corresponds to a positive key sequence value of the random key sequence. This process may be executed via computer-readable code. Once the sine waves are generated for each of the frequency bins corresponding to positive key sequence values, all the sine waves are summed, as represented by block **2140**.

[00106] This method provides an advantage over some other methods because of the great difference between the decibel levels of the various frequency bins when moving from a “zero” to a “boosted” bin. For example, a boosted frequency bin may have a sound pressure level (SPL) of 70dB and the adjacent frequency bin will have a decibel level of zero dB under this methodology. On the other hand, if the frequency bins associated with the negative key sequence values of the key sequence retained an SPL, then the difference between adjacent frequency bins may be relatively small. That is, the adjacent frequency bin may have an SPL of 60dB, which is only a 10dB difference from the previous frequency bin, and therefore, may provide a greater opportunity for noise to degrade the encoded signal.

[00107] Referring to FIGs. 22A and 22B, the watermark signal is shown divided among multiple frequency bins. The corresponding frequency bins from the secret key are also shown, similar to the illustration of FIG. 15 described above; however, there is no host signal in this ultrasonic watermarking implementation. In FIG. 22A, the watermarked signal is created by using only the positive key sequence values, or 1-Bits. The negative key sequence values of the secret key are removed such that the modified secret key includes a SPL of zero for the frequency bins associated with negative key sequence values of the original secret key. Thus, only the frequency bins associated with positive key sequence values may be included in the watermark signal. Conversely, in FIG. 22B, the watermarked signal is created using only the negative key sequence values, or 0-Bits. The positive key sequence values of the secret key are removed such that the modified secret key includes a SPL of zero for the frequency bins associated with positive key sequence values of the original secret key. Thus, only the frequency

bins associated with negative key sequence values may be included in the watermark signal. In some embodiments, the multiplication in 0-Bit encoding may occur before the positive key sequence values are removed from the secret key. In other embodiments, the multiplication in 0-Bit encoding may occur after the positive key sequence values are removed from the secret key.

[00108] In some embodiments, the same secret key used to encode the signal may be used to decode the signal. As shown in FIG. 23A, the watermark signal may include zero SPL key sequence values in the frequency bins corresponding to the positive key sequence values of the original secret key. Conversely, as depicted in FIG. 23B, the modified watermark signal may include zero SPL key sequence values in the frequency bins corresponding to the negative key sequence values of the original secret key.

[00109] As shown in FIGs. 24 and 25, in order to recover the watermark signal and thereby determine if the signal represents a “1” or a “0” bit, the modified watermark signal is multiplied by the secret key. Then, the average of the resulting signal is taken. If that average is positive, then it is determined to be a “1” bit.

[00110] As an example, the aforementioned watermarking technologies may be applied to a retail shopping experience to increase customer engagement. When shopping at a retail location **2610**, the user **102** may benefit from receiving an offer (a coupon, an advertisement, a deal, a message, information, or the like) at the point of sale. Because the user **102** may already be using his mobile device **104** to check prices or read reviews on particular products, there may be a need to transmit an offer to the user’s mobile device **104** while he is physically at the retail location **2610**.

[00111] FIGs. 26 through 35 illustrate embodiments of a system and method for transmitting an offer to the user’s mobile device **104** within a predetermined proximity of the retail location **2610**. An apparatus (a computing device, an application server, a program server, or the like) may be provided for executing this process.

[00112] FIG. 26 depicts a system overview for the present invention. The system may utilize a media distribution network **2600** associated with the present invention. The media distribution network **2600** may include a combination of the aforementioned technologies including watermarking technologies, the application server **106**, the playback device **210**, the program server **207**, the communication system **108**, or the like and may serve the purpose of

transmitting media and messages to mobile devices **104** within range of a predetermined area, such as a retail location **2610**.

[00113] As depicted in FIG. 26, the program server **207** may be configured or controlled by one or more entity. In some embodiments, the program server **207** may be operated by the entity associated with the media distribution network **2600**. In other embodiments, the program server **207** may be operated by the retailer or business owner. In alternative embodiments, the program server **207** may be operated by a third party such as an application provider, a coupon provider, a social network, or the like. Lastly, a product supplier, an advertising agency, a marketing agency, or the like may manage the content of an advertising campaign for the retailer or the third party wherein a message is transmitted to the user's mobile device **104**.

[00114] Each involved piece of the system depicted in FIG. 26 may include a defined role of operation. For example, the third party may provide access to developer content via a software developer kit (SDK), keys, or the like. The advertising or marketing agency may manage the content of the message or offer and may handle how the content is distributed. The agencies may also be under the supervision of the entity, the retailer, or the third party. In some embodiments, the agencies may coordinate with a preexisting network of customers or with an application provider to push advertisements for products within the network **101**. In other embodiments, the entity, the retailer, and the third party may all be the same entity. Furthermore, while the retailer may be enabled to change to which retail locations **2610** the content may be distributed, the retailer may have no or limited access to the content management platform.

[00115] As described herein, FIGs. 27, 30, and 33 illustrate exemplary system diagrams of the present invention operating in a variety of configurations. In some embodiments, the application server **106** may include a content management system that may be controlled by the entity associated with the present invention, as shown in FIG. 27. In other embodiments, the application server **106** may be controlled by the retailer, as illustrated in FIG. 30. In alternative embodiments, the application server **106** may be controlled by a third party, as depicted in FIG. 33. The program server **207** is typically installed at one or more retail location **2610** and may communicate with the application server **106** and/or the user's mobile device **104** via the network **101**.

[00116] In some embodiments, the message may be transmitted from the application server **106** directly to the user's mobile device **104** as demonstrated in FIGs. 27 through 29. In other embodiments, the message may be transmitted from the application server **106** to the program server **2620**. While this method may require the program server **207** to store the message in memory, it may also enable the program server **207** to distribute the message to multiple computing devices (including the user's mobile device **104**) within the predetermined retail location **2610** proximity. This may save time, storage space, and network bandwidth as opposed to transmitting the message from the application server **106** directly to the mobile device **104** confirmed to be at the retail location **2610**.

[00117] In some embodiments, the message may be transmitted directly to the user's mobile device **104** in the form of a text message, an email, an alert, a notification, or the like. The message may include a pop-up window that enables the user **102** to select the message, redeem an offer, or to learn more information. When the user **102** selects the pop-up window, the apparatus may present an interface for learning more information about the message or instructions on how to redeem an offer, an advertisement, or the like. Information associated with the message may include the duration of an offer, a discount, product information, or the like.

[00118] A program server **207** may be installed in a retail location **2610**, wherein the program server **207** is configured as described herein. The program server **207** may scan the surrounding area at a predetermined distance from the physical location of the program server **207** for any mobile device **104** that may be associated with a potential customer.

[00119] Upon locating a mobile device **104**, the program server **207** may communicate to the application server **106** to request to send a message, an advertisement, an offer, or the like to the mobile device **104**. This method ensures that the nearby mobile device **104** receives the message, which may be helpful in increasing sales leads, as well as cross-selling in passerby shoppers, neighboring stores, or the like.

[00120] FIG. 28 depicts the process **2800** for transmitting the message directly to the user's mobile device **104**. At block **2810** the process includes the user **102** having a mobile device **104** in possession. At block **2820** the process includes the user entering a proximity to a retail location **2610**. At block **2830** the process includes the user's mobile device **104** being determined by the apparatus to be at a retail location **2610**. At block **2840** the process includes

the user **102** receiving a message on his mobile device **104**, the message being transmitted by the apparatus in response to determining the user's mobile device **104** to be at the retail location **2610**. FIG. 29 illustrates an example of this process **2800**.

[00121] In other embodiments, the offer may be transmitted via an application associated with the retailer as demonstrated in FIGs. 30 through 32. For example, if the user **102** opens Company A's application on his mobile device **104** while at the retail location **2610**, then the apparatus may present a message, an offer, an advertisement, an alert, a notification, or the like inside the retailer application. The offer may include a pop-up window that enables the user **102** to select the message, redeem an offer, or to learn more information. When the user **102** selects the pop-up window, the apparatus may present an interface for learning more information about the message or instructions on how to redeem an offer, an advertisement, or the like. Information associated with the message may include the duration of an offer, a discount, product information, or the like. FIG. 30 illustrates an exemplary system for transmitting the message directly to the user's mobile device **104** via an application associated with the retailer.

[00122] FIG. 31 depicts the process **3100** for transmitting the message directly to the user's mobile device **104** via an application associated with the retailer. At block **3110** the process includes the user **102** having a mobile device **104** in possession, wherein the mobile device **104** includes an installed application associated with a retailer. At block **3120** the process includes the user **102** entering a proximity to a retail location **2610**. At block **3130** the process includes the user's mobile device **104** being determined by the apparatus to be at a retail location **2610**. At block **3140** the process includes the user **102** receiving a message on his mobile device **104** via the application associated with the retailer, the message being transmitted from the apparatus in response to determining the user's mobile device **104** to be at the retail location **2610**. FIG. 32 exemplifies this process **3100**.

[00123] In alternative embodiments, the message may be transmitted via a third party application. For example, if the user **102** opens an application on his mobile device **104** that is strictly purposed for providing coupons, the message associated with the retail location **2610** may present an alert, a notification, an offer, or the like inside the third party application. The message may include a pop-up window that enables the user **102** to select an offer, redeem the offer, or to learn more information. When the user **102** selects the pop-up window, the apparatus may present an interface for learning more information about the message or instructions on how

to redeem an offer. Information associated with the offer may include the duration of the offer, a discount, product information, or the like. FIG. 33 illustrates an exemplary system for transmitting the offer directly to the user's mobile device **104** via an application associated with a third party application.

[00124] In some embodiments, the user **102** may not need to open the application associated with the retailer or the third party. The message or offer may be presented directly to the user's mobile device **104**. In other embodiments, the mobile device **104** may or may not require installation of a particular application to communicate with the program server **207** or the application server **106**. The present invention may be configured to automatically transmit and receive information. For example, the mobile device **104** may automatically listen for watermarked signals at all times. When the program server **207** at a retail location **2610** determines that the mobile device **104** is within a predetermined distance of a location of interest (e.g., a retail location **2610**), the application server **106** or the program server **207** may automatically transmit a message, a notification, an offer, or the like to the mobile device **104**.

[00125] FIG. 34 depicts the process **3400** for transmitting the message directly to the user's mobile device **104** via a third party application. At block **3410** the process includes the user **102** having a mobile device **104** in possession, wherein the mobile device **104** includes a downloaded application associated with a third party. At block **3420** the process includes the user **102** entering a proximity to a retail location **2610**. At block **3430** the process includes the user's mobile device **104** being determined by the apparatus to be at a retail location **2610**. At block **3440** the process includes the user **102** opening the application associated with the third party. At block **3450** the process includes the user **102** receiving a message on his mobile device **104** via the application associated with the third party, the message being transmitted from the apparatus in response to being determined by the apparatus to be at a retail location **2610**. FIG. 35 exemplifies this process **3400**.

[00126] As an example, the present invention may recognize that the user **102** has entered within a predetermined proximity to a retail location **2610**. The apparatus may present to the user's mobile device **104** a message in the form of a banner, a text message, an SMS message, an image, a pop-up window, or the like. The user **102** may select the message on the mobile device **104** and may be presented with more information associated with an offer (or a deal, an advertisement, or the like). The offer may be presented to the user **102** via a website, an

application, a pop-up window, or the like. In some embodiments, the user **102** may redeem the offer directly from his mobile device **104** or apply to it a purchase while at the retail location **2610**.

[00127] The present invention may also include a content management platform associated with the program server **207**, the playback device **210**, and/or the application server **106**. In some embodiments, the content management platform may enable the retailer to generate or manage the content of an offer, an advertisement, a message, an image, text, a length of an advertisement campaign, a location of an offer, or the like. In other embodiments, the present invention may be configured to enable the retailer to purchase or manage advertising space. In alternative embodiments, the present invention may include analytics to allow the retailer or a third party advertising or marketing agency to track progress of an advertising campaign. The content management platform may also enable the entity, the retailer, or a third party to modify the content at various times throughout the day.

[00128] The present invention may include at least one interface for retailer content management. The interface may be located inside a retail location **2610**. In some embodiments, one interface may enable the retailer to manage the content or advertising campaign for multiple retail locations **2610**, including a subset of retail locations **2610**. For example, if a retailer has multiple stores, the retailer may configure the content management system to operate over a particular geographic area, such as the stores in a specific state, county, country, or the like. Multiple interfaces may also control the same retail location's **2610** content management system. Thus, the present invention may allow for the content management system to be controlled or configured from a central location.

[00129] FIGs. 36 through 41 illustrate exemplary user interfaces for the present invention. FIG. 36 shows how the user (an entity, a retailer, a marketer, an advertiser, an application provider, or the like) may manage campaigns via the content management platform. FIG. 37 depicts how the user may select a campaign type. FIG. 38 shows how the user may create a campaign type. FIG. 39 presents a sample analytics overview of the campaigns and includes the ability to sort by location or by campaign title. FIG. 40 illustrates an information page where the user may learn more about how the present invention works and creates value. FIG. 41 is an illustrated schedule feature for managing campaign durations, locations, or the like. A campaign may be edited or controlled for a predetermined period of time or day.

[00130] All in all, the present invention may promote customer use of the retailer's application while in the store. By providing the user **102** with a message including deals or offers, the retailer can incentivize use of the retailer's application. Increased use of the retailer's application may increase customer awareness of products and coupons, thus potentially generating more sales revenue.

[00131] The system may be further configured to collect information associated with the user's mobile device **104** (and therefore the user **102**). In some embodiments, collected information may include contact information, demographic information, network identification information, an IP address, transaction information (including a transaction history), customer purchasing habits, information associated with an account, or the like. The information may be transmitted from the user's mobile device **104** to the program server **207** or the application server **106** via the network **101**, a wireless network, a satellite network, a Wi-Fi network, audio watermarking technologies, or the like.

[00132] The purpose of collecting this information may be to amass a database of metrics so the entity may better understand its customers. For example, a retailer may be able to process the collected information using a variety of methods or algorithms to gauge how many customers are at a retail location **2610** during a particular period of time or how many purchases of items were made, to calculate a sales conversion rate, or the like. The type processing may be determined by the entity, the retailer, or the third party. Hence, collecting information associated with the user's mobile device **104** may increase awareness of customer habits and may potentially increase sales revenue.

[00133] Any of the features described herein with respect to a particular process flow are also applicable to any other process flow. In accordance with embodiments of the invention, the term "module" with respect to a system may refer to a hardware component of the system, a software component of the system, or a component of the system that includes both hardware and software. As used herein, a module may include one or more modules, where each module may reside in separate pieces of hardware or software.

[00134] Although many embodiments of the present invention have just been described above, the present invention may be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will satisfy applicable legal requirements. Also, it will be understood that,

where possible, any of the advantages, features, functions, devices, and/or operational aspects of any of the embodiments of the present invention described and/or contemplated herein may be included in any of the other embodiments of the present invention described and/or contemplated herein, and/or vice versa. In addition, where possible, any terms expressed in the singular form herein are meant to also include the plural form and/or vice versa, unless explicitly stated otherwise. Accordingly, the terms “a” and/or “an” shall mean “one or more,” even though the phrase “one or more” is also used herein. Like numbers refer to like elements throughout.

[00135] As will be appreciated by one of ordinary skill in the art in view of this disclosure, the present invention may include and/or be embodied as an apparatus (including, for example, a system, machine, device, computer program product, and/or the like), as a method (including, for example, a business method, computer-implemented process, and/or the like), or as any combination of the foregoing. Accordingly, embodiments of the present invention may take the form of an entirely business method embodiment, an entirely software embodiment (including firmware, resident software, micro-code, stored procedures in a database, or the like), an entirely hardware embodiment, or an embodiment combining business method, software, and hardware aspects that may generally be referred to herein as a “system.” Furthermore, embodiments of the present invention may take the form of a computer program product that includes a computer-readable storage medium having one or more computer-executable program code portions stored therein. As used herein, a processor, which may include one or more processors, may be “configured to” perform a certain function in a variety of ways, including, for example, by having one or more general-purpose circuits perform the function by executing one or more computer-executable program code portions embodied in a computer-readable medium, and/or by having one or more application-specific circuits perform the function.

[00136] It will be understood that any suitable computer-readable medium may be utilized. The computer-readable medium may include, but is not limited to, a non-transitory computer-readable medium, such as a tangible electronic, magnetic, optical, electromagnetic, infrared, and/or semiconductor system, device, and/or other apparatus. For example, in some embodiments, the non-transitory computer-readable medium includes a tangible medium such as a portable computer diskette, a hard disk, a random access memory (RAM), a read-only memory (ROM), an erasable programmable read-only memory (EPROM or Flash memory), a compact disc read-only memory (CD-ROM), and/or some other tangible optical and/or magnetic storage

device. In other embodiments of the present invention, however, the computer-readable medium may be transitory, such as, for example, a propagation signal including computer-executable program code portions embodied therein.

[00137] One or more computer-executable program code portions for carrying out operations of the present invention may include object-oriented, scripted, and/or unscripted programming languages, such as, for example, Java, Perl, Smalltalk, C++, SAS, SQL, Python, Objective C, JavaScript, and/or the like. In some embodiments, the one or more computer-executable program code portions for carrying out operations of embodiments of the present invention are written in conventional procedural programming languages, such as the "C" programming languages and/or similar programming languages. The computer program code may alternatively or additionally be written in one or more multi-paradigm programming languages, such as, for example, F#.

[00138] Some embodiments of the present invention are described herein with reference to flowchart illustrations and/or block diagrams of apparatus and/or methods. It will be understood that each block included in the flowchart illustrations and/or block diagrams, and/or combinations of blocks included in the flowchart illustrations and/or block diagrams, may be implemented by one or more computer-executable program code portions. These one or more computer-executable program code portions may be provided to a processor of a general purpose computer, special purpose computer, and/or some other programmable data processing apparatus in order to produce a particular machine, such that the one or more computer-executable program code portions, which execute via the processor of the computer and/or other programmable data processing apparatus, create mechanisms for implementing the steps and/or functions represented by the flowchart(s) and/or block diagram block(s).

[00139] The one or more computer-executable program code portions may be stored in a transitory and/or non-transitory computer-readable medium (e.g., a memory or the like) that can direct, instruct, and/or cause a computer and/or other programmable data processing apparatus to function in a particular manner, such that the computer-executable program code portions stored in the computer-readable medium produce an article of manufacture including instruction mechanisms which implement the steps and/or functions specified in the flowchart(s) and/or block diagram block(s).

[00140] The one or more computer-executable program code portions may also be loaded onto a computer and/or other programmable data processing apparatus to cause a series of operational steps to be performed on the computer and/or other programmable apparatus. In some embodiments, this produces a computer-implemented process such that the one or more computer-executable program code portions which execute on the computer and/or other programmable apparatus provide operational steps to implement the steps specified in the flowchart(s) and/or the functions specified in the block diagram block(s). Alternatively, computer-implemented steps may be combined with, and/or replaced with, operator- and/or human-implemented steps in order to carry out an embodiment of the present invention.

[00141] While certain exemplary embodiments have been described and shown in the accompanying drawings, it is to be understood that such embodiments are merely illustrative of and not restrictive on the broad invention, and that this invention not be limited to the specific constructions and arrangements shown and described, since various other changes, combinations, omissions, modifications and substitutions, in addition to those set forth in the above paragraphs, are possible. Those skilled in the art will appreciate that various adaptations, modifications, and combinations of the just described embodiments can be configured without departing from the scope and spirit of the invention. Therefore, it is to be understood that, within the scope of the appended claims, the invention may be practiced other than as specifically described herein.

WHAT IS CLAIMED IS:

1. A system for creating an audio watermark signal by encoding a message comprising data, the message encoded with a host signal in the audible frequency range, the system comprising at least one encoding device comprising a processing device to:

receive the host signal and data to be encoded;

read a frame from the host signal;

transform the frame from the time domain to the frequency domain;

apply at least one message vector to a plurality of frequency components of the frame, wherein the at least one message vector comprises a randomly generated signal having an equal number of positive components and negative components, the positive components each having substantially the same amplitude and the negative components each having substantially the same amplitude, the amplitude of the positive components and the amplitude of the negative components having substantially the same absolute value; and

transform the frame from the frequency domain to the time domain.

2. The system of claim 1, wherein the processing device is further to:

append the frame to a previously encoded frame.

3. The system of claim 1, wherein applying at least one message vector to a plurality of components of the frame comprises:

applying a one bit message vector to some of the plurality of frequency components of the frame to encode a one; and

applying a zero bit message vector to others of the plurality of frequency components of the frame to encode a zero.

4. The system of claim 3, wherein the zero bit message vector is the one bit message vector multiplied by negative one.

5. The system of claim 4, wherein substantially all or all bits of the data are encoded such that they might be decoded by considering one frame of the audio watermark signal.

6. The system of claim 1, wherein applying at least one message vector to a plurality of components of the frame comprises:

multiplying the frequency components by the at least one message vector

7. The system of claim 1, wherein applying at least one message vector to a plurality of components of the frame comprises:

converting the components to decibels;

adding the message vector to the converted components resulting in a sum; and

converting the sum to a plurality of amplitudes.

8. A system for decoding an audio watermark signal in the audible frequency range, the system comprising a processing device to:

receive the audio watermark signal;

read a frame from the audio watermark signal;

transform the frame from the time domain to the frequency domain;

convert the frame to decibels;

apply at least one message vector to a plurality of frequency components of the frame, wherein the at least one message vector comprises a randomly generated signal having an equal number of positive components and negative components, the positive components each having substantially the same amplitude and the negative components each having substantially the same amplitude, the amplitude of the positive components and the amplitude of the negative components having substantially the same absolute value;

average the amplitudes of the plurality of frequency components for which the at least one message vector was applied; and

determine, based on the amplitude averaging, the encoded data.

9. The system of claim 8, wherein determining comprises:

determining whether the average amplitude is greater than or less than zero;

assigning a one bit to the data when the average amplitude is greater than zero; and

assigning a zero bit to the data when the average amplitude is less than zero.

10. The system of claim 8, wherein determining comprises:

determining that the average amplitude is greater than a predetermined threshold based at least in part on the absolute value of the components of the at least one message vector; and

assigning a one bit to the data.

11. The system of claim 8, wherein determining comprises:

determining that the average amplitude is less than a predetermined threshold based at least in part on the absolute value of the components of the at least one message vector; and

assigning a zero bit to the data.

12. The system of claim 8, wherein applying comprises multiplying the at least one message vector by the plurality of frequency components of the frame.

13. A system for creating an audio watermark signal by encoding a message comprising data, the message encoded in the ultrasonic frequency range, the system comprising at least one encoding device comprising a processing device to:

receive the data to be encoded;

generate at least one message vector, wherein the at least one message vector comprises a randomly generated signal having an equal number of positive components and negative components, the positive components each having substantially the same amplitude and the negative components each having substantially the same amplitude, the amplitude of the positive components and the amplitude of the negative components having substantially the same absolute value;

determine that the data to be encoded comprises a one bit;

determine which components correspond to negative values and set them to zero;

generate a sine wave signal for each component that corresponds to positive values;

add all the sine waves, thereby creating an audio watermark signal.

14. The system of claim 13, wherein the processing device is further to:

determine that the data to be encoded comprises a zero bit;

multiply the at least one message vector by negative one;

determine which components correspond to negative values and set them to zero;
generate a sine wave signal for each component that corresponds to positive values;
add all the sine waves, thereby creating an audio watermark signal.

15. The system of claim 14, wherein the processing device is further to:
determine that the data to be encoded comprises a zero bit;
determine which components correspond to positive values and set them to zero;
multiply the at least one message vector by negative one, thereby resulting in the message vector having only positive value components;
generate a sine wave signal for each component that corresponds to positive values; and
add all the sine waves, thereby creating an audio watermark signal.

16. A system for decoding an audio watermark signal in the ultrasonic frequency range, the system comprising a processing device to:
receive the audio watermark signal;
read a frame from the audio watermark signal;
transform the frame from the time domain to the frequency domain;
convert the frame to decibels;
apply at least one message vector to a plurality of frequency components of the frame, wherein the at least one message vector comprises a randomly generated signal having an equal number of positive components and negative components, the positive components each having substantially the same amplitude and the negative components each having substantially the same amplitude, the amplitude of the positive components and the amplitude of the negative components having substantially the same absolute value;
average the amplitudes of the plurality of frequency components for which the at least one message vector was applied; and
determine, based on the amplitude averaging, the encoded data.

17. The system of claim 16, wherein determining comprises:
determining whether the average amplitude is greater than or less than zero;
assigning a one bit to the data when the average amplitude is greater than zero; and

assigning a zero bit to the data when the average amplitude is less than zero.

18. The system of claim 16, wherein determining comprises:

determining that the average amplitude is greater than a predetermined threshold based at least in part on the absolute value of the components of the at least one message vector; and

assigning a one bit to the data.

19. The system of claim 16, wherein determining comprises:

determining that the average amplitude is less than a predetermined threshold based at least in part on the absolute value of the components of the at least one message vector; and

assigning a zero bit to the data.

20. The system of claim 16, wherein applying comprises multiplying the at least one message vector by the plurality of frequency components of the frame.

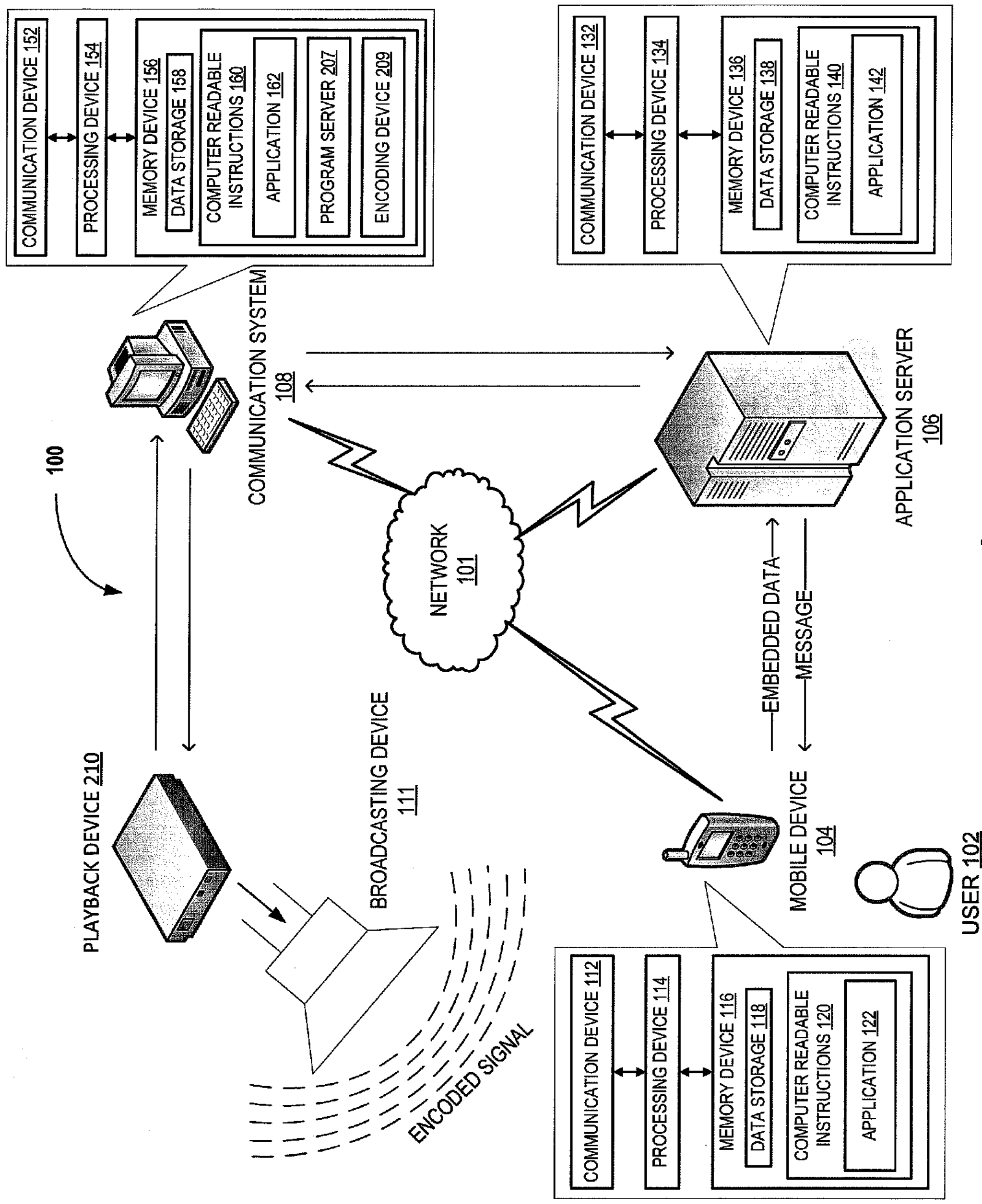

100
PLAYBACK DEVICE 210
BROADCASTING DEVICE 111
ENCODED SIGNAL
COMMUNICATION SYSTEM 108
COMMUNICATION DEVICE 152
PROCESSING DEVICE 154
MEMORY DEVICE 156
DATA STORAGE 158
COMPUTER READABLE INSTRUCTIONS 160
APPLICATION 162
PROGRAM SERVER 207
ENCODING DEVICE 209
NETWORK 101
APPLICATION SERVER 106
COMMUNICATION DEVICE 132
PROCESSING DEVICE 134
MEMORY DEVICE 136
DATA STORAGE 138
COMPUTER READABLE INSTRUCTIONS 140
APPLICATION 142
EMBEDDED DATA
MESSAGE
MOBILE DEVICE 104
USER 102
COMMUNICATION DEVICE 112
PROCESSING DEVICE 114
MEMORY DEVICE 116
DATA STORAGE 118
COMPUTER READABLE INSTRUCTIONS 120
APPLICATION 122

FIG. 1

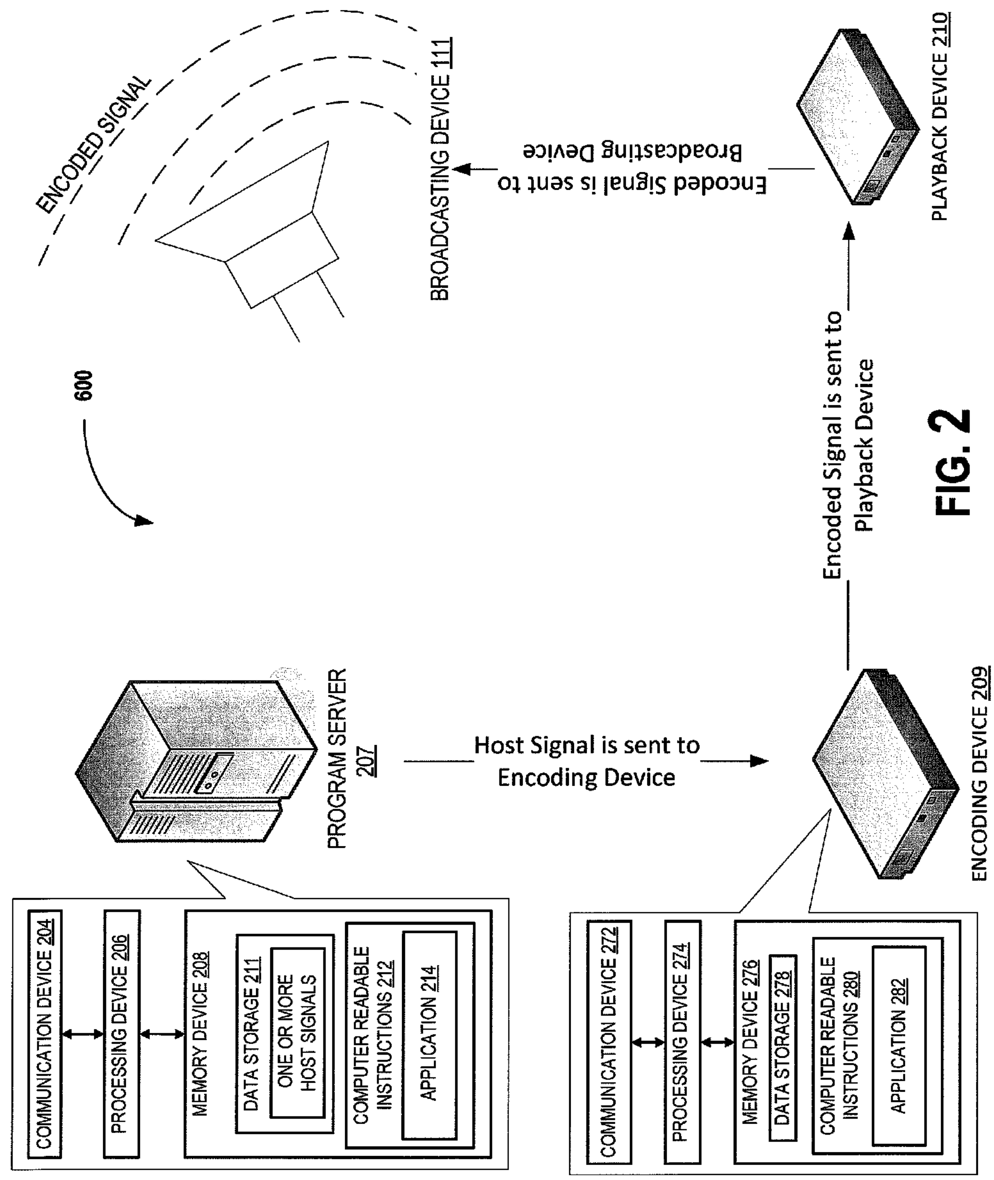

600
ENCODED SIGNAL
BROADCASTING DEVICE 111
Encoded Signal is sent to
Broadcasting Device
PLAYBACK DEVICE 210
Encoded Signal is sent to
Playback Device
PROGRAM SERVER 207
Host Signal is sent to
Encoding Device
ENCODING DEVICE 209
COMMUNICATION DEVICE 204
PROCESSING DEVICE 206
MEMORY DEVICE 208
DATA STORAGE 211
ONE OR MORE HOST SIGNALS
COMPUTER READABLE INSTRUCTIONS 212
APPLICATION 214
COMMUNICATION DEVICE 272
PROCESSING DEVICE 274
MEMORY DEVICE 276
DATA STORAGE 278
COMPUTER READABLE INSTRUCTIONS 280
APPLICATION 282

FIG. 2

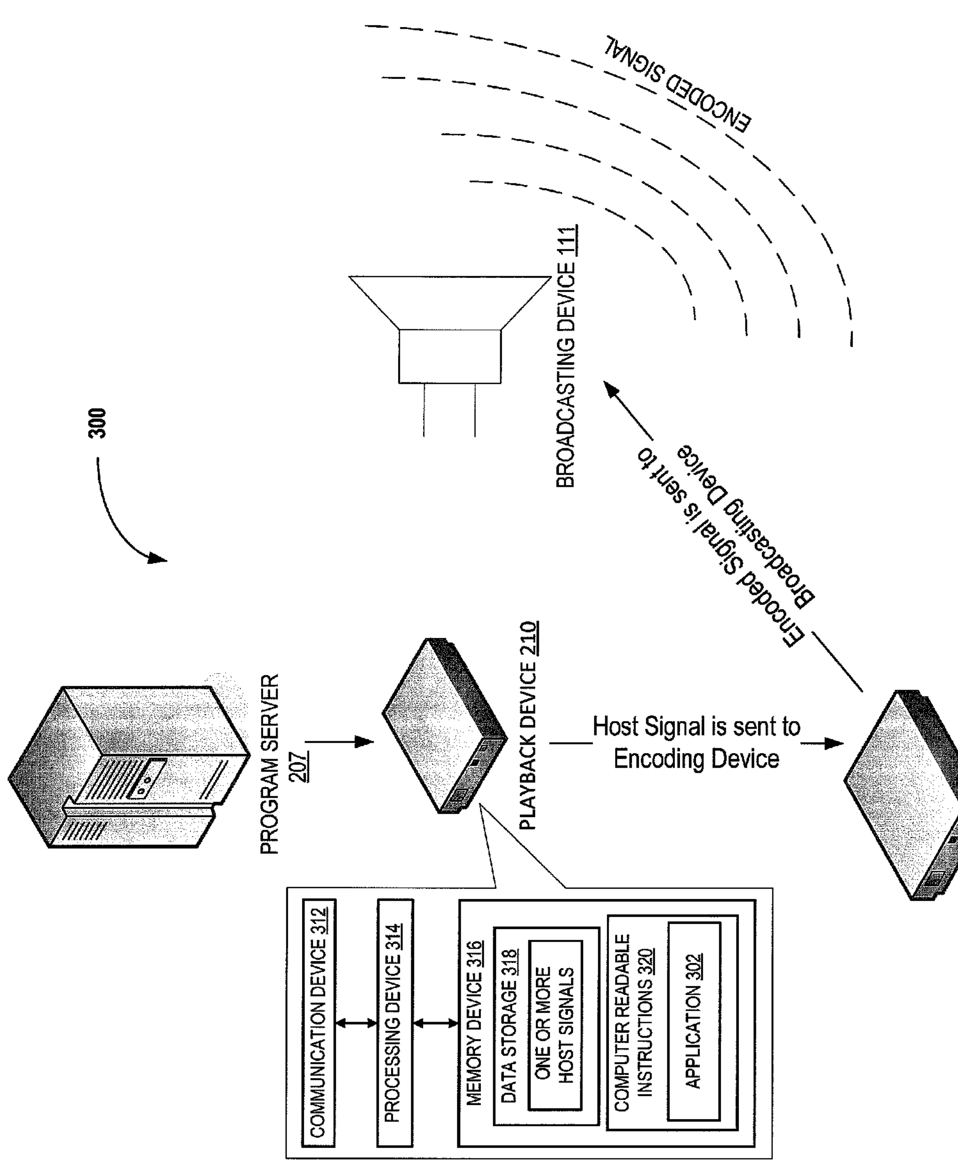

300
PROGRAM SERVER 207
PLAYBACK DEVICE 210
Host Signal is sent to Encoding Device
ENCODING DEVICE 209
Encoded Signal is sent to Broadcasting Device
BROADCASTING DEVICE 111
ENCODED SIGNAL
COMMUNICATION DEVICE 312
PROCESSING DEVICE 314
MEMORY DEVICE 316
DATA STORAGE 318
ONE OR MORE HOST SIGNALS
COMPUTER READABLE INSTRUCTIONS 320
APPLICATION 302

FIG. 3

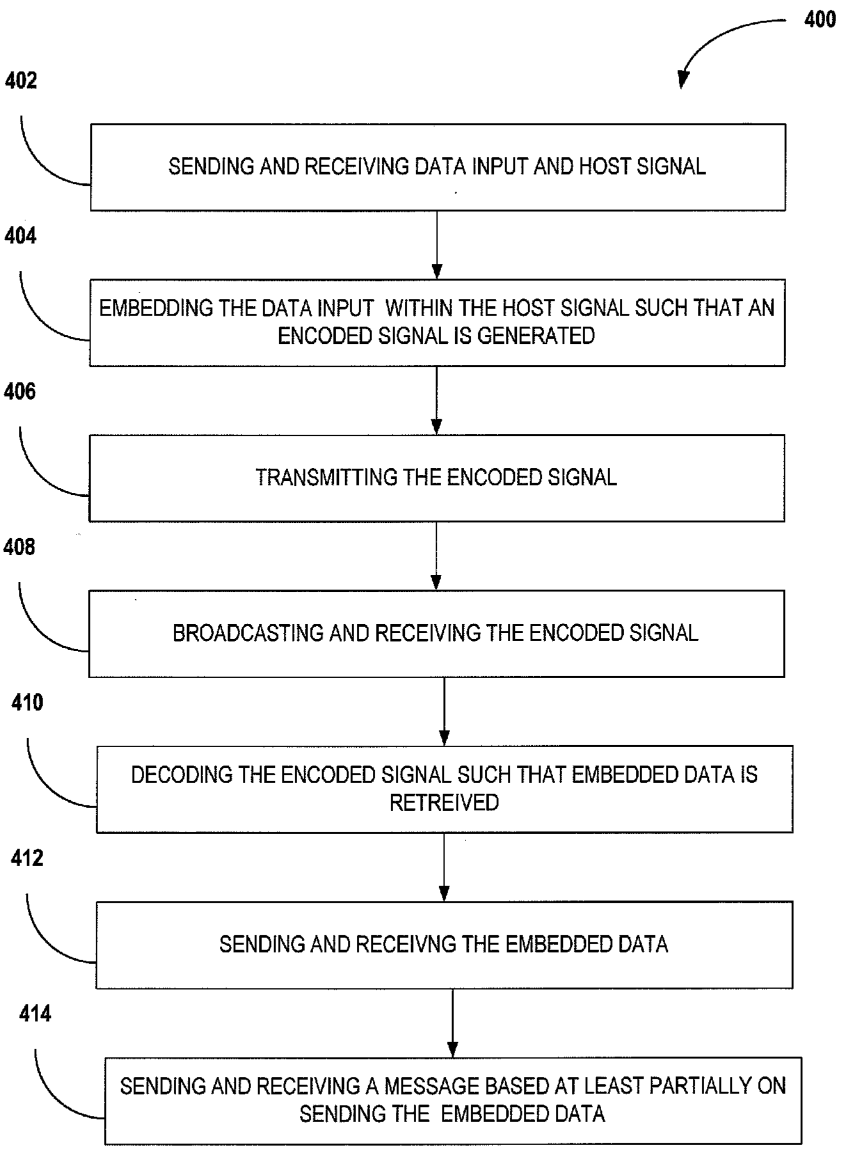

400
402
SENDING AND RECEIVING DATA INPUT AND HOST SIGNAL
404
EMBEDDING THE DATA INPUT WITHIN THE HOST SIGNAL SUCH THAT AN ENCODED SIGNAL IS GENERATED
406
TRANSMITTING THE ENCODED SIGNAL
408
BROADCASTING AND RECEIVING THE ENCODED SIGNAL
410
DECODING THE ENCODED SIGNAL SUCH THAT EMBEDDED DATA IS RETREIVED
412
SENDING AND RECEIVNG THE EMBEDDED DATA
414
SENDING AND RECEIVING A MESSAGE BASED AT LEAST PARTIALLY ON SENDING THE EMBEDDED DATA

FIG. 4

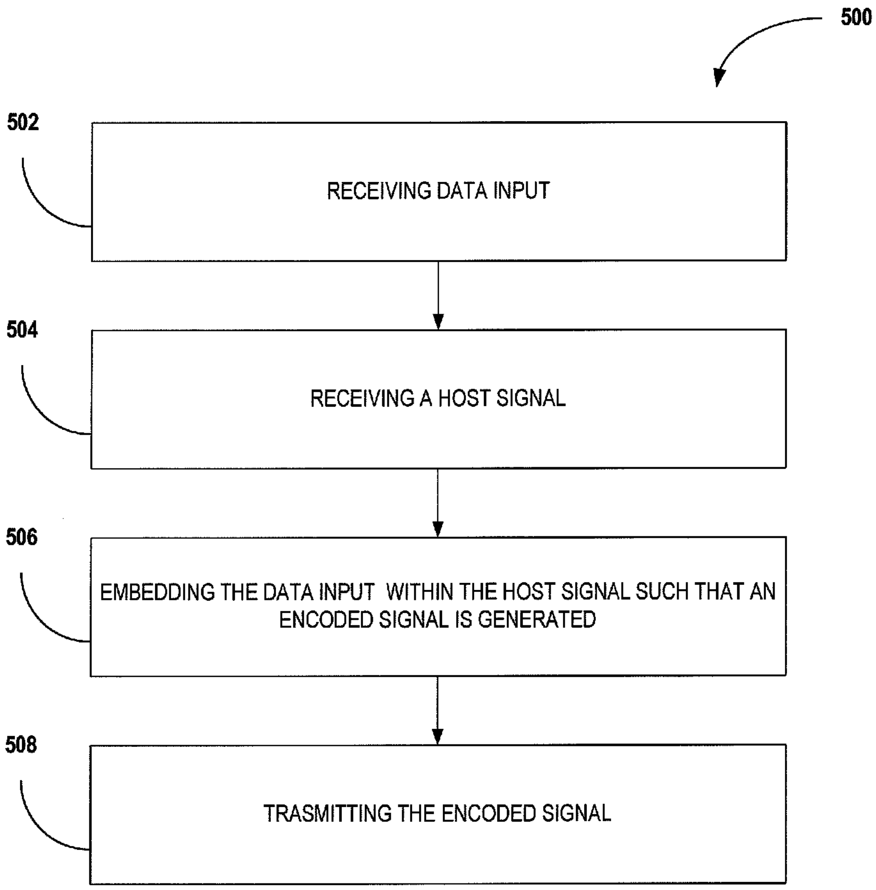

500
502
RECEIVING DATA INPUT
504
RECEIVING A HOST SIGNAL
506
EMBEDDING THE DATA INPUT WITHIN THE HOST SIGNAL SUCH THAT AN ENCODED SIGNAL IS GENERATED
508
TRASMITTING THE ENCODED SIGNAL

FIG. 5

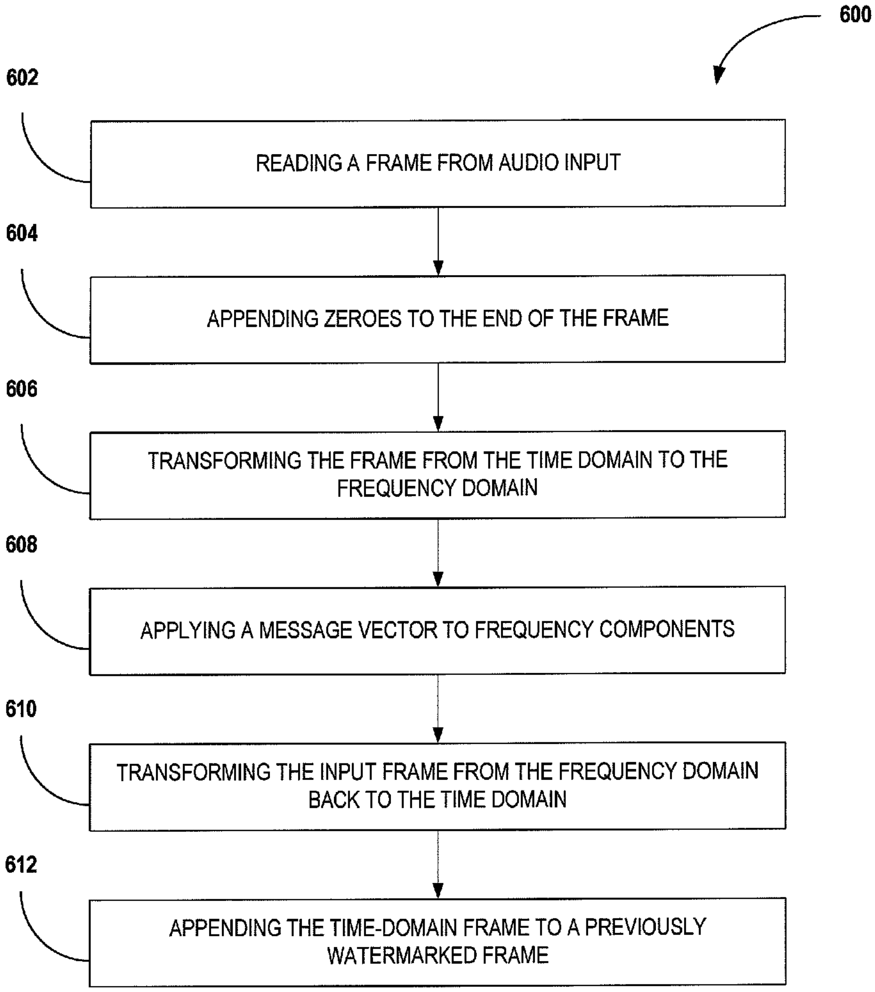

600
602
READING A FRAME FROM AUDIO INPUT
604
APPENDING ZEROES TO THE END OF THE FRAME
606
TRANSFORMING THE FRAME FROM THE TIME DOMAIN TO THE FREQUENCY DOMAIN
608
APPLYING A MESSAGE VECTOR TO FREQUENCY COMPONENTS
610
TRANSFORMING THE INPUT FRAME FROM THE FREQUENCY DOMAIN BACK TO THE TIME DOMAIN
612
APPENDING THE TIME-DOMAIN FRAME TO A PREVIOUSLY WATERMARKED FRAME

FIG. 6

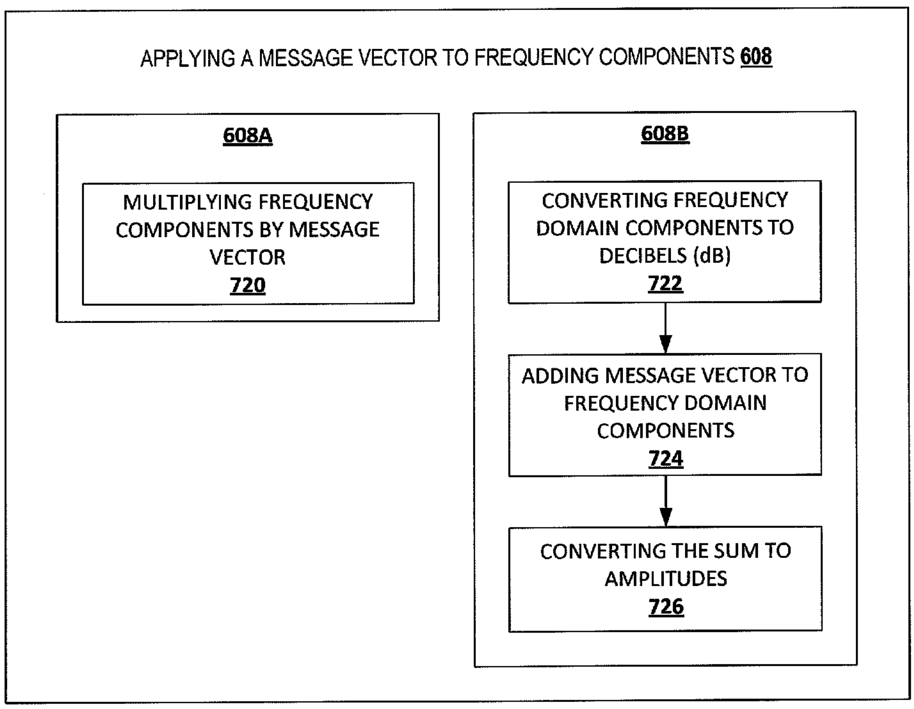

APPLYING A MESSAGE VECTOR TO FREQUENCY COMPONENTS 608
608A
MULTIPLYING FREQUENCY COMPONENTS BY MESSAGE VECTOR
720
608B
CONVERTING FREQUENCY DOMAIN COMPONENTS TO DECIBELS (dB)
722
ADDING MESSAGE VECTOR TO FREQUENCY DOMAIN COMPONENTS
724
CONVERTING THE SUM TO AMPLITUDES
726

FIG. 7

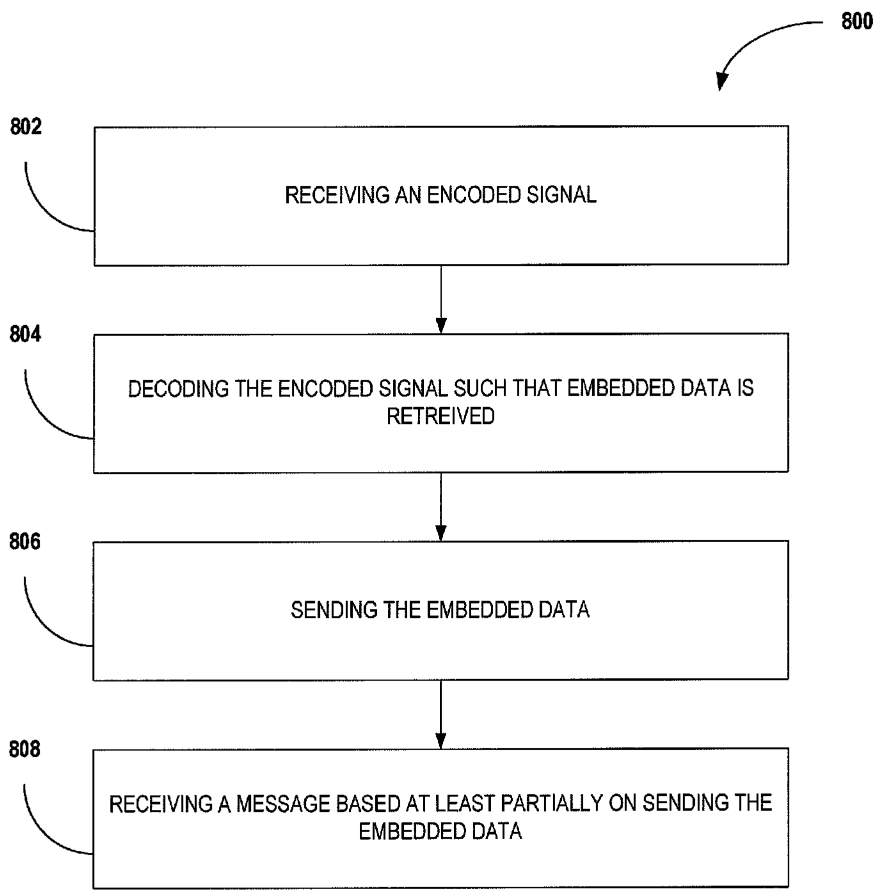

800
802
RECEIVING AN ENCODED SIGNAL
804
DECODING THE ENCODED SIGNAL SUCH THAT EMBEDDED DATA IS RETREIVED
806
SENDING THE EMBEDDED DATA
808
RECEIVING A MESSAGE BASED AT LEAST PARTIALLY ON SENDING THE EMBEDDED DATA

FIG. 8

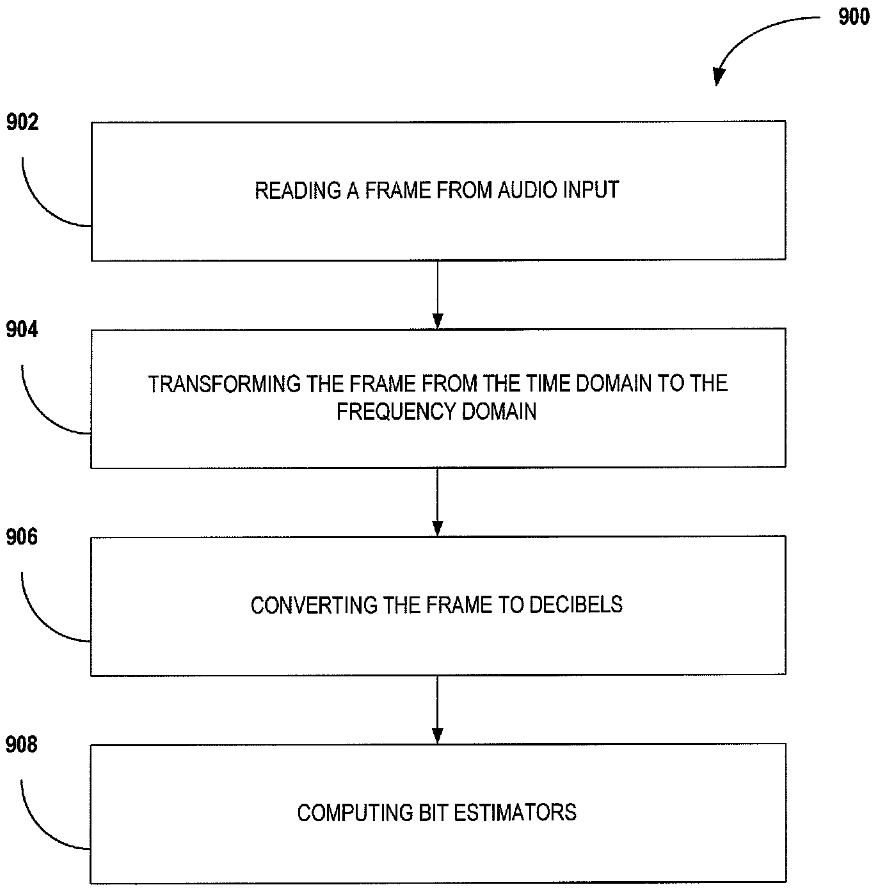

900
902
READING A FRAME FROM AUDIO INPUT
904
TRANSFORMING THE FRAME FROM THE TIME DOMAIN TO THE FREQUENCY DOMAIN
906
CONVERTING THE FRAME TO DECIBELS
908
COMPUTING BIT ESTIMATORS

FIG. 9

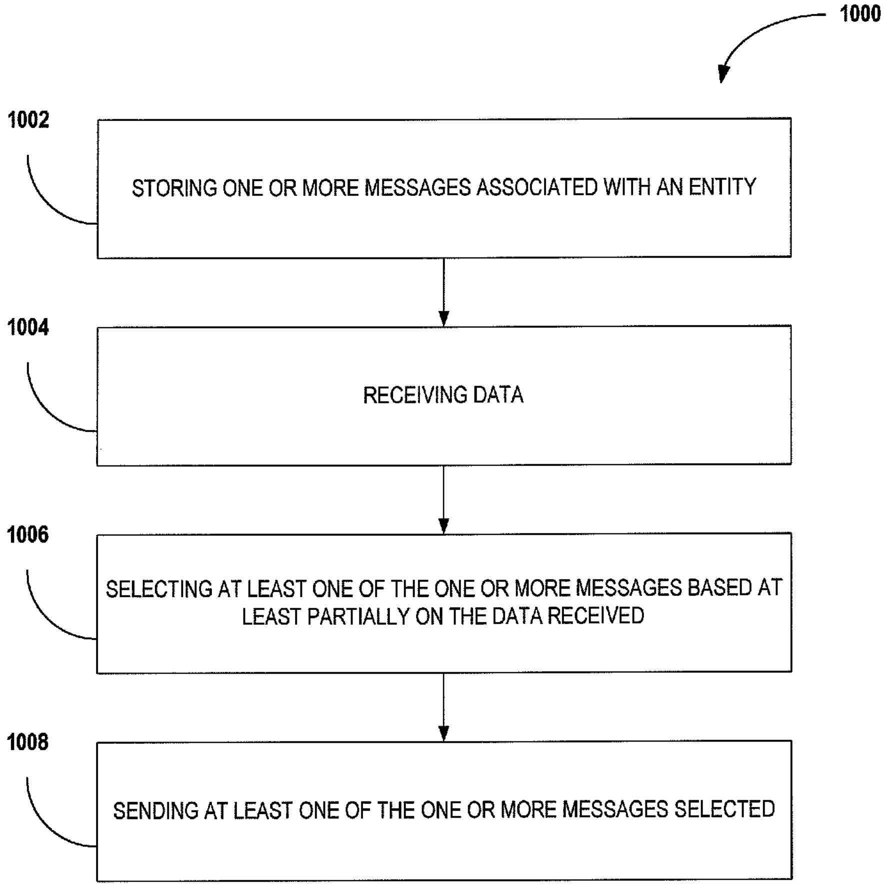

1000
1002
STORING ONE OR MORE MESSAGES ASSOCIATED WITH AN ENTITY
1004
RECEIVING DATA
1006
SELECTING AT LEAST ONE OF THE ONE OR MORE MESSAGES BASED AT LEAST PARTIALLY ON THE DATA RECEIVED
1008
SENDING AT LEAST ONE OF THE ONE OR MORE MESSAGES SELECTED

FIG. 10

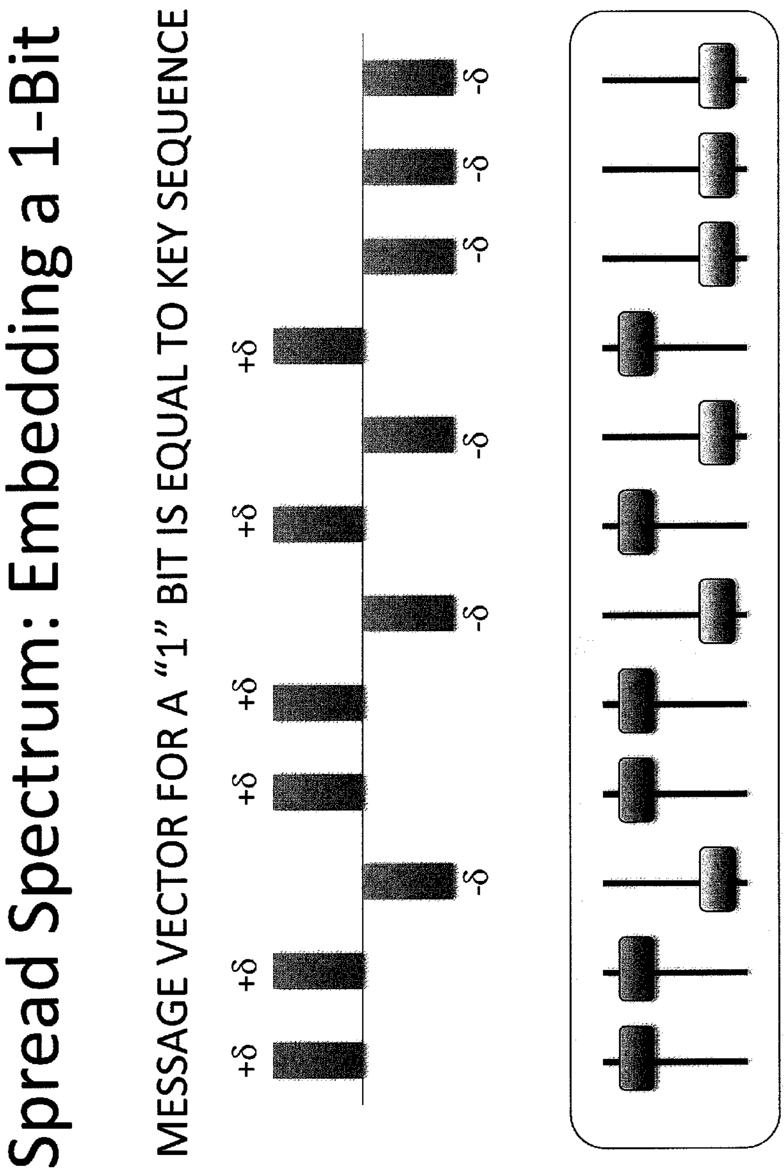

Spread Spectrum: Embedding a 1-Bit
MESSAGE VECTOR FOR A "1" BIT IS EQUAL TO KEY SEQUENCE
+δ
+δ
-δ
+δ
+δ
-δ
+δ
-δ
+δ
-δ
-δ
-δ

FIG. 11

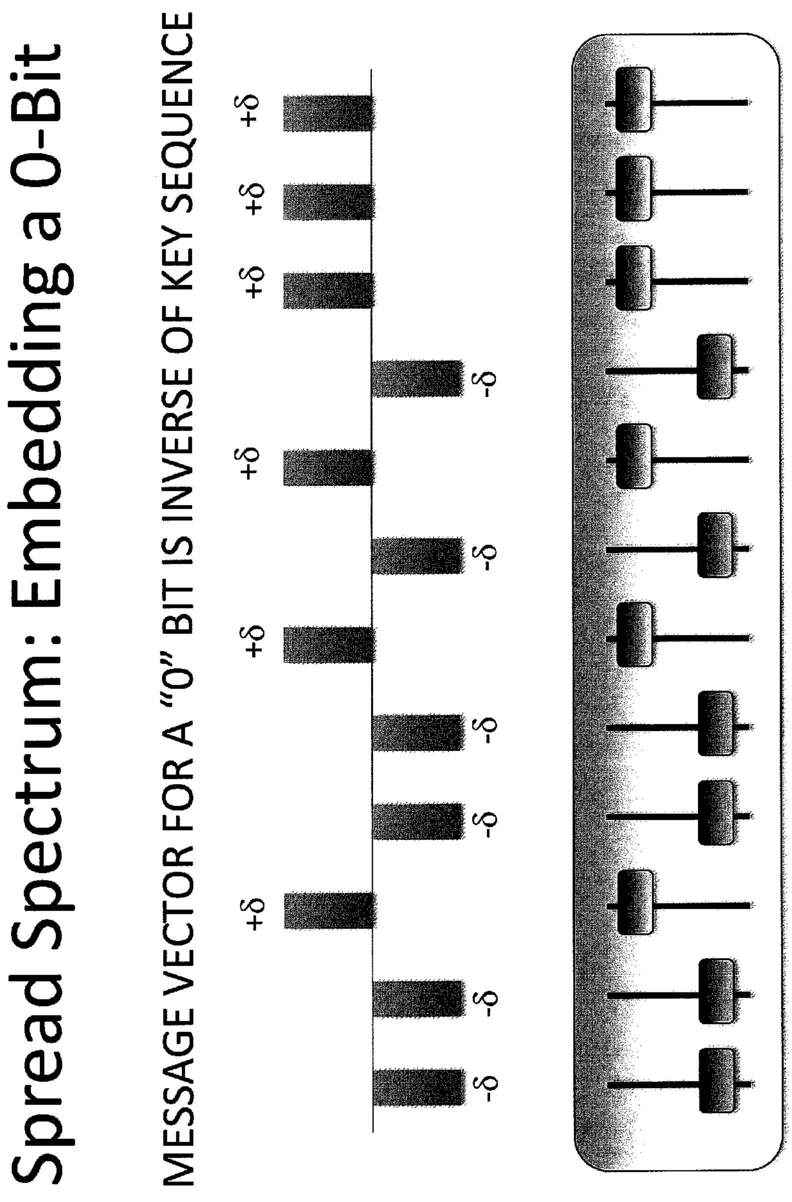

Spread Spectrum: Embedding a 0-Bit
MESSAGE VECTOR FOR A "0" BIT IS INVERSE OF KEY SEQUENCE
-δ
-δ
+δ
-δ
-δ
+δ
-δ
+δ
-δ
+δ
+δ
+δ

FIG. 12

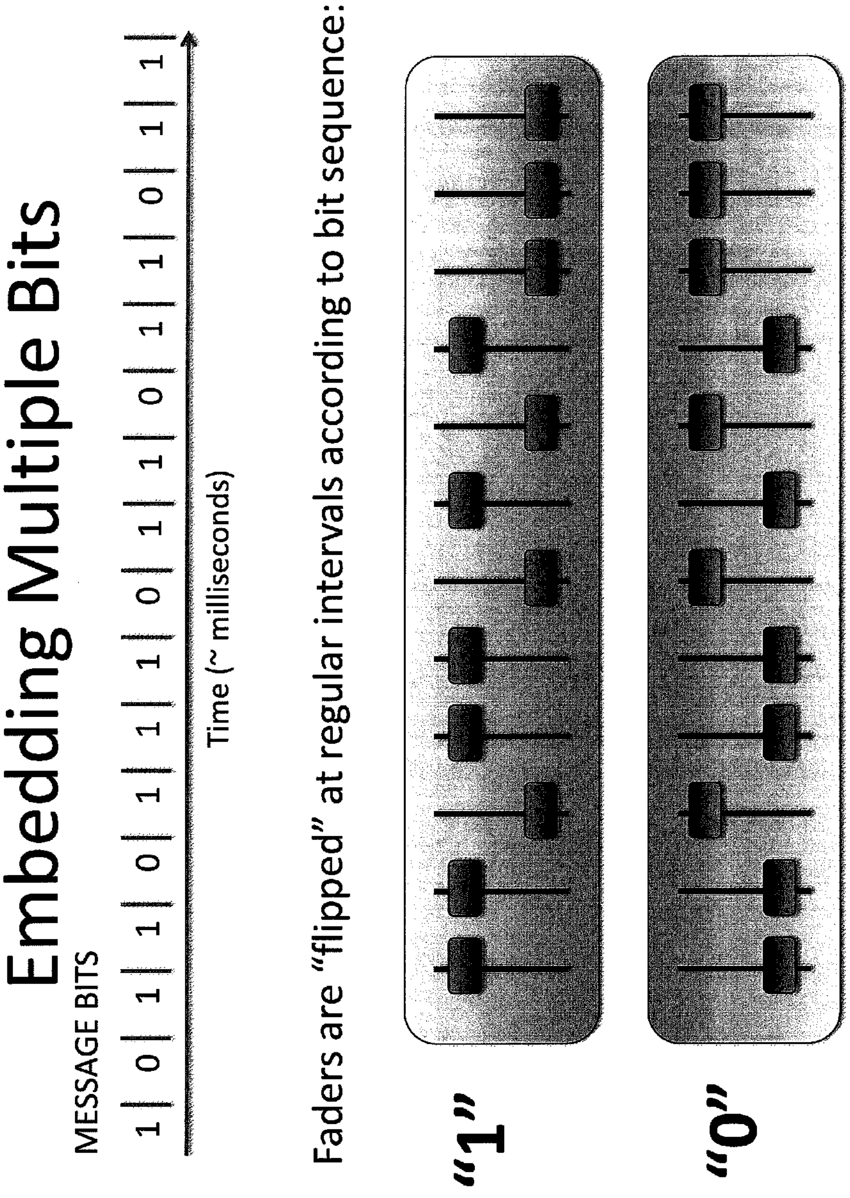

Embedding Multiple Bits
MESSAGE BITS
1 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1
Time (~ milliseconds)
Faders are “flipped” at regular intervals according to bit sequence:
“1”
“0”

FIG. 13

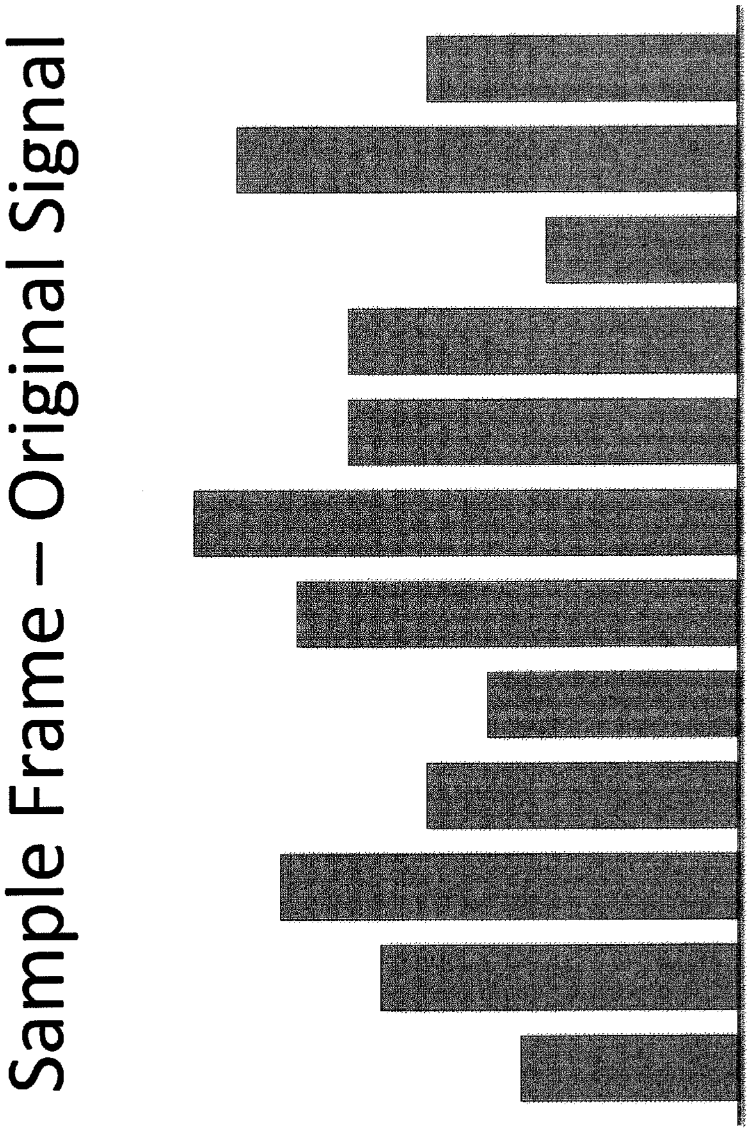


FIG. 14

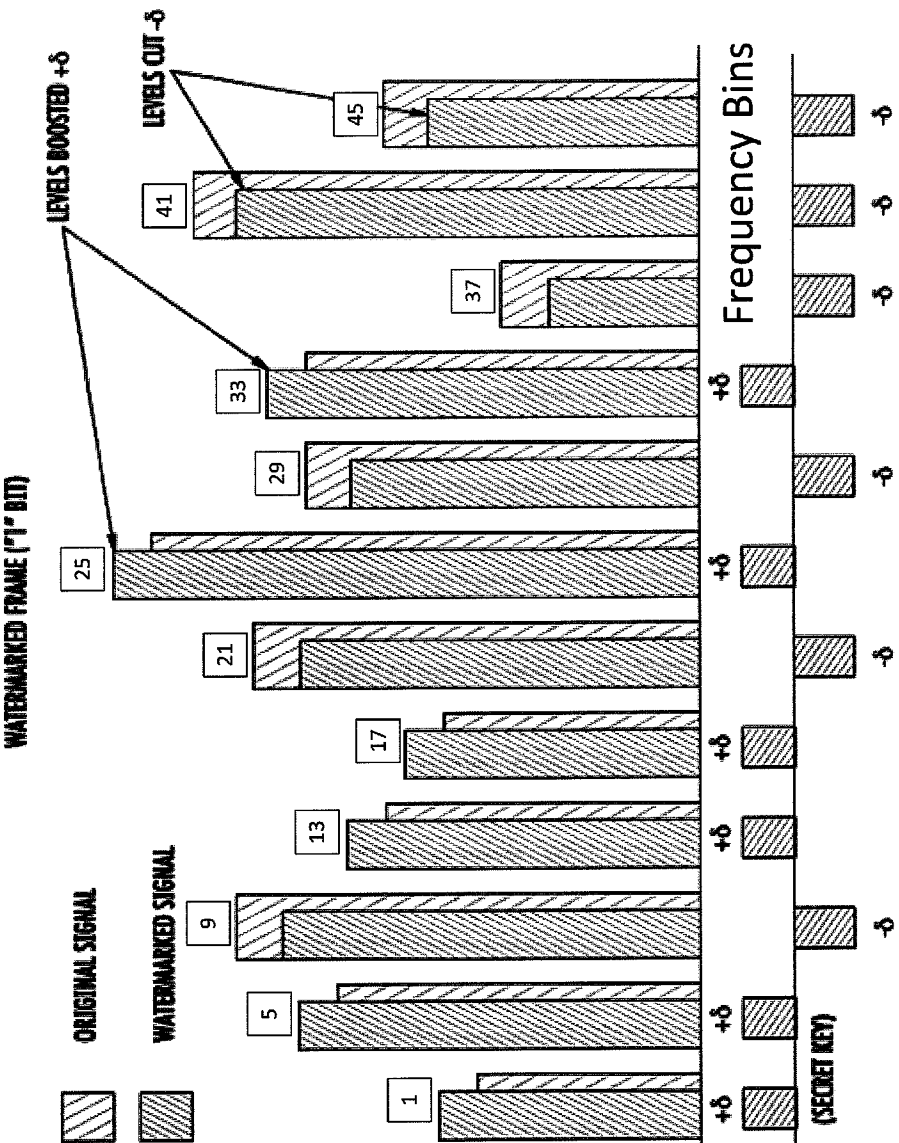

ORIGINAL SIGNAL
WATERMARKED SIGNAL
WATERMARKED FRAME ("1" BIT)
LEVELS BOOSTED +δ
LEVELS CUT -δ
1
5
9
13
17
21
25
29
33
37
41
45
Frequency Bins
+δ
+δ
-δ
+δ
+δ
-δ
+δ
-δ
+δ
-δ
-δ
-δ
(SECRET KEY)

FIG. 15

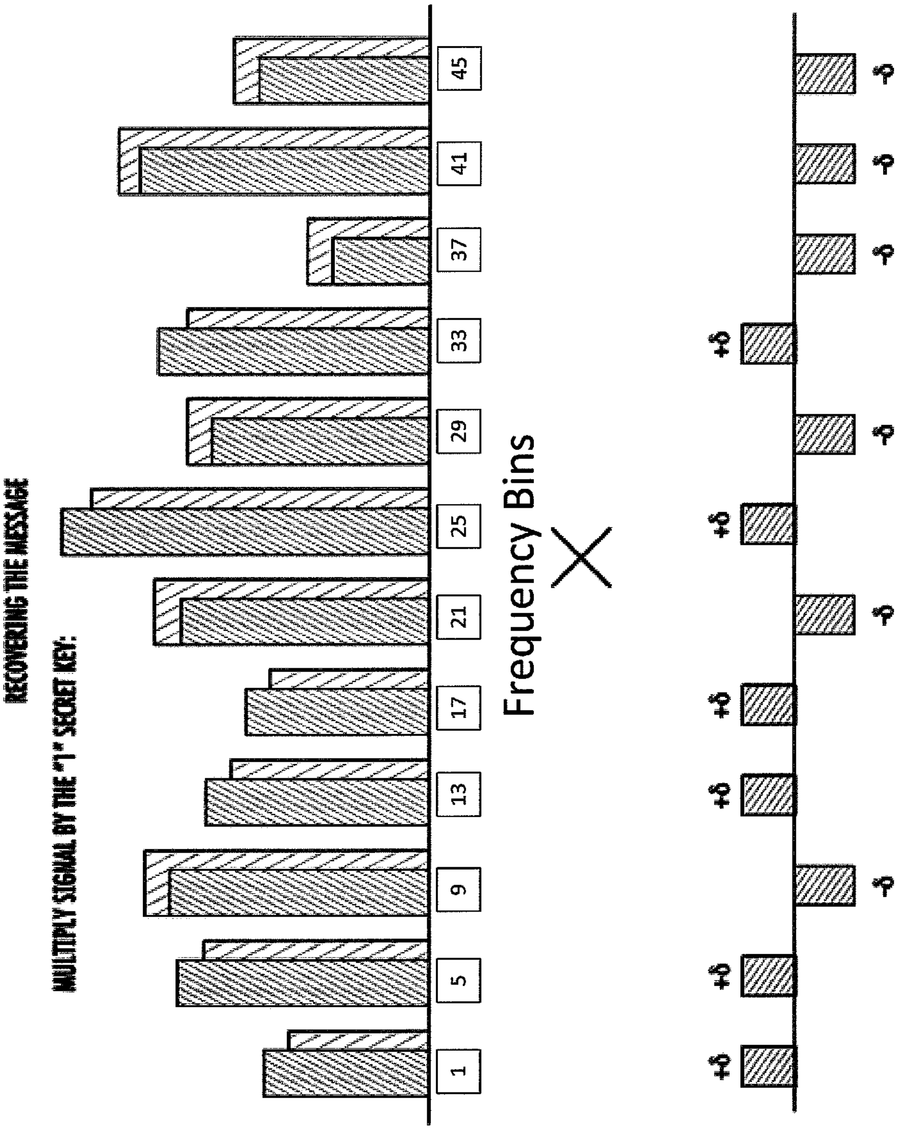

RECOVERING THE MESSAGE
MULTIPLY SIGNAL BY THE "1" SECRET KEY:
1
5
9
13
17
21
25
29
33
37
41
45
Frequency Bins
+δ
+δ
-δ
+δ
+δ
-δ
+δ
-δ
+δ
-δ
-δ
-δ

FIG. 16

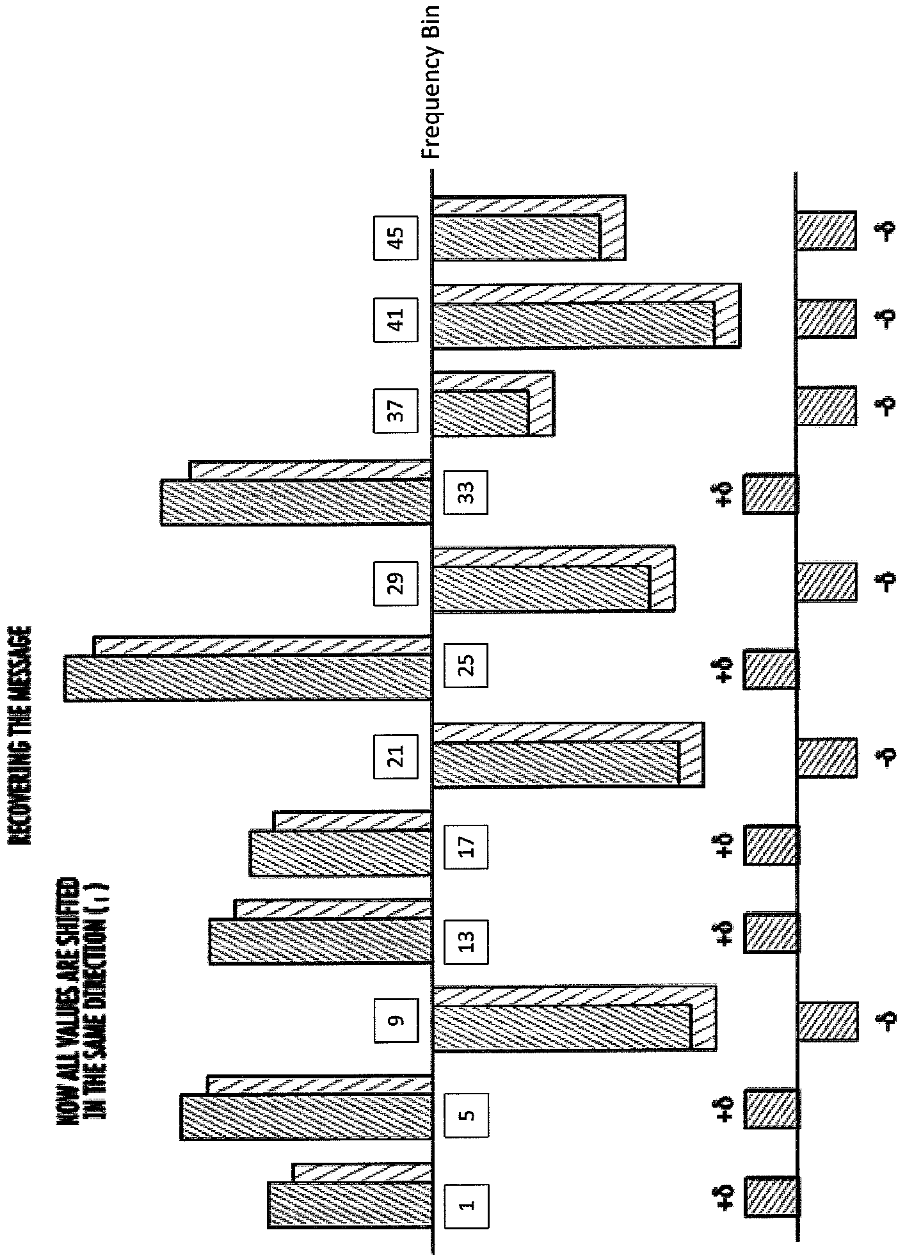

RECOVERING THE MESSAGE
NOW ALL VALUES ARE SHIFTED IN THE SAME DIRECTION
Frequency Bin
1
5
9
13
17
21
25
29
33
37
41
45
+δ
+δ
-δ
+δ
+δ
-δ
+δ
-δ
+δ
-δ
-δ
-δ

FIG. 17

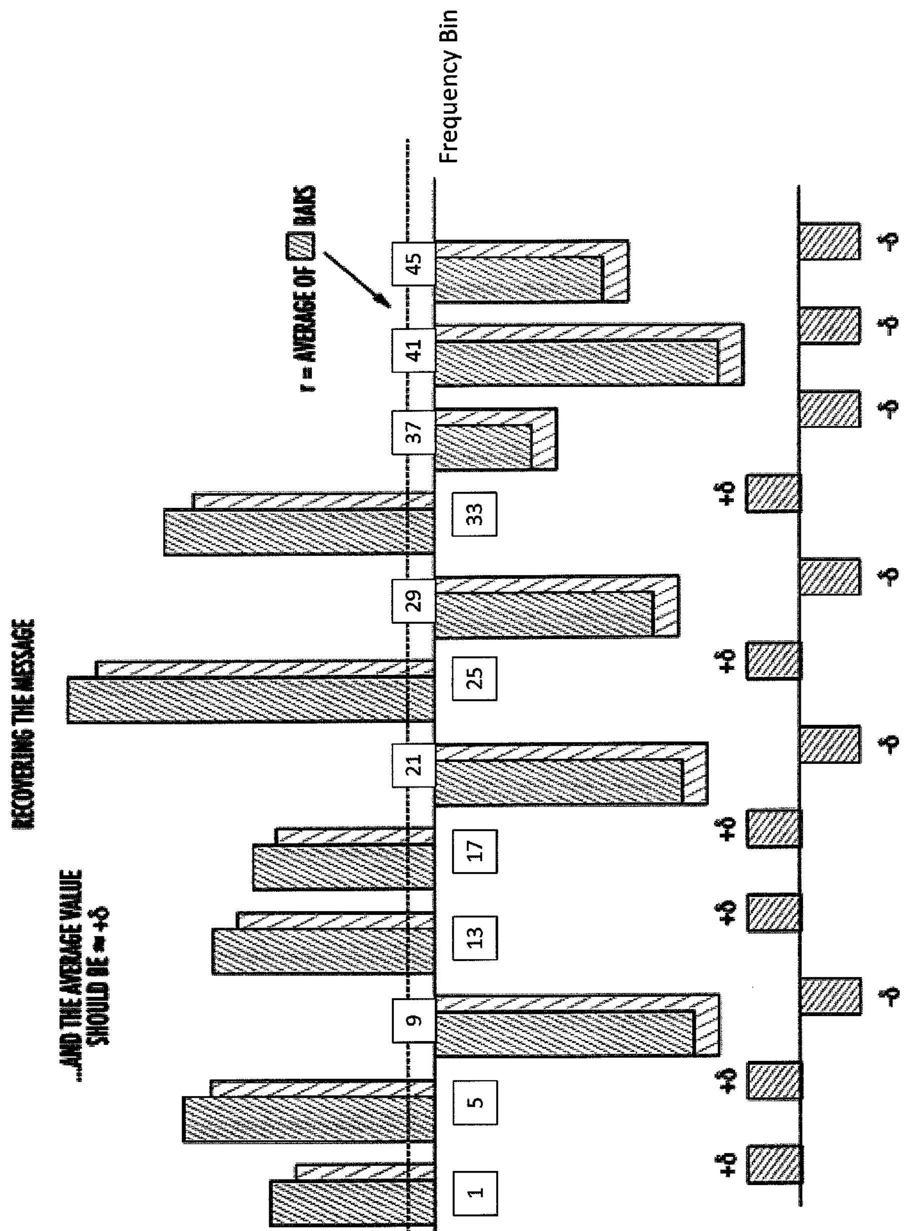

RECOVERING THE MESSAGE
...AND THE AVERAGE VALUE SHOULD BE ≈ +δ
r = AVERAGE OF BARS
Frequency Bin
1
5
9
13
17
21
25
29
33
37
41
45
+δ
+δ
-δ
+δ
+δ
-δ
+δ
-δ
+δ
-δ
-δ
-δ

FIG. 18

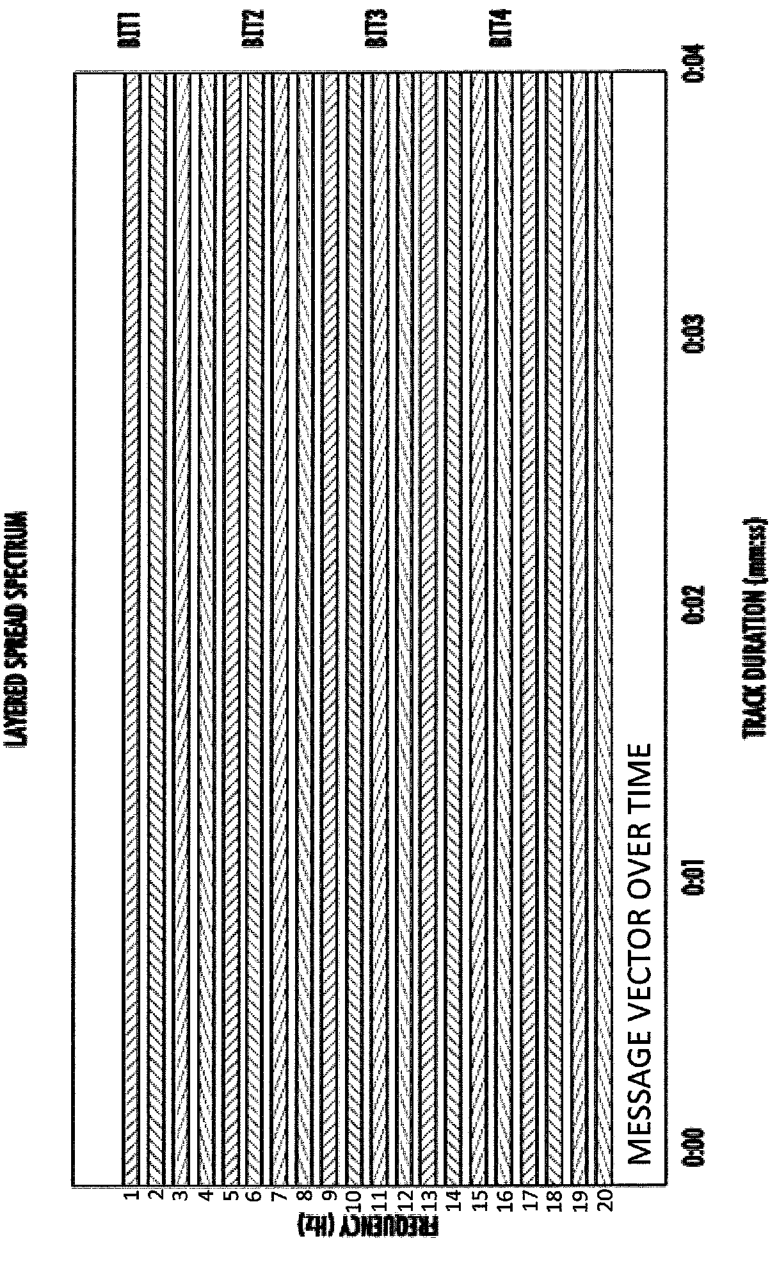

LAYERED SPREAD SPECTRUM
FREQUENCY (Hz)
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
MESSAGE VECTOR OVER TIME
BIT1
BIT2
BIT3
BIT4
0:00
0:01
0:02
0:03
0:04
TRACK DURATION (mm:ss)

FIG. 19

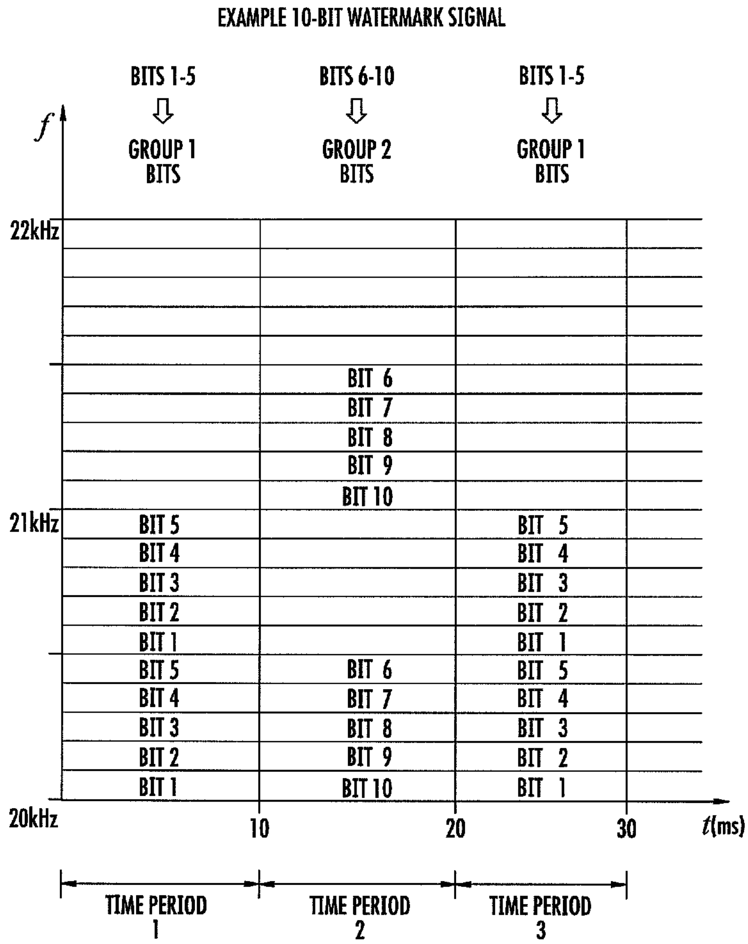

EXAMPLE 10-BIT WATERMARK SIGNAL
BITS 1-5
GROUP 1 BITS
BITS 6-10
GROUP 2 BITS
BITS 1-5
GROUP 1 BITS
f
22kHz
21kHz
20kHz
BIT 6
BIT 7
BIT 8
BIT 9
BIT 10
BIT 5
BIT 4
BIT 3
BIT 2
BIT 1
10
20
30
t(ms)
TIME PERIOD 1
TIME PERIOD 2
TIME PERIOD 3

FIG. 20

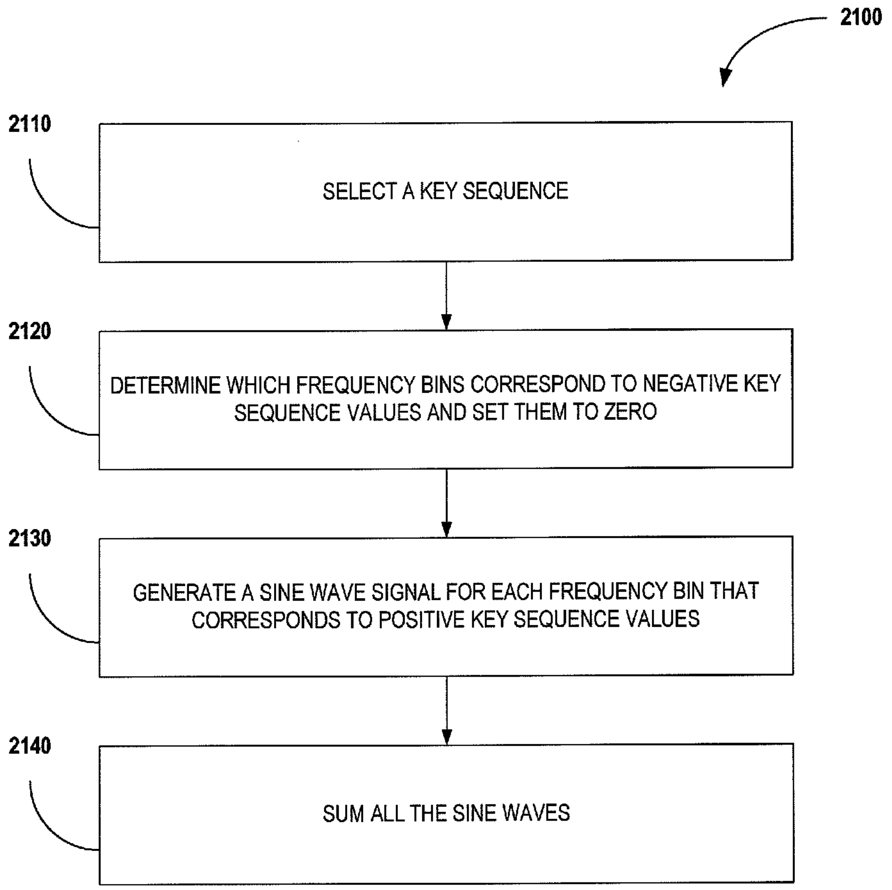

2100
2110
SELECT A KEY SEQUENCE
2120
DETERMINE WHICH FREQUENCY BINS CORRESPOND TO NEGATIVE KEY SEQUENCE VALUES AND SET THEM TO ZERO
2130
GENERATE A SINE WAVE SIGNAL FOR EACH FREQUENCY BIN THAT CORRESPONDS TO POSITIVE KEY SEQUENCE VALUES
2140
SUM ALL THE SINE WAVES

FIG. 21

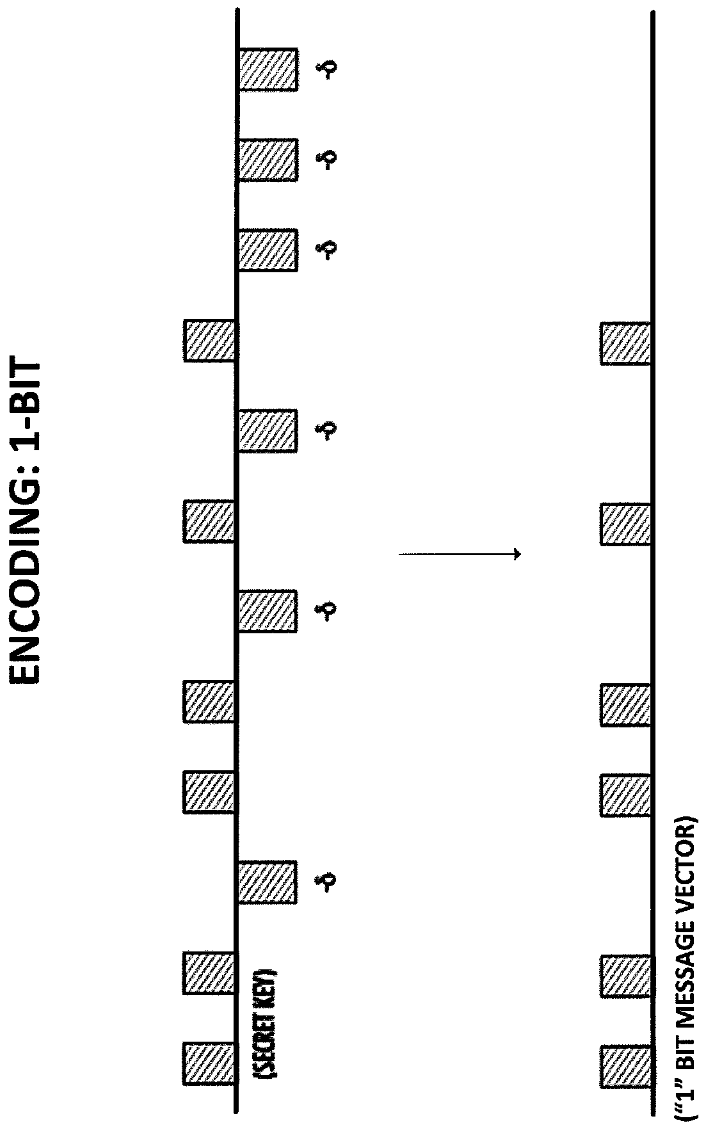


FIG. 22A

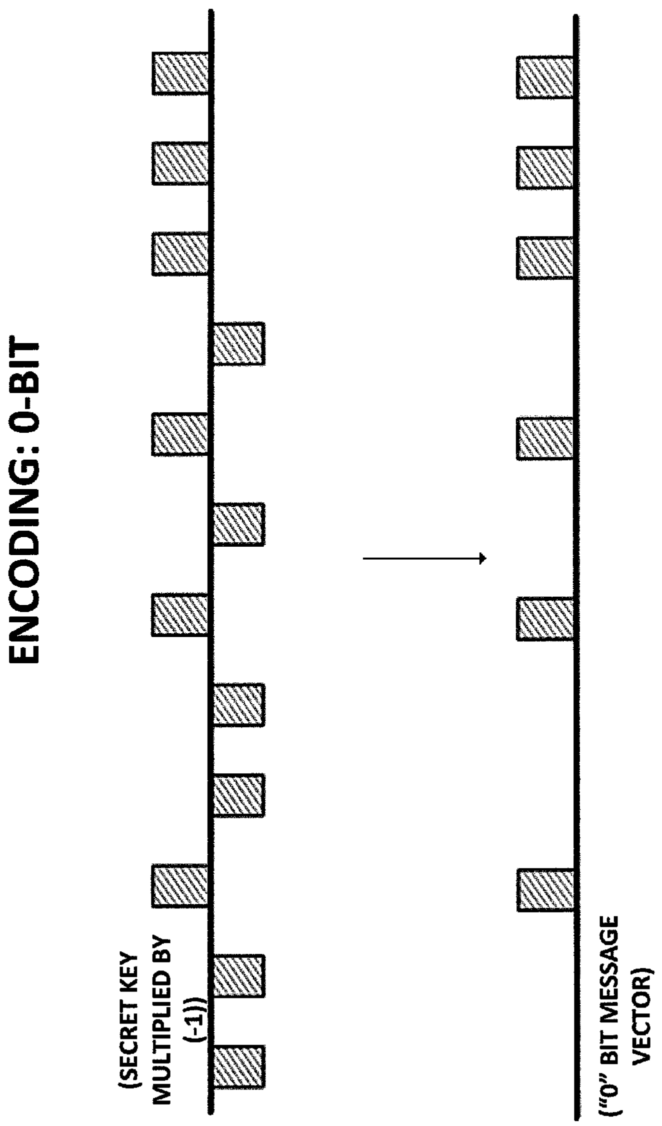

ENCODING: 0-BIT
(SECRET KEY MULTIPLIED BY (-1))
("0" BIT MESSAGE VECTOR)

FIG. 22B

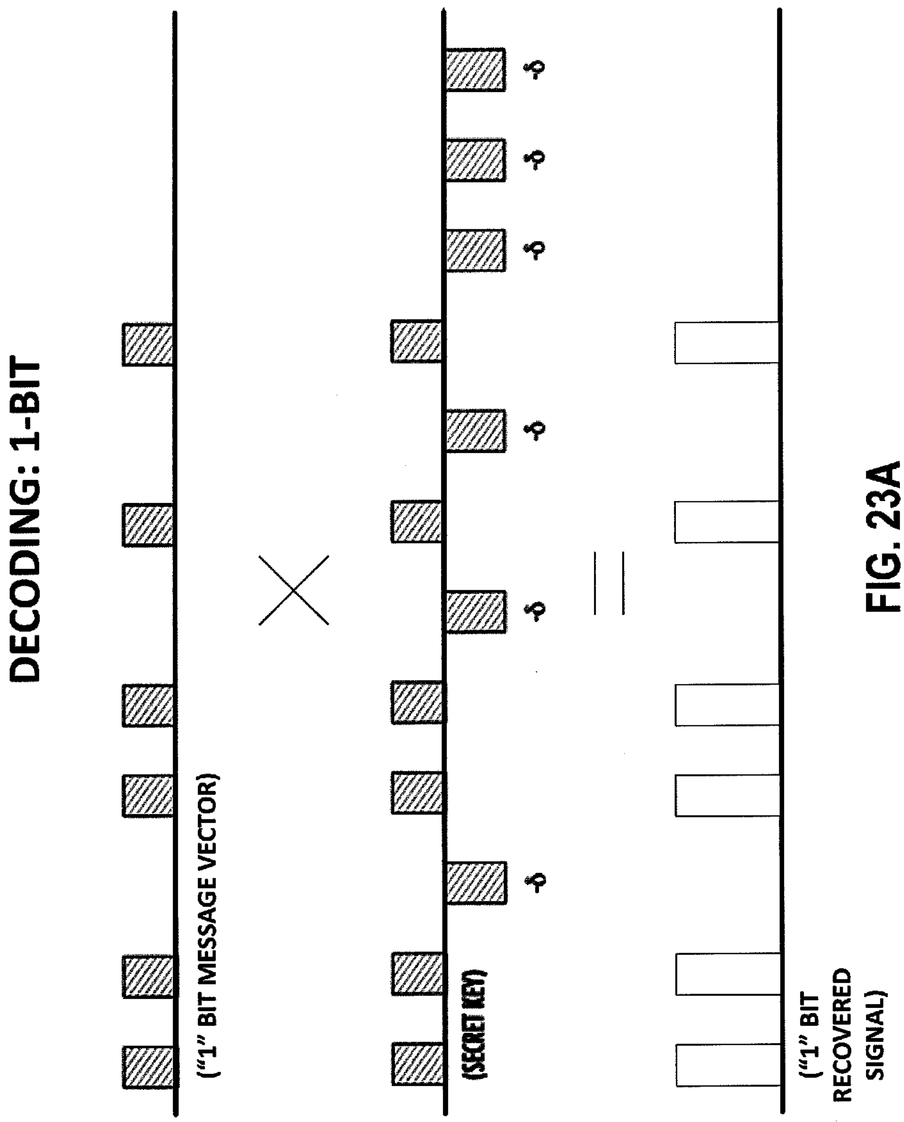

DECODING: 1-BIT
("1" BIT MESSAGE VECTOR)
(SECRET KEY)
-δ
-δ
-δ
-δ
-δ
-δ
("1" BIT RECOVERED SIGNAL)

FIG. 23A

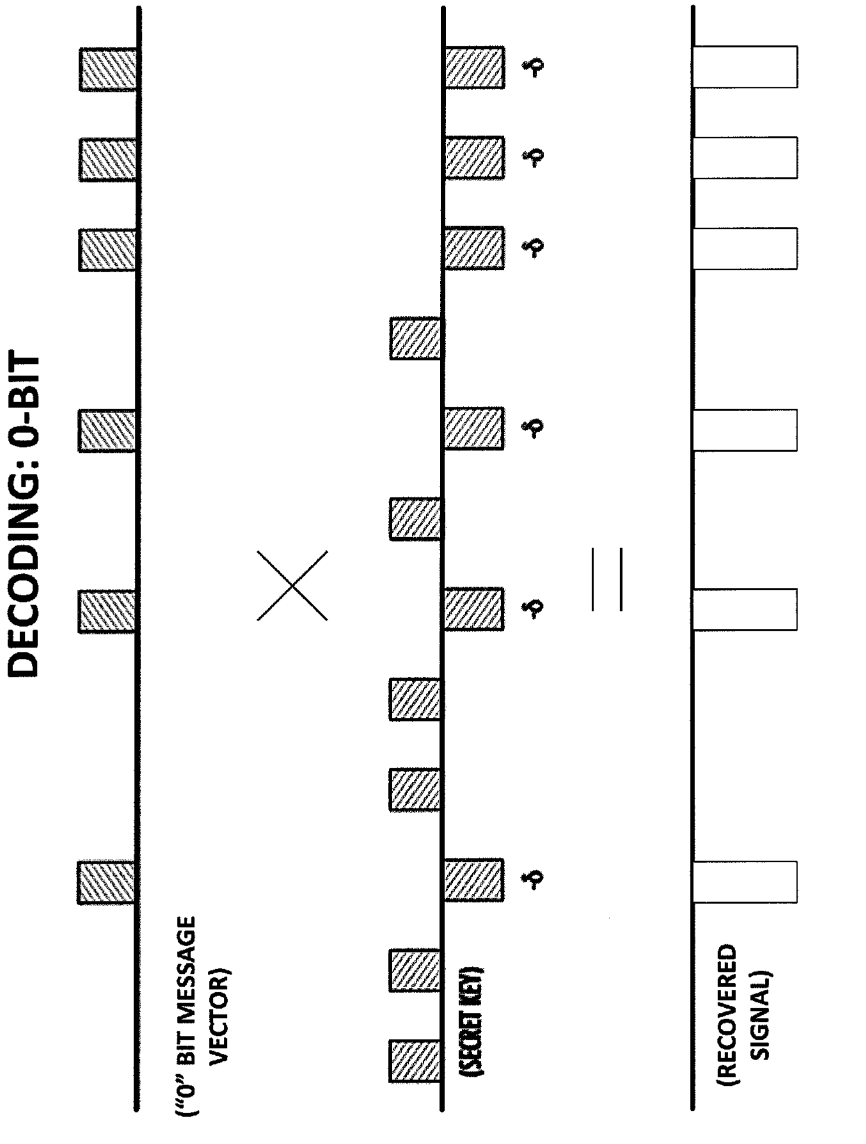
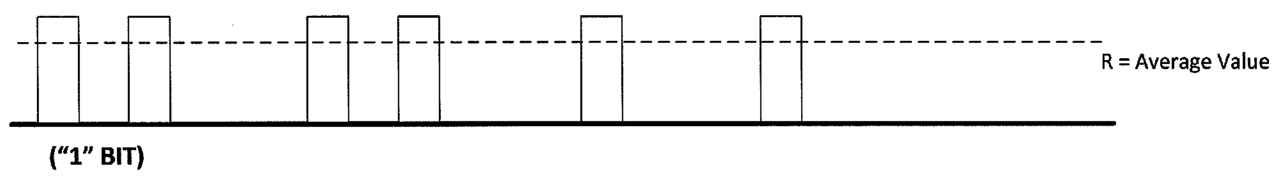
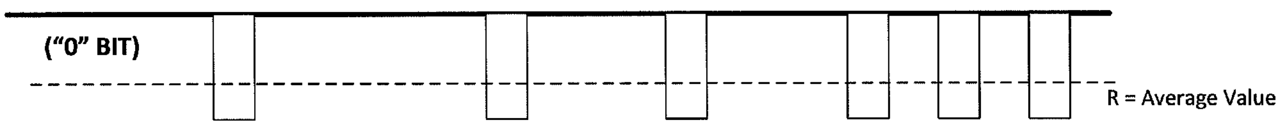

DECODING: 0-BIT
("0" BIT MESSAGE VECTOR)
(SECRET KEY)
(RECOVERED SIGNAL)

FIG. 23B



If R > 0, then recovered signal is "1" - Bit

FIG. 24



If R < 0, then recovered signal is "0" - Bit

FIG. 25

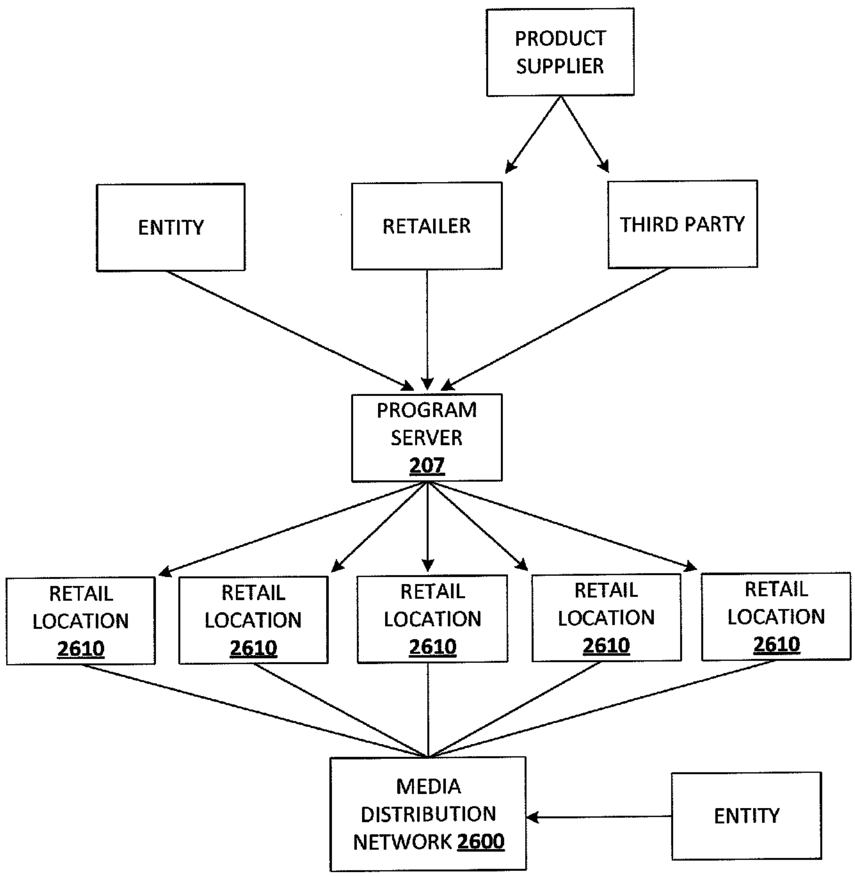

PRODUCT SUPPLIER
ENTITY
RETAILER
THIRD PARTY
PROGRAM SERVER 207
RETAIL LOCATION 2610
RETAIL LOCATION 2610
RETAIL LOCATION 2610
RETAIL LOCATION 2610
RETAIL LOCATION 2610
MEDIA DISTRIBUTION NETWORK 2600
ENTITY

FIG. 26

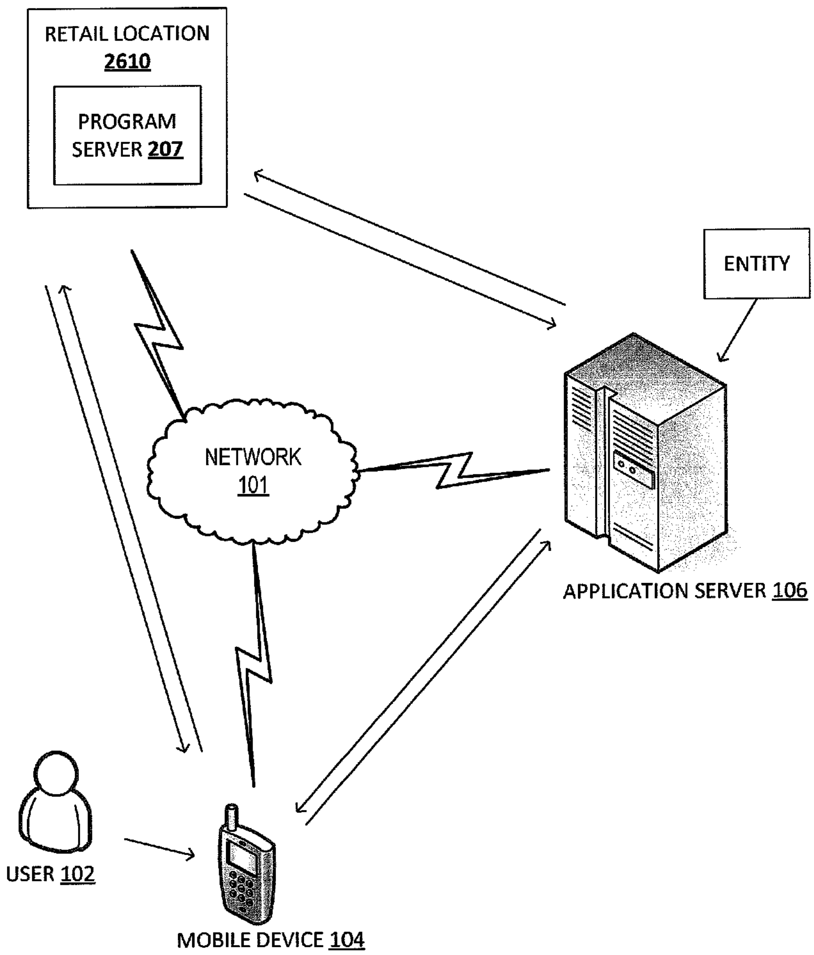

RETAIL LOCATION 2610
PROGRAM SERVER 207
ENTITY
NETWORK 101
APPLICATION SERVER 106
USER 102
MOBILE DEVICE 104

FIG. 27

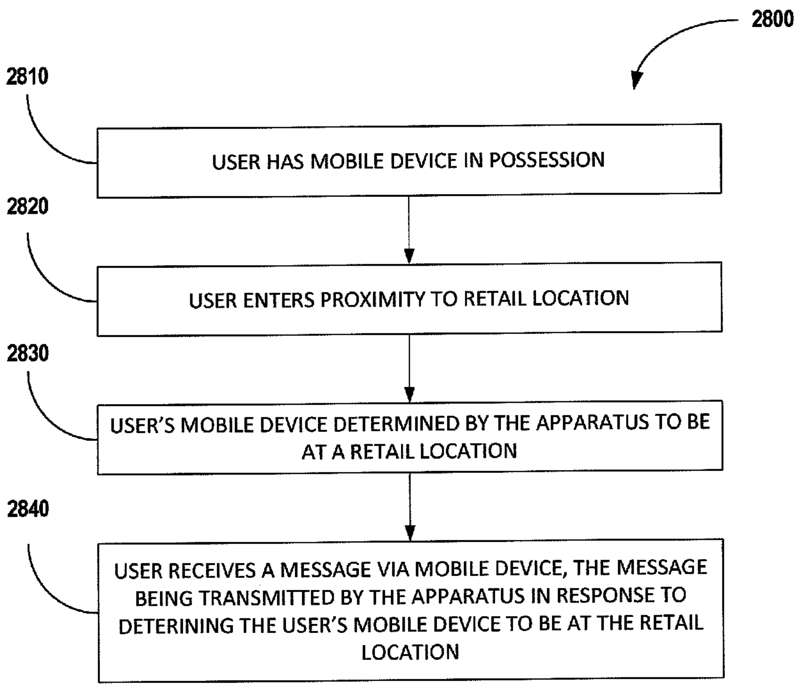

2800
2810
USER HAS MOBILE DEVICE IN POSSESSION
2820
USER ENTERS PROXIMITY TO RETAIL LOCATION
2830
USER'S MOBILE DEVICE DETERMINED BY THE APPARATUS TO BE AT A RETAIL LOCATION
2840
USER RECEIVES A MESSAGE VIA MOBILE DEVICE, THE MESSAGE BEING TRANSMITTED BY THE APPARATUS IN RESPONSE TO DETERINING THE USER'S MOBILE DEVICE TO BE AT THE RETAIL LOCATION

FIG. 28

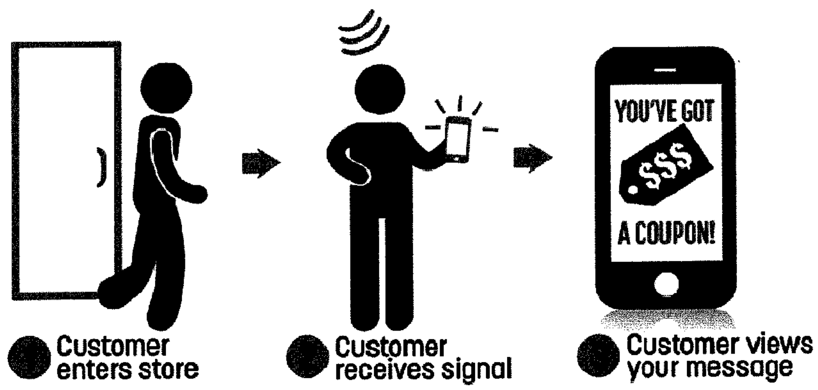

YOU'VE GOT
$$$
A COUPON!
Customer enters store
Customer receives signal
Customer views your message

FIG. 29

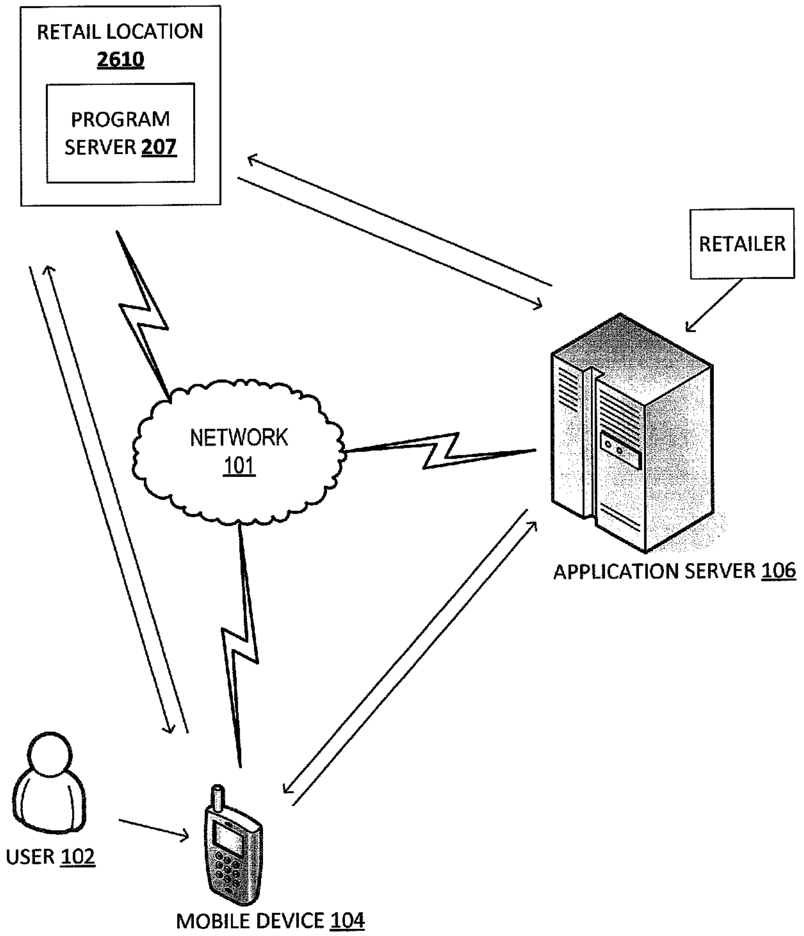

RETAIL LOCATION
2610
PROGRAM
SERVER 207
RETAILER
NETWORK
101
APPLICATION SERVER 106
USER 102
MOBILE DEVICE 104

FIG. 30

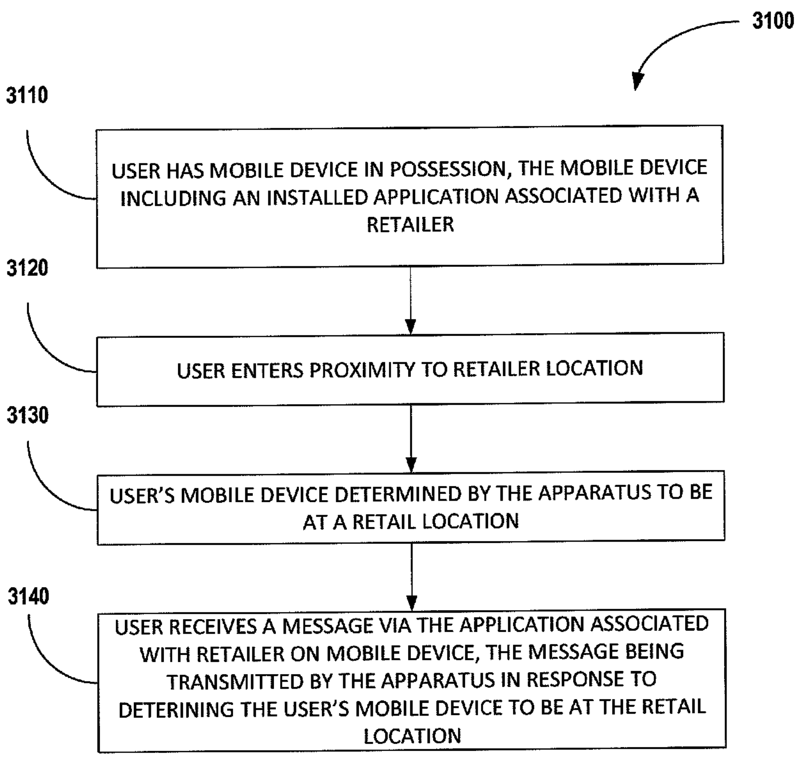

3100
3110
USER HAS MOBILE DEVICE IN POSSESSION, THE MOBILE DEVICE INCLUDING AN INSTALLED APPLICATION ASSOCIATED WITH A RETAILER
3120
USER ENTERS PROXIMITY TO RETAILER LOCATION
3130
USER'S MOBILE DEVICE DETERMINED BY THE APPARATUS TO BE AT A RETAIL LOCATION
3140
USER RECEIVES A MESSAGE VIA THE APPLICATION ASSOCIATED WITH RETAILER ON MOBILE DEVICE, THE MESSAGE BEING TRANSMITTED BY THE APPARATUS IN RESPONSE TO DETERINING THE USER'S MOBILE DEVICE TO BE AT THE RETAIL LOCATION

FIG. 31

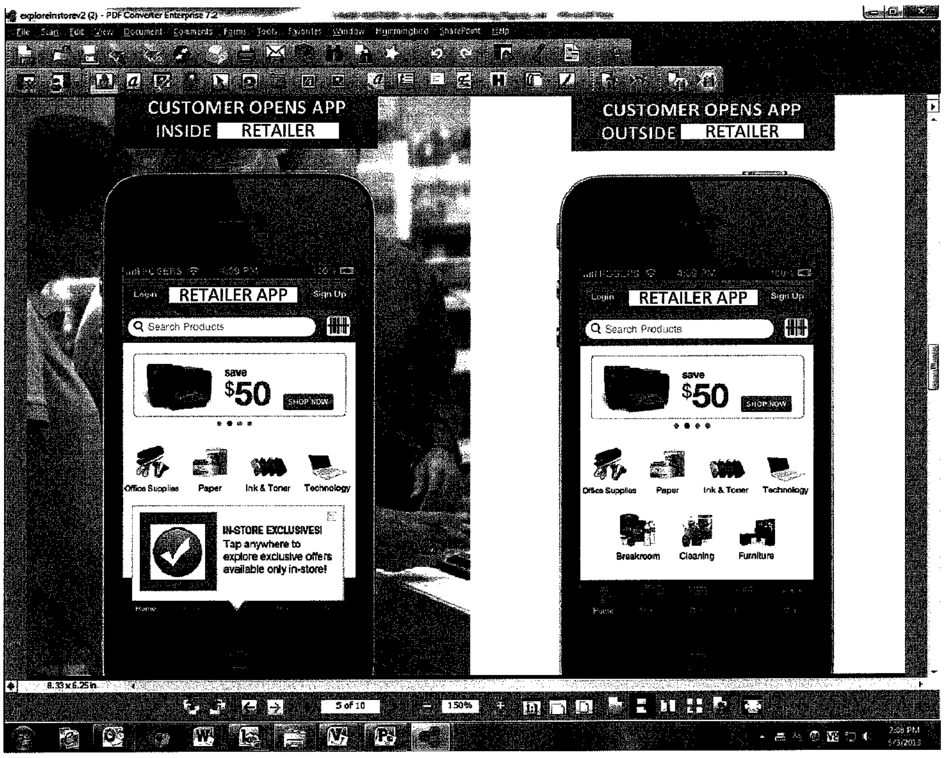

CUSTOMER OPENS APP
INSIDE RETAILER
CUSTOMER OPENS APP
OUTSIDE RETAILER
RETAILER APP
Search Products
save
$50
Office Supplies
Paper
Ink & Toner
Technology
IN-STORE EXCLUSIVES!
Tap anywhere to explore exclusive offers available only in-store!
RETAILER APP
Search Products
save
$50
Office Supplies
Paper
Ink & Toner
Technology
Breakroom
Cleaning
Furniture

FIG. 32

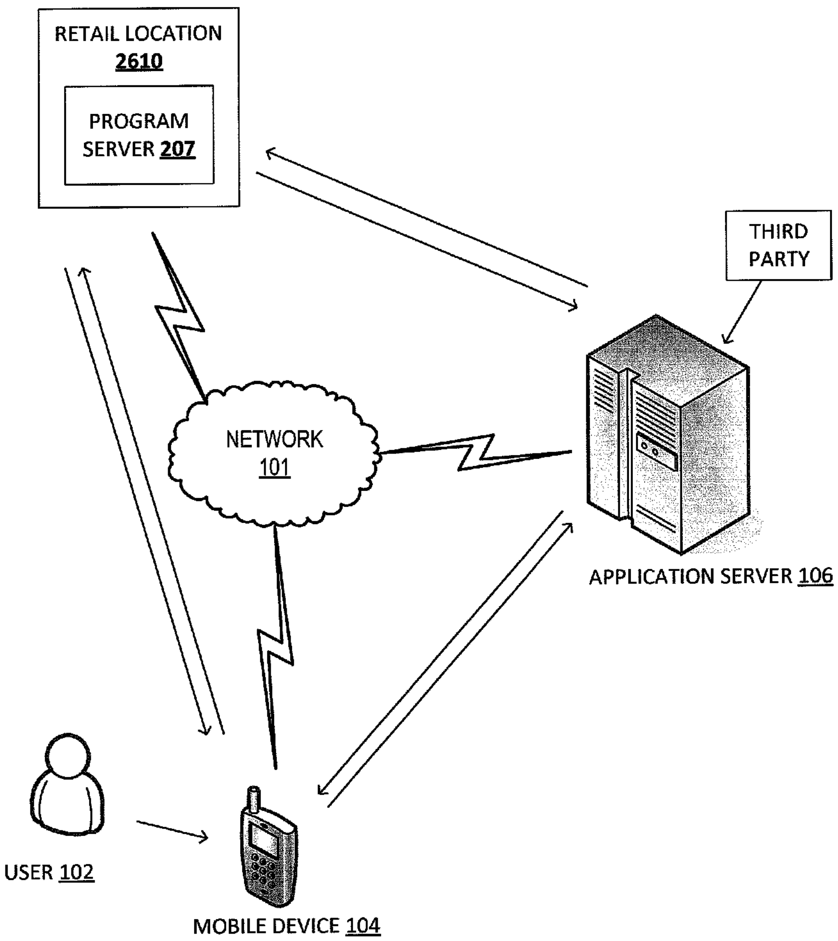

RETAIL LOCATION
2610
PROGRAM
SERVER 207
THIRD
PARTY
NETWORK
101
APPLICATION SERVER 106
USER 102
MOBILE DEVICE 104

FIG. 33

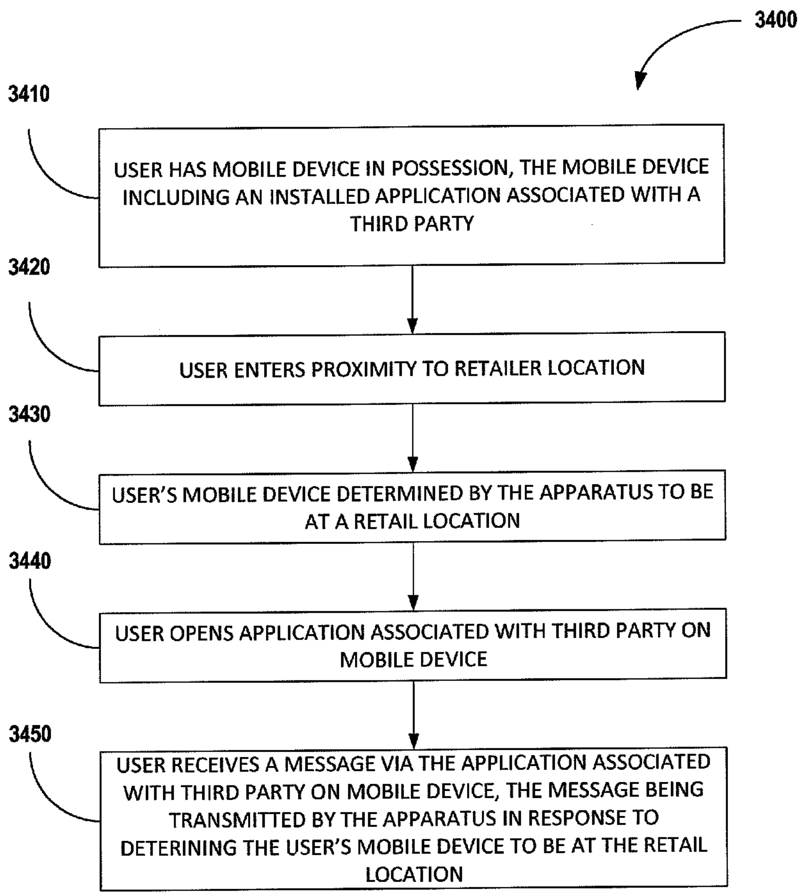

3400
3410
USER HAS MOBILE DEVICE IN POSSESSION, THE MOBILE DEVICE INCLUDING AN INSTALLED APPLICATION ASSOCIATED WITH A THIRD PARTY
3420
USER ENTERS PROXIMITY TO RETAILER LOCATION
3430
USER'S MOBILE DEVICE DETERMINED BY THE APPARATUS TO BE AT A RETAIL LOCATION
3440
USER OPENS APPLICATION ASSOCIATED WITH THIRD PARTY ON MOBILE DEVICE
3450
USER RECEIVES A MESSAGE VIA THE APPLICATION ASSOCIATED WITH THIRD PARTY ON MOBILE DEVICE, THE MESSAGE BEING TRANSMITTED BY THE APPARATUS IN RESPONSE TO DETERINING THE USER'S MOBILE DEVICE TO BE AT THE RETAIL LOCATION

FIG. 34


THIRD PARTY COUPON/
ADVERTISING APPLICATION
ALL DEALS
LOCAL COUPONS
TRAVEL DEALS
BUSINESS COUPONS
IN-STORE EXCLUSIVES!
Tap anywhere to
explore exclusive offers
available only in-store!

FIG. 35

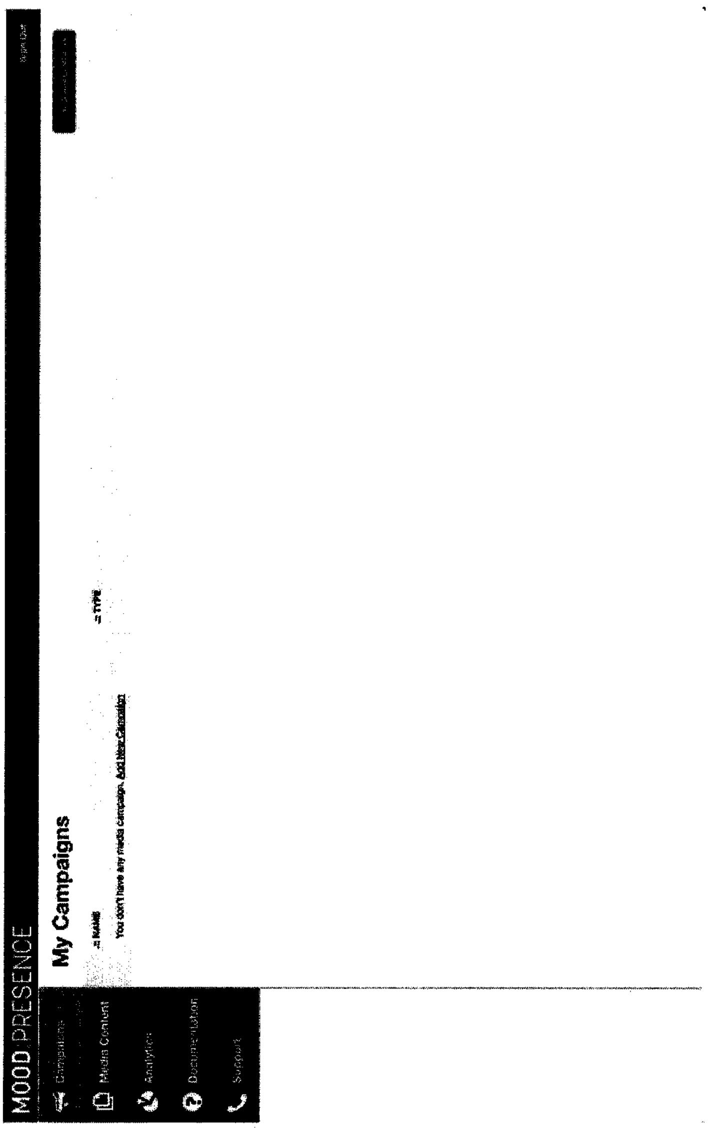

MOOD PRESENCE
Sign Out
My Campaigns
NAME
TYPE
You don't have any media campaign. Add New Campaign
Campaigns
Media Content
Analytics
Documentation
Support

FIG. 36

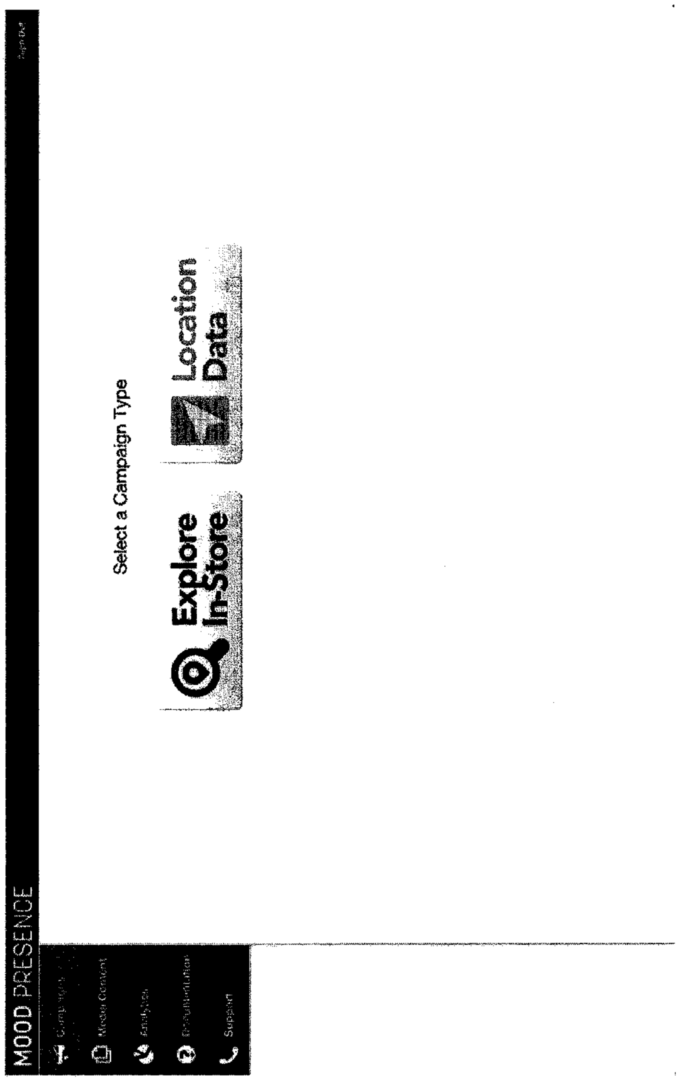

MOOD PRESENCE
Select a Campaign Type
Explore In-Store
Location Data

FIG. 37

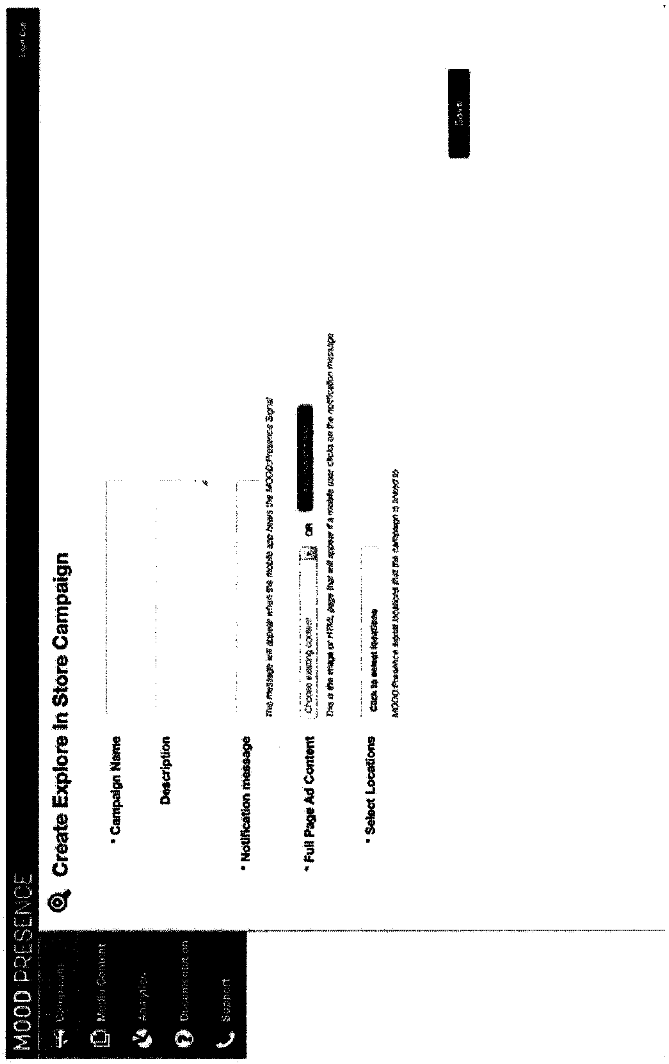

MOOD PRESENCE
Campaigns
Media Content
Analytics
Documentation
Support
Create Explore In Store Campaign
* Campaign Name
Description
* Notification message
* Full Page Ad Content
* Select Locations

FIG. 38

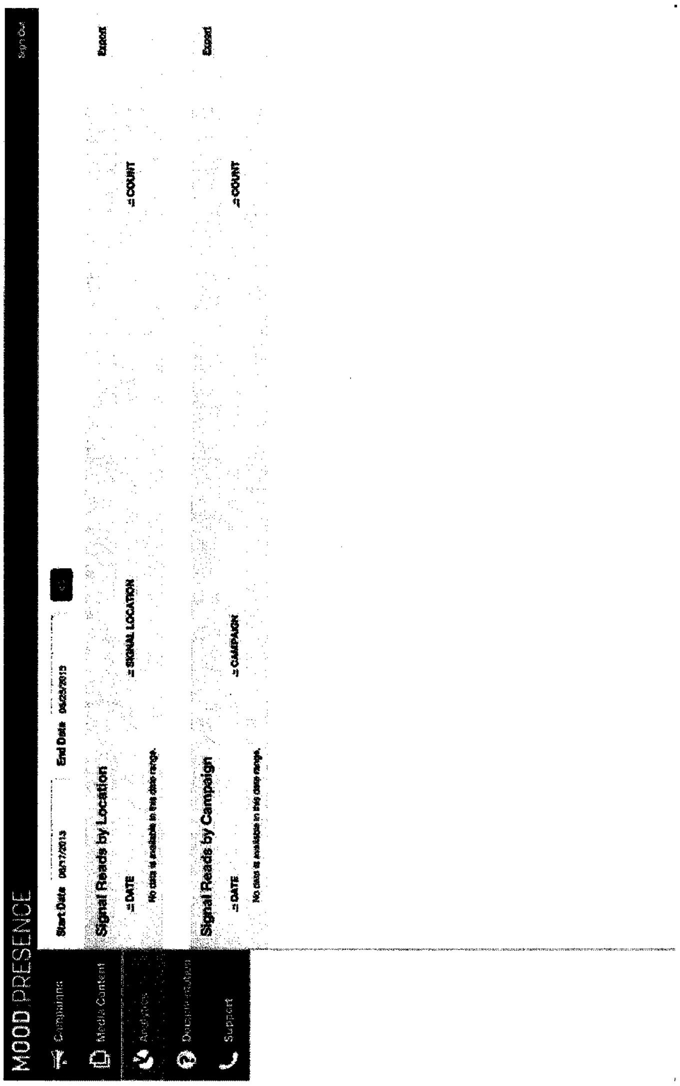

MOOD PRESENCE
Sign Out
Campaigns
Media Content
Analytics
Documentation
Support
Start Date 06/17/2013
End Date 06/25/2013
Signal Reads by Location
Export
DATE
SIGNAL LOCATION
COUNT
No data is available in this date range.
Signal Reads by Campaign
Export
DATE
CAMPAIGN
COUNT
No data is available in this date range.

FIG. 39

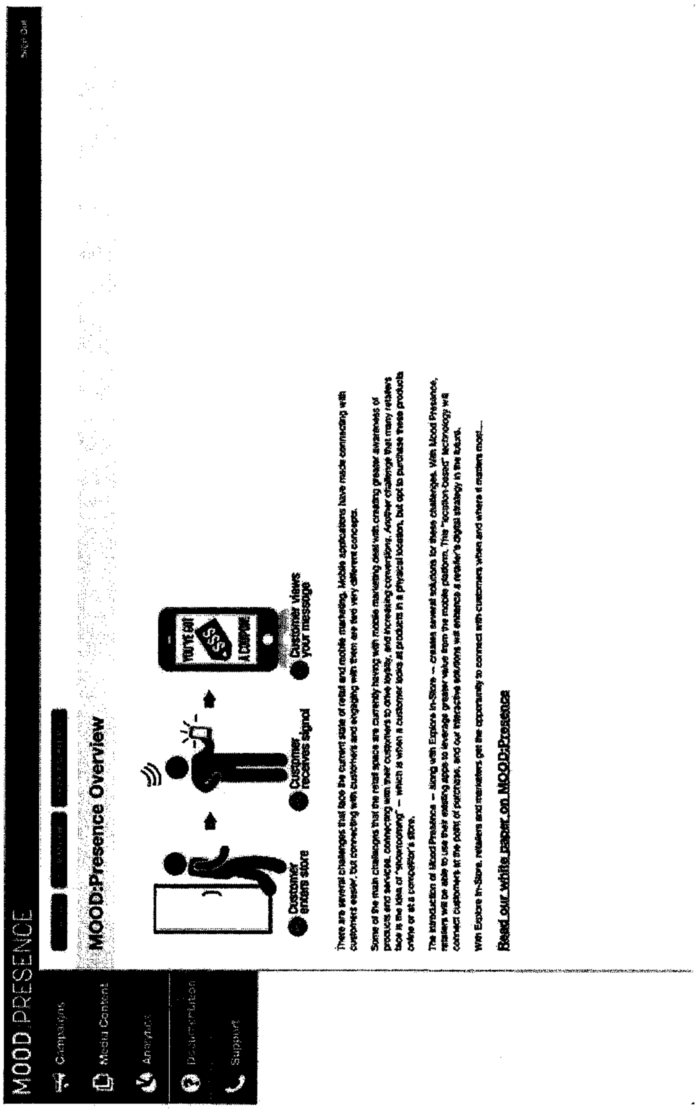

MOOD PRESENCE
Campaigns
Media Content
Analytics
Documentation
Support
MOOD:Presence Overview
Customer enters store
Customer receives signal
Customer views your message
Read our white paper on MOOD:Presence

FIG. 40

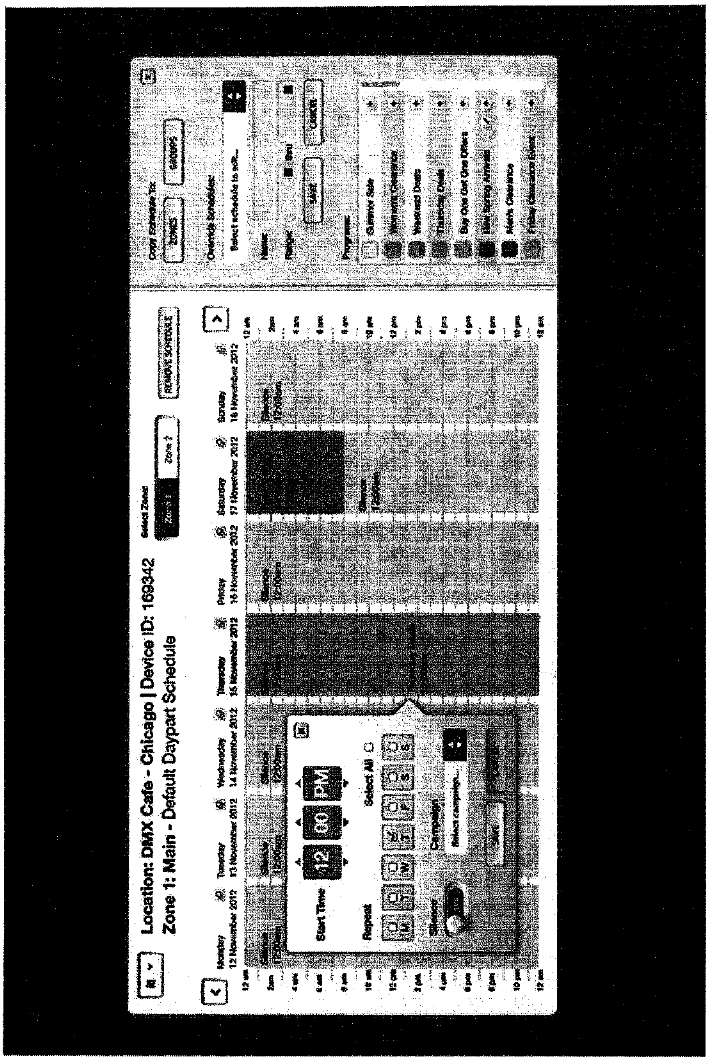

Location: DMX Cafe - Chicago | Device ID: 169342
Zone 1: Main - Default Daypart Schedule
Start Time
12
00
PM
Repeat
Select All
Campaign
REMOVE SCHEDULE
SAVE
CANCEL

FIG. 41

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2014/015149

A. CLASSIFICATION OF SUBJECT MATTER

G10L 19/018(2013.01)i

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)
G10L 19/018; G06F 17/00; H04N 7/087; H04L 9/00; G11B 20/10

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Korean utility models and applications for utility models
Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
eKOMPASS(KIPO internal) & Keywords:audio, watermark, encode, decode, positive, negative, same

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2005-0043830 A1 (KIRYUNG LEE et al.) 24 February 2005 See paragraph [0046]; claim 4; and figure 4.	1-20
A	US 2010-0131767 A1 (GEOFFREY B. RHOADS) 27 May 2010 See abstract; and claims 1-6.	1-20
A	US 2006-0161777 A1 (ANTONIUS ADRIANUS CORNELIS MARIA KALKER et al.) 20 July 2006 See paragraphs [0074]-[0081]; claim 1; and figures 4-5.	1-20
A	US 5940135 A (RADE PETROVLC et al.) 17 August 1999 See column 4, lines 24-45; column 6, line 6-column 7, line 40; claims 1, 17; and figures 1-2.	1-20
A	KR 10-2006-0055925 A (LG ELECTRONICS INC.) 24 May 2006 See page 4, lines 19 - 36; claims 1-3, 10; and figures 1-2, 6.	1-20

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
03 June 2014 (03.06.2014)	**03 June 2014 (03.06.2014)**

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