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(71) Applicant: **MOTOROLA SOLUTIONS, INC.** [US/US];  
500 West Monroe Street, Chicago, Illinois 60661 (US).

(72) Inventors: **HAMBALY, Alfy Merican Ahmad**; Block  
22A-3-10, Persiaran Mayang, 11900 Bayan Baru, Pulau  
Pinang (MY). **KEE, Chew Yee**; 139, Taman Sri Indah Fasa  
2, Seberang Jalan Putra, 05150 Alor Setar, Kedah (MY).  
**HUA, Shijie**; 47, Jalan BK9/5, Bandar Kinrara, 47180 Pu-  
chong, Selangor (MY).

(74) Agent: **ONG, Charmayne Poh Yin**; c/o Skrine, Unit No.  
50-8-1, 8th Floor, Wisma UOA Damansara, 50, Jalan Dun-  
gun, Damansara Heights, 50490 Kuala Lumpur (MY).

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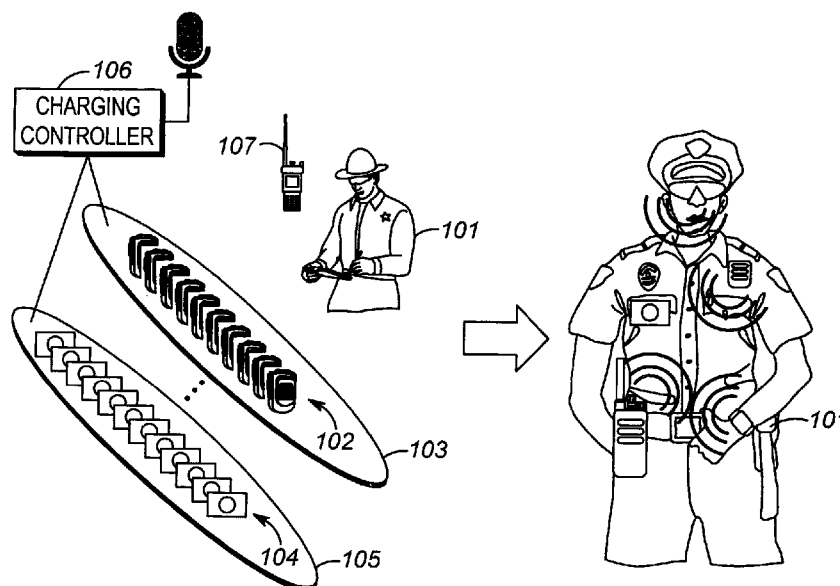


FIG. 1

(57) Abstract: A method and apparatus for quickly forming a PAN is described herein. During operation, a tone will be received that identifies an officer or an incident type. A subset of available devices will be paired/associated to form a PAN based on a frequency of the tone. In one embodiment of the present invention a first device generates the tone and the subset of available devices will form a PAN with the first device acting as a master device within the formed PAN.



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## METHOD AND APPARATUS FOR FORMING A NETWORK

### Field of the Invention

[0001] The present invention generally relates to forming a network, and more particularly to a method and apparatus for forming a network based upon a generated  
5 tone.

### Background of the Invention

[0002] Next-generation public safety officers will be equipped with devices that determine various physical and environmental conditions surrounding the public-safety officer. These conditions are generally reported back to a dispatch operator at a  
10 dispatch center so an appropriate action may be taken. For example, future police officers may have a sensor that determines when a gun is drawn. Upon detecting that an officer has drawn their gun, a notification may be sent back to the dispatch operator so that, for example, other officers in the area may be notified of the situation.

[0003] It is envisioned that the public-safety officer of the future will have an array of  
15 shelved devices available to the officer at the beginning of a shift or at the assignment of a particular task. The officer will select the devices off the shelf, and form a personal area network (PAN) with the devices that will accompany the officer on their shift or task. For example, upon the assignment of a particular task, the officer may pull a gun-draw sensor, a body-worn camera, a wireless microphone, a smart watch, a police  
20 radio, a man-down sensor, . . . , etc. All devices pulled by the officer will be configured to form a PAN by associating (pairing) with each other and communicating wirelessly among the devices.

[0004] A method called bonding is typically used for recognizing specific devices and thus enabling control over which devices are allowed to connect to each other when  
25 forming the PAN. Once bonded, devices then can establish a connection without user intervention. A bond is created through a process called "pairing". The pairing process is typically triggered by a specific request by the user to create a bond from a user via a user interface on the device.

[0005] Thus, pairing and unpairing devices to form or tear down a PAN typically  
30 involves some level of user interaction. This user interaction is the basis for confirming the identity of devices. Once pairing successfully completes, a bond will have been

formed between the two devices, enabling those two devices to connect to each other in the future without again requiring the pairing process. When desired, the bonding relationship can later be removed by the user.

5 [0006] Because devices are pulled randomly at the beginning of a shift/task, an officer may pull a different array of devices every time they form a PAN. This requires that old bonds be cleared from every device at the end of a shift/task, and new be formed every time the officer pulls devices at the beginning of their shift/task.

10 [0007] A problem with the above-described scenario is that forming a PAN at the beginning of a shift/task from the pulled devices, as well as tearing down the PAN at the end of the shift/task from the pulled devices can take a considerable amount time for the officer. For example, a public-safety officer will need to access each device and “associate/pair” the device to the PAN at the beginning of their shift/task. In a similar manner, the public-safety officer will need to access each device and “disassociate/unpair” the device from the PAN at the end of their shift/task. This will  
15 take a considerable amount of time and effort. Considering this fact, there is a need for a method and apparatus for quickly forming a PAN that requires little user interaction to do so.

#### Brief Description of the Several Views of the Drawings

20 [0008] The accompanying figures where like reference numerals refer to identical or functionally similar elements throughout the separate views, and which together with the detailed description below are incorporated in and form part of the specification, serve to further illustrate various embodiments and to explain various principles and advantages all in accordance with the present invention.

[0009] FIG. 1 illustrates an operational environment for the present invention.

25 [0010] FIG. 2 depicts an example communication system.

[0011] FIG. 3 depicts a more-detailed view of the personal-area network of FIG. 1.

[0012] FIG. 4 is a block diagram of a controller of FIG. 1.

[0013] FIG. 5 illustrates the charging ports of FIG. 1.

[0014] FIG. 6 is a flow chart showing operation of the controller of FIG. 4.

[0015] Skilled artisans will appreciate that elements in the figures are illustrated for simplicity and clarity and have not necessarily been drawn to scale. For example, the dimensions and/or relative positioning of some of the elements in the figures may be exaggerated relative to other elements to help to improve understanding of various embodiments of the present invention. Also, common but well-understood elements that are useful or necessary in a commercially feasible embodiment are often not depicted in order to facilitate a less obstructed view of these various embodiments of the present invention. It will further be appreciated that certain actions and/or steps may be described or depicted in a particular order of occurrence while those skilled in the art will understand that such specificity with respect to sequence is not actually required.

#### Detailed Description

[0016] In order to address the above-mentioned need, a method and apparatus for quickly forming a PAN is describe herein. During operation, a tone will be received that identifies an officer or an incident type. A subset of available devices will be paired/associated to form a PAN based on a frequency of the tone. In one embodiment of the present invention a first device generates the tone and the subset of available devices will form a PAN with the first device acting as a master device within the formed PAN.

[0017] Since devices uniquely needed by an officer are automatically associated with each other to form a PAN upon the detection of the tone, the time consumed during the formation of a PAN is greatly reduced. In addition, user involvement in the formation of the PAN is minimized.

[0018] In a preferred embodiment of the present invention the tone is an un-modulated signal of constant frequency. In a further embodiment of the present invention, the

subset of available devices forming the PAN will be identified by illuminating a light on, or in the proximity to each device within the subset of available devices.

[0019] In yet a further embodiment of the present invention, a computer-aided dispatch (CAD) incident identifier is utilized to determine a frequency of a current tone generated by a device. An incident identification (sometimes referred to as an incident scene identifier, or a CAD incident identifier) is generated for incidents where an officer is dispatched. This ID could be something as simple as a number, or something as complicated as an identification that is a function of populated fields, one of which may comprise an incident type.

5 [0020] It should be noted that the terms associate, associating, pair, pairing, form, and forming can be used interchangeably, and simply mean that a device is added to an existing PAN, or a PAN is created with the device as a member. The PAN described above that is formed between devices preferably comprises a wireless PAN that comprises a low-powered PAN carried over a short-distance wireless network technology such as PANs formed using the following standards: INSTEON, IrDA, 15 Wireless USB, Bluetooth, Z-Wave, ZigBee, and Body Area Network. The reach of a wireless PAN varies from a few centimeters to a few meters. Associating/pairing and disassociating/unpairing a device from the PAN is well known in the art, and takes place as instructed by any of the above standards.

20 [0021] It should also be noted that the present invention forms a PAN with at least some devices that are *not* in service at the time of the incident. These devices are not associated with any network, talkgroup, . . . , etc. Once placed into service, the devices form a PAN that is generally under the control of one user, and is very local in nature (e.g., within 10 feet). The PAN is formed by automatically associating and pairing 25 those devices needed for a particular tone. For example, when an officer accepts a task/mission, a device currently associated with the officer (e.g., their police radio) may generate a tone that identifies the devices that are required for the incident/mission based on the incident type.

[0022] The devices that are identified shall connect to the officer's PAN, or if no PAN currently exists, the identified devices will form a PAN with the police radio acting as a master device, for example.

5 [0023] As an example of the above, assume an officer is assigned a task to issue parking tickets, the devices necessary for the tasks may be identified as a radio, a hand-held tablet, a camera, and a portable printer. The necessary devices will be instructed to form a PAN, while the devices that are not required for the mission (e.g., a helmet) will not be part of the PAN. It should be noted that there may be multiple redundant devices of a particular type (e.g., multiple cameras) that are being charged  
10 and not currently part of a network. In the preferred embodiment, only one device from the multiple redundant devices will be paired with the PAN.

[0024] As one of ordinary skill in the art will recognize, during the formation of a Bluetooth PAN there is typically one master device (hub) and one or more slave devices. The number of slave devices is limited by the capability of the master device.  
15 All communication within a PAN is between the master and slave devices. There is no direct communication between the slave devices over a PAN, although these devices may have separate Bluetooth connections between them that do not use the PAN.

[0025] After a PAN is established, the slave devices are synchronized to the timing and frequencies specified by the master device (sometimes referred to as a hub). Note  
20 that in a PAN, each slave device uses a different physical channel. Thus, a PAN starts with two connected devices, and may grow to any number of connected devices (although in some systems eight is the maximum number of devices within a Bluetooth PAN). Bluetooth communication always designates one of the Bluetooth devices as a main controlling unit or master unit. Other devices that follow the master unit are slave  
25 units. This allows the Bluetooth system to be non-contention based (no collisions). This means that after a Bluetooth device has been added to the PAN, each device is assigned a specific time period to transmit and they do not collide or overlap with other units operating within the same PAN.

[0026] As a further example of the above, assume that each officer on a police force is  
30 assigned their own radio for communications on a semi-permanent basis. Each radio

may also generate a unique audio tone. At the beginning of a shift, an officer need only instruct their radio to generate the unique tone in order to identify that officer and automatically create a PAN with devices that are specifically suited for that officer's task or role. For example, assume Officer Smith is assigned a first radio that generates  
5 a first tone (e.g., a 5 KHz tone), and Officer Jones is assigned a second radio that generates a second tone (e.g., a 2 KHz tone). The generation of the first tone may pair a first subset of devices (e.g., a wireless microphone and a camera and the first radio), while the generation of the second tone may pair a second subset of devices (e.g., a helmet, a wireless microphone, and the second radio).

10 [0027] As described above, in a further embodiment of the present invention, the tone generated may be based on an incident type, so that during a first type of incident, a first tone may be generated by a device, and during a second type of incident, a second tone may be generated by the device. For example, a device may be provided an incident type. The device will generate a tone based on the incident type. The tone  
15 will uniquely identify and pair devices needed for the particular incident.

[0028] Therefore, the specific tone generated by a device is used to:

- identify an officer and pair devices used by the officer; and/or
- identify an incident and pair devices used for the incident; and/or
- identify a particular device, and pair other devices with the particular device;  
20 and/or
- identify a particular device as a master device, and pair other devices with the master device.

[0029] FIG. 1 depicts a general operating environment for the above-described technique for forming a PAN. As shown, public-safety officer 101 has an array of  
25 devices 102 and 104 to use during the officer's shift or after being assigned a particular task. For example, the officer may be permanently assigned one radio 107. The officer may need one camera 104 and one wireless microphone 102 for use during their shift or during a particular task. Other devices may be assigned as well. As shown, devices 102 and 104 may be located on a charging port 103/105. Ports 103  
30 and 105 will preferably be equipped with a controller 106 to receive a tone, and

instruct a subset of devices 102/104 to form a PAN. As described above, the PAN may be formed with device 107 acting as a master device.

5 [0030] When any device 102/104 is placed in/on ports 103/105, the devices will proceed into a charging state and a device ID will be detected by the charger. The device ID will uniquely identify the type of device. Controller 106 can receive the device ID thru any technique that convey an ID, for example, near-field communications (NFC) or via direct charging contact/ports. The device ID conveys information such as the device type, and current network association (if any).

10 [0031] As shown in FIG. 1, officer 101 will preferably wear the devices during a shift or incident by attaching the devices to worn clothing. These devices will form a PAN throughout the officer's shift or assigned task.

15 [0032] FIG. 2 depicts an example communication system 200 that incorporates PANs created as described above. System 200 includes one or more radio access networks (RANs) 202, a public-safety core network 204, hub (PAN master device) 210, local devices (slave devices) 212, a computer 214, and communication links 218, 224, and 232. In a preferred embodiment of the present invention, hub 210 and devices 212 form a PAN 240, with communication links 232 between devices 212 and hub 210 taking place utilizing a short-range communication system protocol such as a Bluetooth communication system protocol.

20 [0033] Each RAN 202 includes typical RAN elements such as base stations, base station controllers (BSCs), routers, switches, and the like, arranged, connected, and programmed to provide wireless service to user equipment (e.g., hub 210, and the like) in a manner known to those of skill in the relevant art.

25 [0034] The public-safety core network 204 may include one or more packet-switched networks and/or one or more circuit-switched networks, and in general provides one or more public-safety agencies with any necessary computing and communication needs, transmitting any necessary public-safety-related data and communications.

[0035] The hub 210 may be any suitable computing and communication devices configured to engage in wireless communication with the RANs 202 over the air interface as is known to those in the relevant art. Moreover, one or more hub 210 are further configured to engage in wired and/or wireless communication with one or more  
5 local device 212 via the communication link 232. Hub 210 will be configured to determine when to forward information via RANs 202 based on a combination of device 212 inputs.

[0036] Devices 212 and hub 210 may comprise any device capable of forming a PAN. For example, devices 212 may comprise a gun-draw sensor, a camera, a GPS  
10 receiver capable of determining a location of the user device, a clock, calendar, environmental sensors (e.g. a thermometer capable of determining an ambient temperature, humidity, presence of dispersed chemicals, radiation detector, etc.), an accelerometer, a barometer, speech recognition circuitry, a gunshot detector, . . . , etc.

[0037] Any one or more of the communication links 218, 224, could include one or  
15 more wireless-communication links and/or one or more wired-communication links.

[0038] Finally, computer 214 is part of a computer-aided-dispatch center, manned by an operator providing necessary dispatch operations. For example, computer 214 typically comprises a graphical user interface that provides the dispatch operator necessary information about public-safety officers. As discussed above, much of this  
20 information originates from devices 212 providing information to hub 210, which forwards the information to RAN 202 and ultimately to computer 214.

[0039] FIG. 3 depicts a more-detailed view of the personal-area network of FIG. 2. Personal-area network comprises a very local-area network that has a range of, for example 10 feet. As shown in FIG. 3, various devices 212 are shown attached to  
25 equipment utilized by a public-safety officer. In this particular example, a bio-sensor is located within a police vest, a voice detector is located within a police microphone, a handcuff deployment sensor is located with a handcuff pouch, a gun-draw sensor is located within a holster, and a camera 212 is provided. In FIG. 3, all sensors (except for camera 212) are represented by circles attached to an item to be monitored.

[0040] Devices 212 and hub 210 form a PAN 240. PAN 240 preferably comprises a Bluetooth PAN. Devices 212 and hub 210 are considered Bluetooth devices in that they operate using a Bluetooth, a short range wireless communications technology at the 2.4 GHz band, commercially available from the "Bluetooth special interest group".

5    Devices 212 and hub 210 are connected via Bluetooth technology in an ad hoc fashion forming a PAN. Hub 210 serves as a master device while devices 212 serve as slave devices. Devices 212 notify hub 210 of a sensed condition by sending a local status alert transmitted from the sensor as a Bluetooth message. Hub 210 in turn, may forward the local status alert over a wide-area network (e.g., RAN/Core Network) to

10   computer 214. In alternate embodiments of the present invention, hub 210 may forward the local status alert to mobile and non-mobile peers (shift supervisor, peers in the field, etc), or to the public via social media.

[0041] FIG. 4 is a block diagram of a controller 106 of FIG. 1. As shown, controller 106 may include receiver 402, power source 406, logic circuitry (microprocessor) 403, and

15   memory 404. In other implementations, controller 106 may include more, fewer, or different components.

[0042] Receiver 402 may be any form of microphone utilized to receive an audible or even non-audible sound. Power source 406 (which may exist external to controller 106) provides a way of charging devices 102 and 104. In a particular embodiment,

20   power source 406 is coupled to devices 102 and 104 by direct contact with devices 102 and 104 at ports 103 and 105. Thus ports 103 and 105 serves as a physical connection between power source 406 and devices 102 and 104. In the situation where devices 102 and 104 are wireless, ports 103 and 105 comprises a receiver that is both used to charge and receive data, for example a device ID. Thus, controller 106

25   comprises a device capable of generating a charging voltage and receiving unique device identification for those devices currently being charged.

[0043] It should be noted that power source 406 and devices 102 and 104 comprise standard elements that are well known in the art of charging and powering devices. For example, power source 406 can comprise standard circuitry that is capable of

direct and/or wireless charging when brought into contact/vicinity of devices 102 and 104.

[0044] Memory 404 comprises standard random access memory and is used to store frequencies and devices needed for each received frequency. Memory 404 may also  
5 store device identification information for those devices currently assigned to a user along with any PAN information for those assigned devices.

[0045] Logic circuitry 403 comprises a digital signal processor (DSP), general purpose microprocessor, a programmable logic device, or application specific integrated circuit (ASIC) and is configured to receive a tone from receiver 402. Once a tone is received,  
10 a PAN is formed with necessary devices in contact with controller 106 (e.g., those devices currently charging). More specifically, logic circuitry 403 instructs a subset of devices 102/103 to form, or join a PAN. The PAN may be formed/joined with other devices not currently charging. As discussed above, the devices may be identified to a user by activating an indicator associated with the device. For example, all devices  
15 chosen may be instructed to activate their display screens in a similar manner, or all devices chosen may have an associated light activated. This is illustrated in FIG. 5.

[0046] The detection if the tone is preferably accomplished by receiver 402 receiving an over-the-air tone from either another device (e.g., a potential master device), or from dispatch center 214. Additionally, devices used to form a PAN are determined by  
20 logic circuitry 403 by accessing memory 404 and determining those devices needed based on a frequency of the received tone. In particular, memory 404 stores devices needed based on frequency. This information is used by logic circuitry 403 in determining a subset of devices 102/103 to automatically associate with a PAN.

[0047] With the above in mind, controller 106 is configured to:

- 25
- receive a tone having a first frequency;
  - determine a plurality of devices needed based on the first frequency; and
  - instruct the plurality of devices to form a personal-area network (PAN) based on the plurality of devices needed.

- [0048] The PAN network is formed by logic circuitry 403 providing necessary information for pairing to (or forming) a PAN to those devices chosen. In a preferred embodiment, this is accomplished by providing the necessary information through ports 103 and 105. However, in an alternate embodiment of the present invention, a transmitter may be provided (not shown in FIG. 4) that will transmit the necessary information in a wireless manner to devices 102/104. In addition logic circuitry 403 may instruct devices 102/104 to listen for necessary PAN-forming messages transmitted by other devices. PAN formation takes place as described in, for example, the Bluetooth standard.
- 10 [0049] Thus, the device provided in FIG. 4 comprises a receiver receiving a first tone having a first frequency, and logic circuitry determining a first plurality of devices needed based on the first frequency and instructing the first plurality of devices to form a first personal-area network (PAN) based on the first plurality of devices needed.
- 15 [0050] FIG. 5 illustrates operation of charging ports 103/105. In FIG. 5, charging port 103 is shown as a wireless charging table equipped with light sources located below devices that are being charged. Charging port 105 is shown as a wireless charging cabinet having a light source located behind devices being charged. During operation devices that are being used in the formation of a PAN are illuminated from below and behind. So for example, in FIG. 5, smart phone 501, glasses 502, harness 503, helmet
- 20 504, and coat 505 have been identified as devices based on a received tone. As described above, these devices will be part of a PAN formed based on the particular tone. As shown in FIG. 5, these devices will have a light or other form of identification that will aide a user in obtaining the paired device.
- 25 [0051] FIG. 6 is a flow chart showing operation of the controller of FIG. 4. 1. The logic flow begins at step 601 where microphone 401 receives a first tone having a first frequency. The tone is passed to logic circuitry 403 where logic circuitry 403 determines a first plurality of devices needed based on the first frequency (step 603). Logic circuitry 403 then instructs the first plurality of devices to form a first personal-area network (PAN) based on the first plurality of devices needed (step 605).

[0052] As discussed above, the first tone is received from a first device. The step of instructing the first plurality of devices to form the first PAN may comprise the step of instructing the first plurality of devices to form the first PAN with the first device. The first device may act as a master device.

- 5 [0053] As discussed above, there may be multiple PANs created that are unique to each individual, device, or incident type. With this in mind, microphone 401 may receive a second tone having a second frequency. Logic circuitry 403 may then determine a second plurality of devices needed based on the second frequency, and instruct the second plurality of devices to form a second PAN based on the second  
10 plurality of devices needed.

[0054] The second tone may be received from a second device. The second plurality of devices may be instructed to form the second PAN the second device. The second device may become a master device within the second PAN, respectively.

- [0055] As discussed above, a frequency of the tone can be based on an incident type,  
15 so that, for example, a first incident will cause a first frequency tone to be broadcast, while a second incident will cause a second frequency tone to be broadcast. As discussed, the devices themselves may broadcast the tone when instructed to do so, or the tone may be generated by any other device in proximity to the charger.

- [0056] As discussed above, all devices can be programmed to generate a different  
20 frequency tone so that the device ID may be determined by the charger based on the frequency of the received tone. Devices formed within the PAN may change based on the device ID (received tone), so that, for example, a first police radio may form a PAN with a first plurality of devices, while a second police radio may form a PAN with a second plurality of devices. A frequency of the tone may be based on a device ID.

- 25 [0057] In the foregoing specification, specific embodiments have been described. However, one of ordinary skill in the art appreciates that various modifications and changes can be made without departing from the scope of the invention as set forth in the claims below. For example, while the above technique was described with reference to forming/associating with a PAN, one of ordinary skill will recognize that a

PAN, or association with any network may be achieved as described above. For example, association with a LAN may be performed as described above. Additionally, the above description was described with a single receiver receiving a tone and then instructing devices to form a PAN. One of ordinary skill in the art will recognize that each device *themselves* may receive the tone, and form a network accordingly. Additionally, the PANs formed above are based on a tone of a signal received, however, other information may be used to determine PAN members. For example, the tone may be modulated in any number of ways (e.g., amplitude/frequency). Accordingly, the specification and figures are to be regarded in an illustrative rather than a restrictive sense, and all such modifications are intended to be included within the scope of present teachings.

[0058] Those skilled in the art will further recognize that references to specific implementation embodiments such as "circuitry" may equally be accomplished via either on general purpose computing apparatus (e.g., CPU) or specialized processing apparatus (e.g., DSP) executing software instructions stored in non-transitory computer-readable memory. It will also be understood that the terms and expressions used herein have the ordinary technical meaning as is accorded to such terms and expressions by persons skilled in the technical field as set forth above except where different specific meanings have otherwise been set forth herein.

[0059] The benefits, advantages, solutions to problems, and any element(s) that may cause any benefit, advantage, or solution to occur or become more pronounced are not to be construed as a critical, required, or essential features or elements of any or all the claims. The invention is defined solely by the appended claims including any amendments made during the pendency of this application and all equivalents of those claims as issued.

[0060] Moreover in this document, relational terms such as first and second, top and bottom, and the like may be used solely to distinguish one entity or action from another entity or action without necessarily requiring or implying any actual such relationship or order between such entities or actions. The terms "comprises," "comprising," "has", "having," "includes", "including," "contains", "containing" or any other variation thereof, are intended to cover a non-exclusive inclusion, such that a process, method, article,

or apparatus that comprises, has, includes, contains a list of elements does not include only those elements but may include other elements not expressly listed or inherent to such process, method, article, or apparatus. An element preceded by "comprises ...a", "has ...a", "includes ...a", "contains ...a" does not, without more  
5 constraints, preclude the existence of additional identical elements in the process, method, article, or apparatus that comprises, has, includes, contains the element. The terms "a" and "an" are defined as one or more unless explicitly stated otherwise herein. The terms "substantially", "essentially", "approximately", "about" or any other version thereof, are defined as being close to as understood by one of ordinary skill in the art,  
10 and in one non-limiting embodiment the term is defined to be within 10%, in another embodiment within 5%, in another embodiment within 1% and in another embodiment within 0.5%. The term "coupled" as used herein is defined as connected, although not necessarily directly and not necessarily mechanically. A device or structure that is "configured" in a certain way is configured in at least that way, but may also be  
15 configured in ways that are not listed.

[0061] It will be appreciated that some embodiments may be comprised of one or more generic or specialized processors (or "processing devices") such as microprocessors, digital signal processors, customized processors and field programmable gate arrays (FPGAs) and unique stored program instructions (including  
20 both software and firmware) that control the one or more processors to implement, in conjunction with certain non-processor circuits, some, most, or all of the functions of the method and/or apparatus described herein. Alternatively, some or all functions could be implemented by a state machine that has no stored program instructions, or in one or more application specific integrated circuits (ASICs), in which each function  
25 or some combinations of certain of the functions are implemented as custom logic. Of course, a combination of the two approaches could be used.

[0062] Moreover, an embodiment can be implemented as a computer-readable storage medium having computer readable code stored thereon for programming a computer (e.g., comprising a processor) to perform a method as described and  
30 claimed herein. Examples of such computer-readable storage mediums include, but are not limited to, a hard disk, a CD-ROM, an optical storage device, a magnetic

storage device, a ROM (Read Only Memory), a PROM (Programmable Read Only Memory), an EPROM (Erasable Programmable Read Only Memory), an EEPROM (Electrically Erasable Programmable Read Only Memory) and a Flash memory. Further, it is expected that one of ordinary skill, notwithstanding possibly significant effort and many design choices motivated by, for example, available time, current technology, and economic considerations, when guided by the concepts and principles disclosed herein will be readily capable of generating such software instructions and programs and ICs with minimal experimentation.

[0063] The Abstract of the Disclosure is provided to allow the reader to quickly ascertain the nature of the technical disclosure. It is submitted with the understanding that it will not be used to interpret or limit the scope or meaning of the claims. In addition, in the foregoing Detailed Description, it can be seen that various features are grouped together in various embodiments for the purpose of streamlining the disclosure. This method of disclosure is not to be interpreted as reflecting an intention that the claimed embodiments require more features than are expressly recited in each claim. Rather, as the following claims reflect, inventive subject matter lies in less than all features of a single disclosed embodiment. Thus the following claims are hereby incorporated into the Detailed Description, with each claim standing on its own as a separately claimed subject matter.

CLAIMS

1. A method for forming a network, the method comprising the steps of:  
receiving a first tone having a first frequency;  
determining a first plurality of devices needed based on the first frequency; and  
5        instructing the first plurality of devices to form a first personal-area network (PAN) based on the first plurality of devices needed.
2. The method of claim 1 wherein the first tone is received from a first device, and wherein the step of instructing the first plurality of devices to form the first PAN  
10        comprises the step of instructing the first plurality of devices to form the first PAN with the first device.
3. The method of claim 2 further comprising the steps of:  
receiving a second tone having a second frequency;  
15        determining a second plurality of devices needed based on the second frequency; and  
instructing the second plurality of devices to form a second PAN based on the second plurality of devices needed.
- 20    4. The method of claim 3 wherein the second tone is received from a second device, and wherein the step of instructing the second plurality of devices to form the second PAN comprises the step of instructing the second plurality of devices to form the PAN with the second device.
- 25    5. The method of claim 4 wherein the first and the second devices become master devices within the first and the second PAN, respectively.
6. The method of claim 1 wherein the first tone received is based on a device ID.
- 30    7. The method of claim 1 wherein the first tone received is based on an incident type.

8. An apparatus comprising:

a receiver receiving a first tone having a first frequency; and

logic circuitry determining a first plurality of devices needed based on the first frequency and instructing the first plurality of devices to form a first personal-area  
5 network (PAN) based on the first plurality of devices needed.

9. The apparatus of claim 8 wherein the first tone is received from a first device, and wherein the logic circuitry instructs the first plurality of devices to form the first PAN by instructing the first plurality of devices to form the first PAN with the first device.

10

10. The apparatus of claim 9 wherein:

the receiver also receives a second tone having a second frequency; and

the logic circuitry determines a second plurality of devices needed based on the second frequency and instructs the second plurality of devices to form a second  
15 PAN based on the second plurality of devices needed.

11. The apparatus of claim 10 wherein the second tone is received from a second device, and wherein the logic circuitry instructs the second plurality of devices to form the second PAN by instructing the second plurality of devices to form the PAN with the  
20 second device.

12. The apparatus of claim 11 wherein the first and the second devices become master devices within the first and the second PAN, respectively.

25 13. The apparatus of claim 8 further comprising:

a charging port; and

wherein the logic circuitry instructs the first plurality of devices to form the PAN by sending instructions through the charging port.

14. The apparatus of claim 8 wherein a frequency of the first tone is based on an incident type.

15. The apparatus of claim 8 wherein a frequency of the first tone is based on a device  
5 ID.

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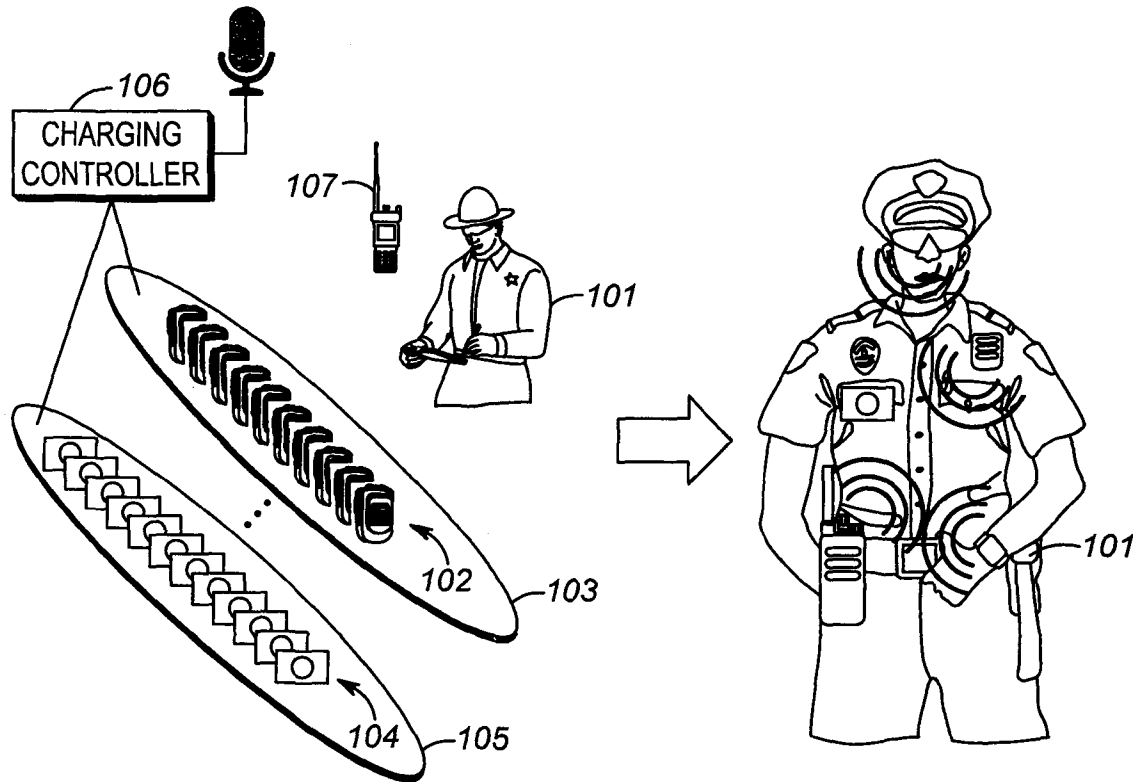


FIG. 1

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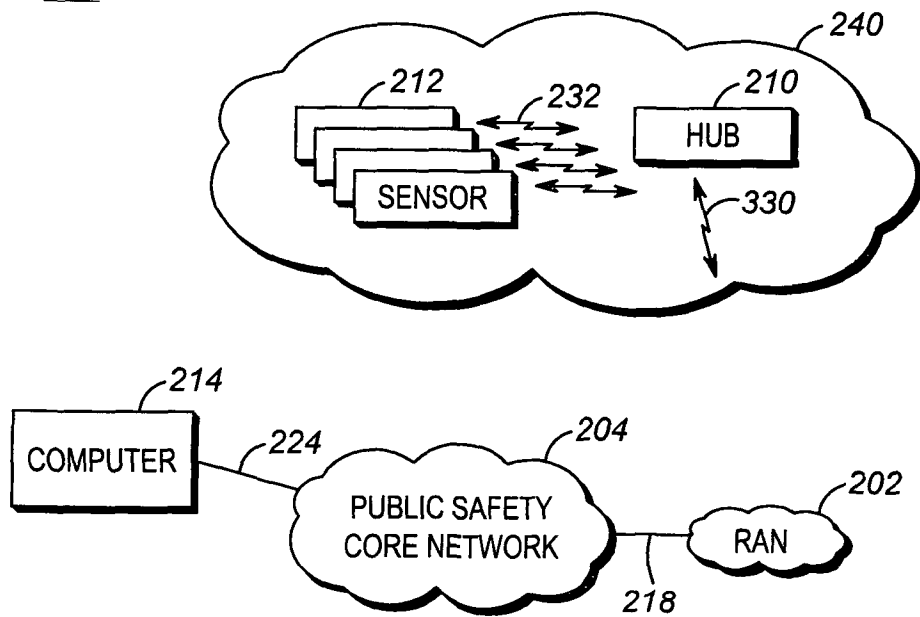


FIG. 2

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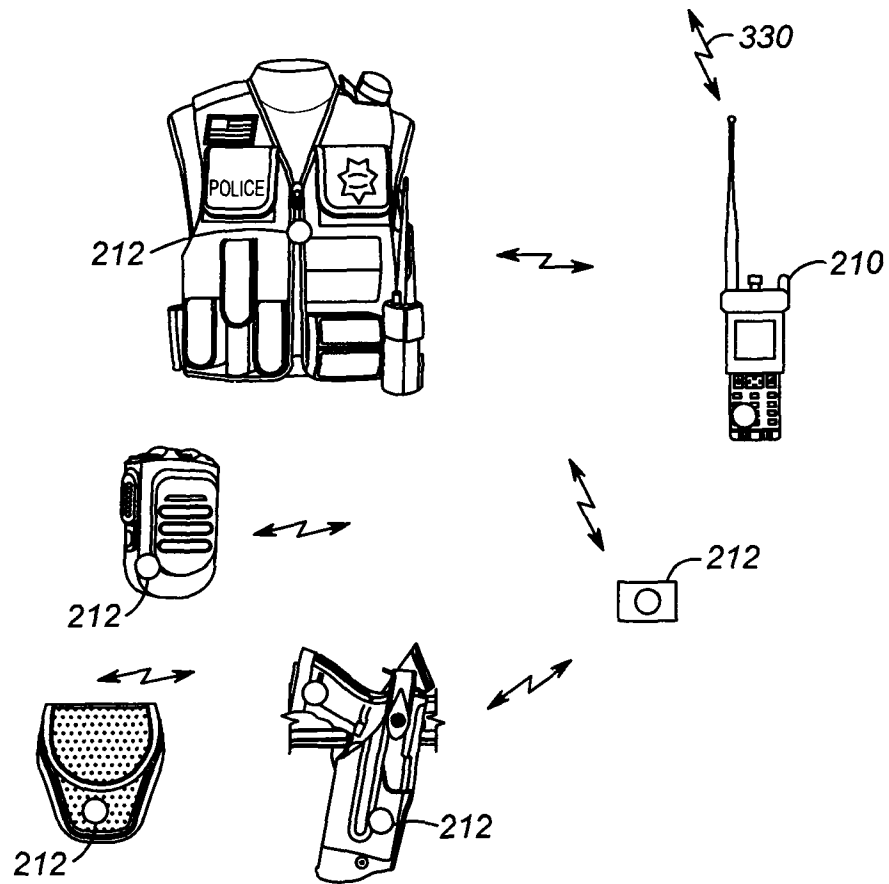


FIG. 3

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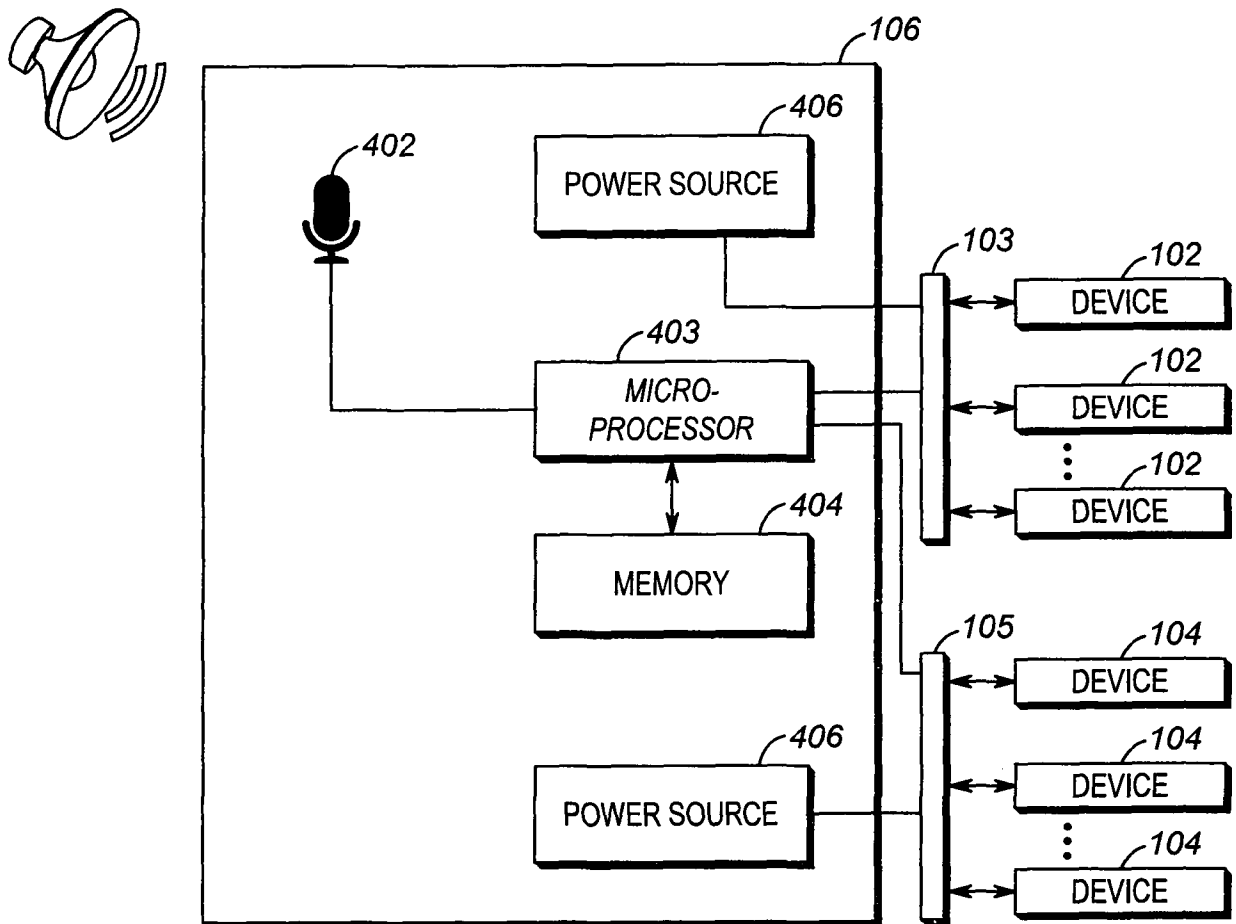


FIG. 4

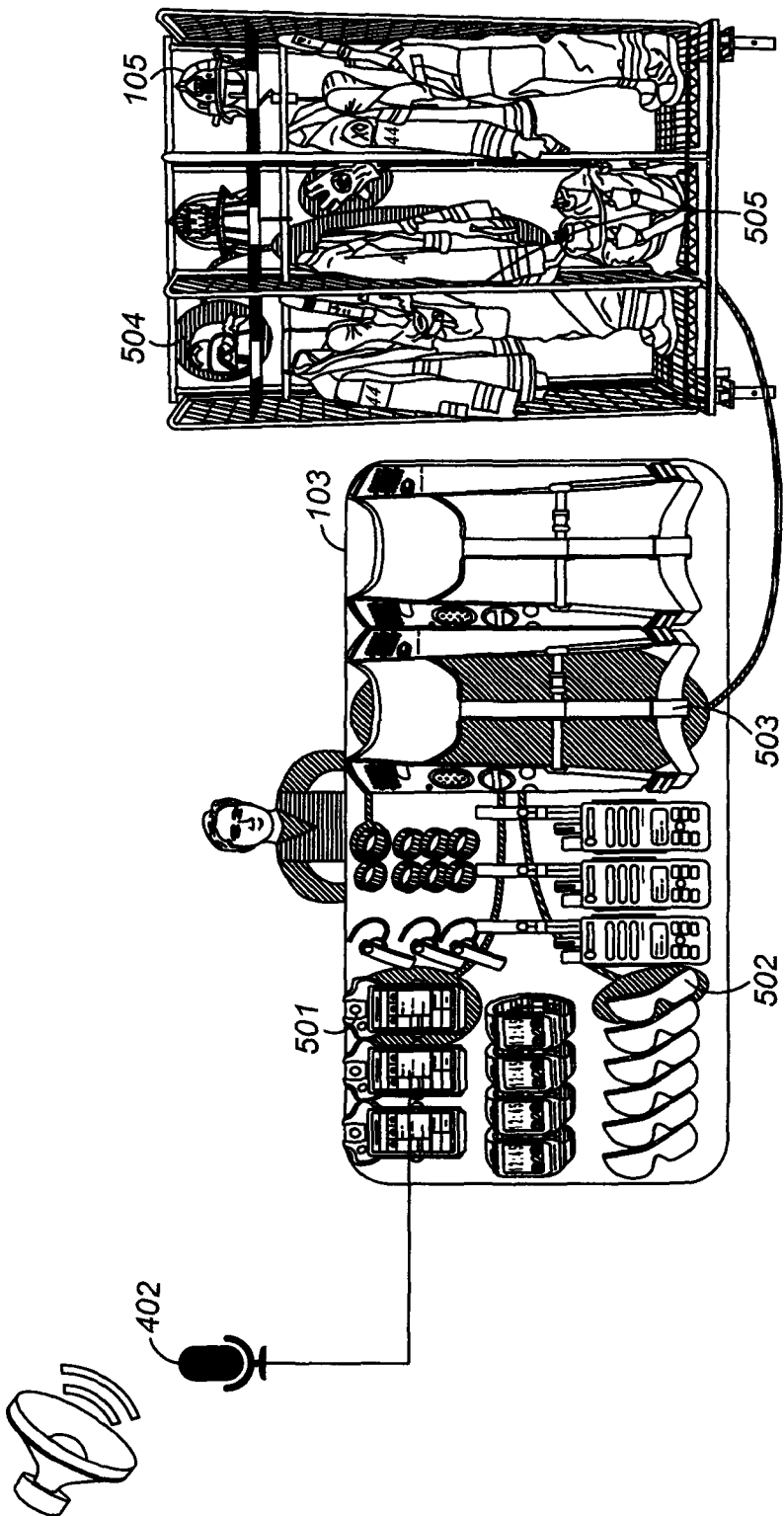


FIG. 5

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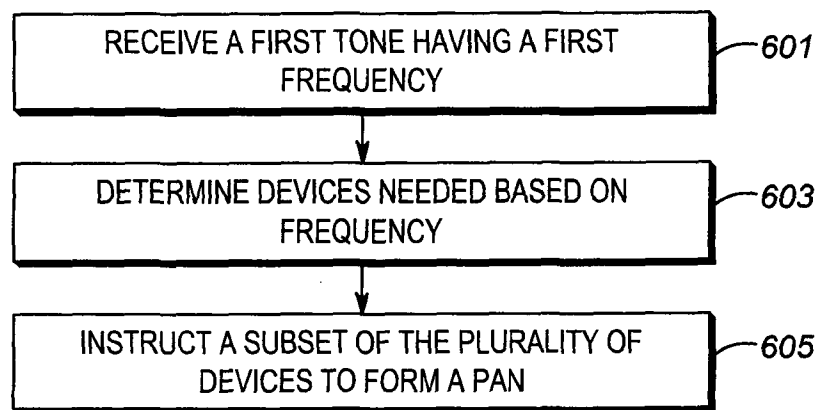


FIG. 6

# INTERNATIONAL SEARCH REPORT

International application No  
PCT/MY2016/000044

**A. CLASSIFICATION OF SUBJECT MATTER**  
INV. H04W4/00 H04W4/22 H04W8/00  
ADD. H04W84/18

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)  
H04W

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EP0-Internal, WPI Data

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages                                                              | Relevant to claim No. |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| X         | EP 2 860 998 A1 (SAMSUNG ELECTRONICS CO LTD [KR]) 15 April 2015 (2015-04-15)                                                                    | 1-6,8-15              |
| A         | paragraphs [0019] - [0052]<br>-----                                                                                                             | 7                     |
| X         | US 2015/099466 A1 (NARENDRA SIVA G [US] ET AL) 9 April 2015 (2015-04-09)                                                                        | 1-6,8-15              |
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| X         | WO 2015/056995 A2 (LG ELECTRONICS INC) 23 April 2015 (2015-04-23)                                                                               | 1-6,8-15              |
| A         | abstract<br>& US 2016/277873 A1 (PARK JANGWOONG [KR] ET AL) 22 September 2016 (2016-09-22)<br>paragraphs [0162] - [0243]; figures 8-10<br>----- | 7                     |

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Further documents are listed in the continuation of Box C.

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See patent family annex.

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Date of the actual completion of the international search

12 April 2017

Date of mailing of the international search report

26/04/2017

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040,  
Fax: (+31-70) 340-3016

Authorized officer

Biro, Udo Bela

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/MY2016/000044

| Patent document<br>cited in search report |    | Publication<br>date | Patent family<br>member(s) | Publication<br>date |
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|                                           |    |                     | WO 2015056995 A2           | 23-04-2015          |
| -----                                     |    |                     |                            |                     |