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(54) **Title:** A DEVICE FOR AND A METHOD OF EXTENDING AND ENHANCING COVERAGE OF A LONG-RANGE WIRE-
LESS COMMUNICATION SYSTEM

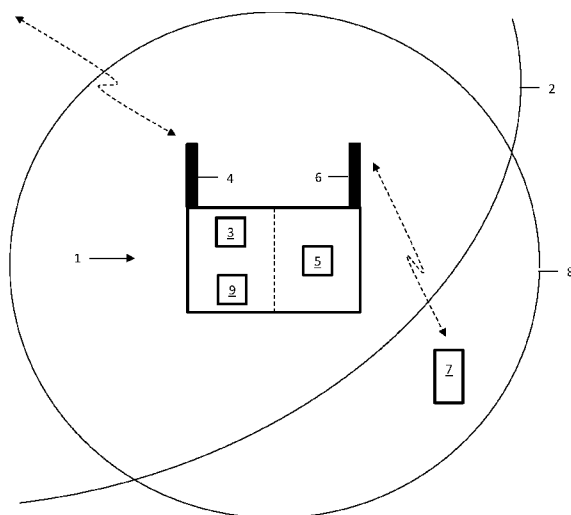


FIG.1

(57) **Abstract:** The invention relates to a device (1) for ex-
tending and enhancing coverage (2) of a long-range wireless
communication system, wherein the device (1) comprises a
first wireless communication means (3, 4) based on a long-
range wireless communication standard and a second wireless
communication means (5, 6) based on a short-range wireless
communication standard, said first and second wireless com-
munication means (3, 4; 5, 6) being operable to transmit and
receive data wirelessly in a long range and a short range, re-
spectively, wherein, when data intended to a recipient (7)
within coverage (8) of the device (1) is received from the
long-range wireless com- munication system by the first wire-
less communication means (3, 4), the device (1) is configured
to establish a new connection with the recipient (7) via the
second wireless communication means (5, 6), and, when data
is received from the recipient (7) by the second wireless
communication means (5, 6), the device (1) is configured to estab-
lish a new connection with the long-range wireless commu-
nication system via the first wireless communication means
(3, 4). Also, the invention relates to a method (100) of extend-
ing and enhancing coverage (2) of a long-range wireless com-
munication system.

A DEVICE FOR AND A METHOD OF EXTENDING AND ENHANCING COVERAGE OF A LONG-RANGE
WIRELESS COMMUNICATION SYSTEM

Field of the invention

The invention relates to the technical field of wireless communication systems, particularly to devices for and methods of extending and enhancing coverage of long-range wireless communication systems.

Background of the invention

Mobile phone users often experience poor coverage from cellular networks both indoors (e.g., in houses, offices, warehouses, etc.) and outdoors (e.g., in so-called urban canyons), for example in terms of disconnections or low data rates.

A solution to this problem is either to install a cellular base station or a repeater in an area of poor coverage. In particular, a repeater may amplify and forward the signal received from a cellular base station. However, especially indoors, the latter solutions do not provide optimal coverage due to the fact that the technologies employed in cellular systems have not been designed for indoor propagation conditions. Moreover, the employment of said solutions would imply a larger and more costly infrastructure to be managed by the mobile operator, due to the installation and maintenance of relatively complex base stations or repeaters. Finally, in most countries, only mobile operators, which have bought a license for cellular frequencies, are allowed to install base stations or repeaters and use them within the same frequency band. As a consequence, a lower market freedom and a likely higher service price to be paid by the customer would be the result of the introduction of such solutions.

Hence, there is a long-felt need in the technical field of long-range wireless communication systems of extending and enhancing coverage by overcoming the abovementioned drawbacks of the state-of-the-art.

Aspects of the invention

A first aspect of the invention is to provide an improvement to the state-of-the-art.

A second aspect of the invention is to solve the aforementioned drawbacks of the prior art by providing a solution that extends and enhances coverage of long-range wireless communication systems both indoors and outdoors.

- 5 A third aspect is to solve drawbacks in signal reception due to local obstacles.

A fourth aspect is to solve communications issues during critical or emergency situations in areas with extended wireless coverage.

Description of the invention

- 10 The aforementioned aspects of the invention are achieved by a device (e.g., a gateway, a router, an extender, etc.) for extending and enhancing coverage of a long-range wireless communication system (e.g., a cellular system), wherein the device comprises a first wireless communication means (e.g., a physical or a logical SIM card, a transceiver and an antenna) based on a long-range wireless communication standard (e.g.,
- 15 GSM, UMTS, LTE, WiMAX, etc.) and a second wireless communication means (e.g., a transceiver and an antenna) based on a short-range wireless communication standard (e.g., WiFi, Bluetooth, ZigBee, etc.), said first and second wireless communication means being operable to transmit and receive data wirelessly in a long range and a short range, respectively, wherein, when data (e.g., associated to a GSM call, an SMS,
- 20 an MMS, a video call, etc.) intended to a recipient (e.g., a user device such as a smartphone, a tablet, a laptop, a PC, etc.) within coverage of the device is received from the long-range wireless communication system by the first wireless communication means, the device is configured to establish a new connection (e.g., a VOIP call) with the recipient via the second wireless communication means, and, when data (e.g.,
- 25 associated to a VOIP call) is received from the recipient by the second wireless communication means, the device is configured to establish a new connection (e.g., a GSM call) with the long-range wireless communication system via the first wireless communication means.
- 30 Herein, “long range” refers to the coverage of cellular- or metropolitan area network-based systems (e.g., GSM, UMTS, LTE, WiMAX, etc.) and “short range” refers to the coverage of local-, personal- and body area network-based systems (e.g., WiFi, Blue-

tooth, ZigBee, etc.). For example, a GSM base station may have a coverage of up to 80 km and a WiFi access point of up to 100 m indoors and 200 m outdoors.

5 Advantageously, the antennas of the first and second wireless communication means may be co-located with the device or located at a distance from the device. As a consequence, the antennas may be placed so as to obtain the best signal reception (e.g., on the roof of a building or a car) while the device may be placed where it is more convenient for the user (e.g., in a closet or in the trunk of a car).

10 Naturally, if one or both of the two new connections (e.g., the GSM and VOIP connections) have already been established, the device needs not to establish new connections but may continue to use the already established connections.

15 The technical effect achieved by the invention is to increase the probability of good signal reception at the recipient by replacing a poor direct link (e.g., a link in non-line-of-sight and/or with a low signal-to-noise/signal-to-interference-plus-noise ratio) between the long-range wireless communication system and the recipient with two links hopping through the device, since the shorter range of the link device-recipient intrinsically implies a higher likelihood of better signal reception by the recipient (e.g., due to a more likely line-of-sight condition).

20

Hence, the invention, besides establishing a gateway between two or more wireless communication standards, has the advantage of virtually enhancing the coverage of the long-range wireless communication system by providing better signal reception within the same area. Also, the invention has the advantage of virtually extending the coverage of the long-range wireless communication system thanks to the physical transmission range of the second wireless communication means of the device. This is, for example, advantageous when the recipient is in fact outside coverage of the long-range wireless communication system but inside coverage of the device, since data intended to the recipient will anyhow reach it by being routed via the device.

25

30 Moreover, owing to the fact that, contrarily to long-range wireless communication standards, short-range wireless communication standards have been designed to adapt to indoor propagation environments, the invention has the advantage of enhancing and increasing the coverage of long-range wireless communication systems indoors. Final-

ly, since the device establishes a new connection (e.g., by starting a new GSM/VOIP call), there is no need for performing a conversion from one data type to the other within the device.

5 Advantageously, the short-range wireless communication standard is WiFi. This has the advantage that mobile operators cannot monopolize the market, thus any manufacturer would be able to sell the device in question without needing to request and pay for a license for the use of the frequencies, as the WiFi frequencies are indeed free to use.

10

Advantageously, the device further comprises a Private Branch Exchange (PBX) computer for automatic call (e.g., a GSM call or a UMTS/LTE video call) forwarding.

15

For example, in case the intended user does not answer the call or the caller has dialled the wrong number, the call may be routed to another user in the device's network by the device or to the right user in the device's network by the wrong user, respectively.

20

Advantageously, the device may also comprise an interface to a wired connection (e.g., a LAN port) for establishing a gateway also between any wired and wireless communication standards.

25

In an embodiment, the device comprises components that can perform WI-FI, GoIP and PBX functions. The device has external antennas for both WI-FI and GSM/UMTS/WDCMA.

30

The device is configured to optionally replace the external antennas on with extra detachable antennas. Such extra antenna may be configured to be attached on a vehicle such as an car.

The device may be configured with a Wi-Fi unit. The Wi-Fi unit may be configured to operate as a full independent Wi-Fi unit and to work as an extender or pass-through to another WiFi-unit or a device.

The device may be configured with a noise-filtering or a noise-reduction unit. The noise-filtering or noise-reduction unit may be configured to filter out or reduce noise in the voice spectrum.

5 The device may have a unit to convert between a communication standard of the second wireless communication standard or codec and a first wireless communication standard or codec. The device may be configured to convert from, from or between a GSM/UMTS/LTE and VoIP codec.

10 The device is configured to select or automatically detect and select data or voice communication and to operate in a preferred operational mode as either 'heavy voice or conversation communication', such as one or a 'heavy data intensive communication' such as an additional mode. By this is meant, that the 'heavy conversation communication' is primarily based on GSM, while the 'heavy data intensive communication' is based primarily on UMTS/LTE or higher.

The device may be configured to automatically change between frequency-channels in the Wi-Fi.

20 In an embodiment the device is configured to divert data including voice data via a private branch exchange (PBX).

In one configuration, a call or collection of data with a caller ID for a recipient within the coverage of the second wireless communication means may be received by the device.

25 When an incoming call or connection with a call ID, i.e. a phone number or any other ID carried in data, is received by the device, the device may be configured to direct such call or connection.

30 The device may be configured to forward the call to another recipient within the coverage if the ID is not available or not within the coverage of the device, or does not accept the call,

The device may be configured to handle one or more chain of calls and so configured that if a recipient in the predefined chain is not available within coverage of the device, the device will skip such recipient..

- 5 The device may be configured to that if no intended or listed recipient is available within the coverage of the device, the call or data will be directed to the voice mail or data storage device so that data is delivered for later collection. The device may be configured to automatically send notification to the intended recipient or the administrator of the device.

10

Likewise, the device may be configured to forwarding IP call from one recipient to another within the coverage of the second wireless communication zone.

The device may be configured to establish a client environment in a recipient device.

15

The client may retrieve and broadcast a unique ID, such as an internal IP address or MAC address, to the device.

Such client environment may include a Session Initiation Protocol (SIP) dialer. The device may be configured to offer or require such client environment to be retrieved and installed on the recipient platform when connected to the second wireless communication network or Wi-Fi when within the coverage.

20

A recipient may be able to choose between automatic or manual diversion of calls or data via the client environment.

25

The client environment may be configured to assess the signal strength or durability of the first wireless communication means and the second wireless communication means.

30

The client environment may be able to transmit the respective signal strengths to the device.

If the client environment detects that a first wireless signal strength is falling dramatically, and it is not yet chosen to divert to the device's GSM/UMTS/LTE number, the client environment may be configured to get a response from the user if an in-

35

struction is to be transmitted via the first wireless network to divert calls to the device.

5 In an aspect of the device, the exchange of data to or from the recipient is via the establishment of a new connection performed as a function of signal strength or quality.

Advantageously the device interacting between the recipient and the first wireless network may facilitate not only extended coverage range, but also enhance the quality of service of the wireless network. The device may adaptably select an optimal communication path.

10

In an aspect, the device may further comprise a computer for Private Branch Exchange (PBX) handling of connections.

15 Such PBX or similar may facilitate aspects of the invention. The computer unit may be a PBX as widely known by a person skilled in the art. The computer unit or implementation may be with a similar functionality to a PBX. A person skilled in the art may also implement a necessary subset of functions or include extended functionality.

20 In an aspect, the device may further comprise means for delivering a client environment on a recipient and to communicate with and to store and process data from a client environment of a recipient.

Thereby the device may be able to collect and process data or information from a recipient device. The client environment may be what has become known as an APP(lication) or some equivalent programming implemented on a handset device such as a phone, a tablet or a computer.

25

In an aspect, the device may further be configured to store and process geotagged estimated with signal strengths from one or more recipient and to process the geotagged signal strengths to build a signal strength map.

30

By geotagged information is understood either absolute coordinates or estimated to a location. Such geotagged information may be obtained by a GPS-like device or trian-

gulations using coordinates of antennas or locations of the first or second wireless networks.

The geotagging may also be understood or based relative coordinates to a device.
5 Hence a device may be the centre of a polar coordinate system and the relative location of a recipient to a device may be an estimated angle and an estimated distance.

The device may be configured to map and update a map by collecting combined locations and signal strengths. The device may configured to build and assemble such map
10 by information from several independent recipients over time. The device may be configured to assemble a map through a calibration procedure with predetermined positions. The map may be made available to a client environment with a recipient device.

The map may reflect communications zones that are high quality with respect to either
15 first wireless communication or second wireless communication or both. The map may reflect zones that are low or unusable quality with respect to first or second wireless communication. The map may reflect “shadow” zones or areas. The map may be used as an input to optimally select a communication path adoptively and according to local signal conditions.

20 In an aspect, the device may be configured to establish new connections and or routings of data as a function of current location or estimate of a current location of a recipient with respect to the signal strength map.

25 Thereby a recipient is ensured enhanced or optimal coverage and to use the optimal communication path within the coverage range of a device. This may be advantageous for stationary locations of a recipient when the recipient is moving.

In an aspect, the device may be configured to establish new connections and or routings of data as a function of a predicted future location or estimate of future location
30 of a recipient with respect to the signal strength map.

This may be further advantageous when a recipient is directed towards a “dead” zone of the first or second wireless network and it allows the device to take actions. The

action may be to change to a first or second wireless connection or to warn the recipient that a

In an aspect, the device may be configured to exchange data with another device.

5

Thereby the coverage may be extended. Each device may function as an assess point simply relaying information.

10

In an aspect, the device may be configured to store and process geotagged signal strengths from one or more devices and to process the geotagged signal strengths to build a collective signal strength map.

15

Thereby multiple devices may be placed to extend the coverage of a larger area and one or more device may be configured to construct individual signal strength maps or a collective map. Advantageously some devices may be calibrated to generate precise reference maps and other devices may be configured to generate maps weighted towards the more precise maps.

20

In an aspect, the device may further be configured to execute a predetermined or configurable set of actions based on an event triggered and communicated to the device via the second wireless communication means and where the set of actions include: establishment of a set new connections via the first or second wireless communication means and sending or receiving the same data via one or more of the set of new connections.

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The event triggering may be an event from a sensor, a user input or a signal transmitted via a first or second wireless network. The event may be an alarm.

30

The device or a recipient may be configured to establish connections predetermined to be necessary or vital according to a particular event.

Thereby according to the event, a local event handling or alarm system is established.

In an aspect, the device may further be configured to execute a predetermined or configurable set of actions based on an event triggered and communicated to the device via the first wireless communication means and where the set of actions includes: establishment of a set new connections via the first or second wireless communication means and sending or receiving the same data via one or more of the set of new connections.

Similarly, and according to the event, an external event handling or alarm system is established. Depending on the severity of the event the device may facilitate broadcast the event or alarm to a recipient on the first wireless communications system.

In an aspect, the device may be configured to receive and handle an event triggering is performed by recipient.

The event triggering may be an alarm intended for police, firebrigade or alarm centre. The event triggering may be a simple common call to one or more recipients within the second wireless coverage range.

In an aspect, the device may be configured to enter an event triggered mode of operation with priority to one or more recipients within the coverage range of the second wireless communication range and with priority to one or more connections between the device and the first communication network.

Thus advantageously the device may support and optimise handling of a particular event. In an example the event is a fire and the mode of operation may be to alert recipients within the second wireless coverage and call for external assistance. The mode of prioritized operation may alter or change depending on the stage of crisis handling.

In an aspect, the device may be configured to transmit the location or estimated location of one or more recipients including the event triggering

Thus the device may advantageously support handling an event. In one exemplary situation of a fire, the location or best known location may be transmitted or made

available to firemen thereby providing valuable information to facilitate organised and directed assistance accordingly.

5 This may be particularly advantageous since the existing wireless network may not be able to give a precise location or no information about location at all.

10 In an aspect, the device may be configured to transmit or otherwise make a signal strength map available to a predetermined recipient. The availability may be without restriction or with some restrictions according to say privacy settings or filtered according to the event.

Thus the device may facilitate not only extended and enhanced coverage, but also extended and enhanced support during the cause of an event.

15 An object may also be accomplished by a network of devices configured to extending and enhancing coverage of one long-range wireless communication system where each device is one of the devices disclosed herein.

20 Also, the aforementioned aspects of the invention are achieved by a method of extending and enhancing coverage of a long-range wireless communication system, wherein the method comprises:

- providing a device as described above;
- determining whether a recipient is within coverage of the device (e.g., if the recipient is able to receive the received signal strength indicator of the device), and, if so, routing any communication initiated from or intended to the recipient via the device;
- when data intended to a recipient within coverage of the device is received from the long-range wireless communication system by the first wireless communication means, the device establishing a new connection with the recipient via the second wireless communication means; and
- when data is received from the recipient by the second wireless communication means, the device establishing a new connection with the long-range wireless communication system via the first wireless communication means.

Advantageously, the routing may be enabled by, for example, the user downloading a software application on his smartphone and setting it up by inserting his smartphone number. Consequently, any incoming communication intended to the user will be routed from the long-range wireless communication system to the device (and not
5 directly to the user device, unless the user device is out of the device's coverage) and any outgoing communication initiated by the user will be routed to the device (and not directly to the long-range wireless communication system, unless the user device is out of the device's coverage).

Note that all the aforementioned advantages of the system are also met by the method
10 described above.

In an aspect, the method may further comprise collecting geospatial information about the location of one or more recipients along with signal strength about the first communication means and the second communication means for a particular geospatial
15 location constructing a signal strength map.

Thus the device may establish new connections and route data as a function of the signal strength map. Thereby the coverage of a wireless communication system is enhanced according to local conditions.
20

In an aspect, the method may further comprise triggering of an event and operating the device in a prioritised mode of operating of the device as a result of the triggering of an event.

25 Thereby the device further extends, enhances or even enables support and handling of a particular event, such as an alarm, support during the cause of an event.

Hereafter, the invention will be described in connection with drawings illustrating non-limiting examples of devices for and methods of extending and enhancing coverage of long-range wireless communication systems.
30

Brief description of the drawings

FIG.1: Device for extending and enhancing coverage of a GSM network.

FIG.2: Method for extending and enhancing coverage of a GSM network.

FIG.3: Device for extending and enhancing coverage of a GSM network in a car.

Notations

- 1: Device.
- 2: Coverage of the long-range wireless communication system.
- 5 3, 4: First wireless communication means.
- 5, 6: Second wireless communication means.
- 7: Recipient.
- 8: Coverage of the device.
- 9: SIM card.
- 10 10: Chassis.
- 11: Car.

Preferred embodiments of the invention

FIGs.1 and 2 respectively show a device 1 for and a method 100 of extending and enhancing coverage 2 of a GSM network (not shown). The device 1 comprises a GSM
15 SIM card 9 and a first wireless communication means including a GSM transceiver 3 and a GSM antenna 4. Also, the device 1 comprises a second wireless communication means including a WiFi transceiver 5 and a WiFi antenna 6.

In operation, it is determined 102 whether a recipient, e.g., in the form of a
20 smartphone 7 of a user, is within coverage 8 of the device's WiFi network, and, if so, any communication (voice and data such as an SMS) initiated from or intended to the smartphone 7 will be routed 103 via the device 1. The latter operations may be carried out as follows. When the smartphone 7 enters the device's WiFi network, the user/smartphone is offered to divert all his communications to the device 1 (e.g., in case
25 of an incoming voice call, this practically implies diverting it to the device's GSM number). Once this is confirmed either manually by the user or automatically by the smartphone 7, a SIP dialer, which is loaded on the smartphone 7 when the latter is within coverage 8 of the device's WiFi network, will establish an IP connection to the device 1 and will control all incoming and outgoing communications between the
30 smartphone 7 and the GSM network. On the GSM network side, instead, the smartphone 7 will automatically send a code to the GSM operator containing a diversion order, so that all communications generated in the GSM network and intended to the user of the smartphone 7 will be diverted through the device 1.

Consequently, when a voice call intended to the user of the smartphone 7 will be received from the GSM network by the first wireless communication means 3, 4, the device 1 will establish 104 a new VOIP connection with the smartphone 7 via the second wireless communication means 5, 6. When a voice call will, instead, be received from the smartphone 7 by the second wireless communication means 5, 6, the device 1 will establish 105 a new GSM connection with the GSM network via the first wireless communication means 3, 4.

Similarly to voice calls, any data communication (e.g., SMS, MMS, video call, etc.) received from a GSM/UMTS/LTE network will be either converted by the device 1 or simply relayed within the device 1 from the first wireless communication means 3, 4 to the second wireless communication means 5, 6. Vice versa, any data communication received by the smartphone 7 on the WiFi network will be either converted by the device 1 into GSM/UMTS/LTE data packets or, if GSM/UMTS/LTE coded data is embedded in the IP packets, simply relayed within the device 1 from the second wireless communication means 5, 6 to the first wireless communication means 3, 4.

Finally, if the smartphone 7 is out of coverage 8 of the device's WiFi network, the smartphone 7 will automatically send a code to the GSM operator containing an interrupt diversion order, so that all communications generated in the GSM network and intended to the user of the smartphone 7 will not be diverted anymore through the device 1.

FIG.2 shows another advantageous embodiment of the invention. Normally, the chassis 10 of a car 11 shields the electromagnetic waves and thereby dampens the received signal inside the car 11 (e.g., up to 15 dB). Additionally, users typically store their smartphones in their jackets, which further worsen the signal reception. Thus, by mounting the GSM antenna 4 of the device 1 at the roof of the car 11, on the outside, and the WiFi antenna 6 of the device 1 at the roof of the car 11, on the inside, the signal reception from the GSM network will be optimal and the device 1 (not shown) will then provide for an optimal signal reception inside the car 11 via WiFi.

CLAIMS

1. A device (1) for extending and enhancing coverage (2) of a long-range wireless communication system, **characterized in that** the device (1) comprises
- 5 - a first wireless communication means (3, 4) based on a long-range wireless communication standard and
- a second wireless communication means (5, 6) based on a short-range wireless communication standard, said first and second wireless communication means (3, 4; 5, 6) being operable to transmit and receive data wirelessly in a long range and a short
- 10 range, respectively, wherein,
- the device (1) is enabled to establish a new connection with a recipient (7) via the second wireless communication means (5, 6), when data intended to the recipient (7) within coverage (8) of the device (1) is received from the long-range wireless communication system by the first wireless communication means (3, 4), and,
- 15 - the device (1) is enabled to establish a new connection with the long-range wireless communication system via the first wireless communication means (3, 4) when data is received from the recipient (7) by the second wireless communication means (5, 6).
2. The device (1) according to claim 1, further configured so that the exchange of data
- 20 to or from the recipient (7) is via the establishment of a new connection established as a function of signal strength or quality.
3. The device (1), further comprising a computer for Private Branch Exchange (PBX) handling of connections.
- 25
4. The device (1), further comprising means for delivering a client environment on a recipient (7) and to communicate with and to store and process data from a client environment of a recipient (7).
- 30
5. The device (1) according to claim 4, further configured to store and process geotagged estimated with signal strengths from one or more recipient (7) and to process the geotagged signal strengths to build a signal strength map.

6. The device (1) according to claim 5, configured to establish new connections and or routings of data as a function of current location or estimate of a current location of a recipient (7) with respect to the signal strength map.

5 7. The device (1) according to claim 5 or 6, configured to establish new connections and or routings of data as a function of a predicted future location or estimate of future location of a recipient (7) with respect to the signal strength map.

10 8. The device (1) according to any of claims 1 to 7, configured to exchange data with another device (1).

15 9. The device (1) according to claim 8, configured to store and process geotagged signal strengths from one or more devices (1) and to process the geotagged signal strengths to build a collective signal strength map.

15 10. The device (1) according to any of claim 1 to 9, further configured to execute a predetermined or configurable set of actions based on an event triggered and communicated to the device (1) via the second wireless communication means (5, 6) and where the set of actions include:

20 establishment of a set new connections via the first or second wireless communication means (3,4 or 5,6) and sending or receiving the same data via one or more of the set of new connections.

25 11. The device (1) according to any of claim 1 to 10 further configured to execute a predetermined or configurable set of actions based on an event triggered and communicated to the device (1) via the first wireless communication means (5, 6) and where the set of actions includes:

30 establishment of a set new connections via the first or second wireless communication means (3,4 or 5,6) and sending or receiving the same data via one or more of the set of new connections.

12. The device (1) according to claim 10 or 11, further configured to receive and handle an event triggering performed by recipient (7).

13. The device (1) according to claim, configured to enter an event triggered mode of operation with priority to a one or more recipients (7) within the coverage range of the second wireless communication range and with priority to one or more connections between the device (1) and the first communication network.

5

14. The device (1) according to claim 12 or 13, configured to transmit the location or estimated location of one or more recipients (7) including the event triggering

15. The device (1) according to any of claim and configured to transmit or otherwise
10 make a signal strength map available to a predetermined recipient.

16. A network of connected devices (1) configured to extending and enhancing coverage (2) of one long-range wireless communication system where each device (1) is one of the devices (1) according to any of claim 1 to 15.

15

17. A method (100) of extending and enhancing coverage (2) of a long-range wireless communication system, **characterized in that** the method (100) comprises:

- providing (101) a device (1) according to any of claims 1 to 16;
- determining (102) whether a recipient (7) is within coverage (8) of the device (1),
20 and, if so, routing (103) any communication initiated from or intended to the recipient (7) via the device (1);
- when data intended to a recipient (7) within coverage (8) of the device (1) is received from the long-range wireless communication system by the first wireless communication means (3, 4), the device (1) establishing (104) a new connection with the recipient
25 (7) via the second wireless communication means (5, 6); and
- when data is received from the recipient (7) by the second wireless communication means (5, 6), the device (1) establishing (105) a new connection with the long-range wireless communication system via the first wireless communication means (3, 4).

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18. The method (100) according to claim 17 further comprising

- collecting geospatial information about the location of one or more recipients (7) along with signal strength about the first communication means and the second communication means for a particular geospatial location;
- constructing a signal strength map; and

- establishing new connections and routing data as a function of the signal strength map.

19. The method (100) according to claim 17 or 18 further comprising

- 5 -triggering of an event; and
- operating the device in a prioritised mode of operating of the device (1) as a result of the triggering of an event.

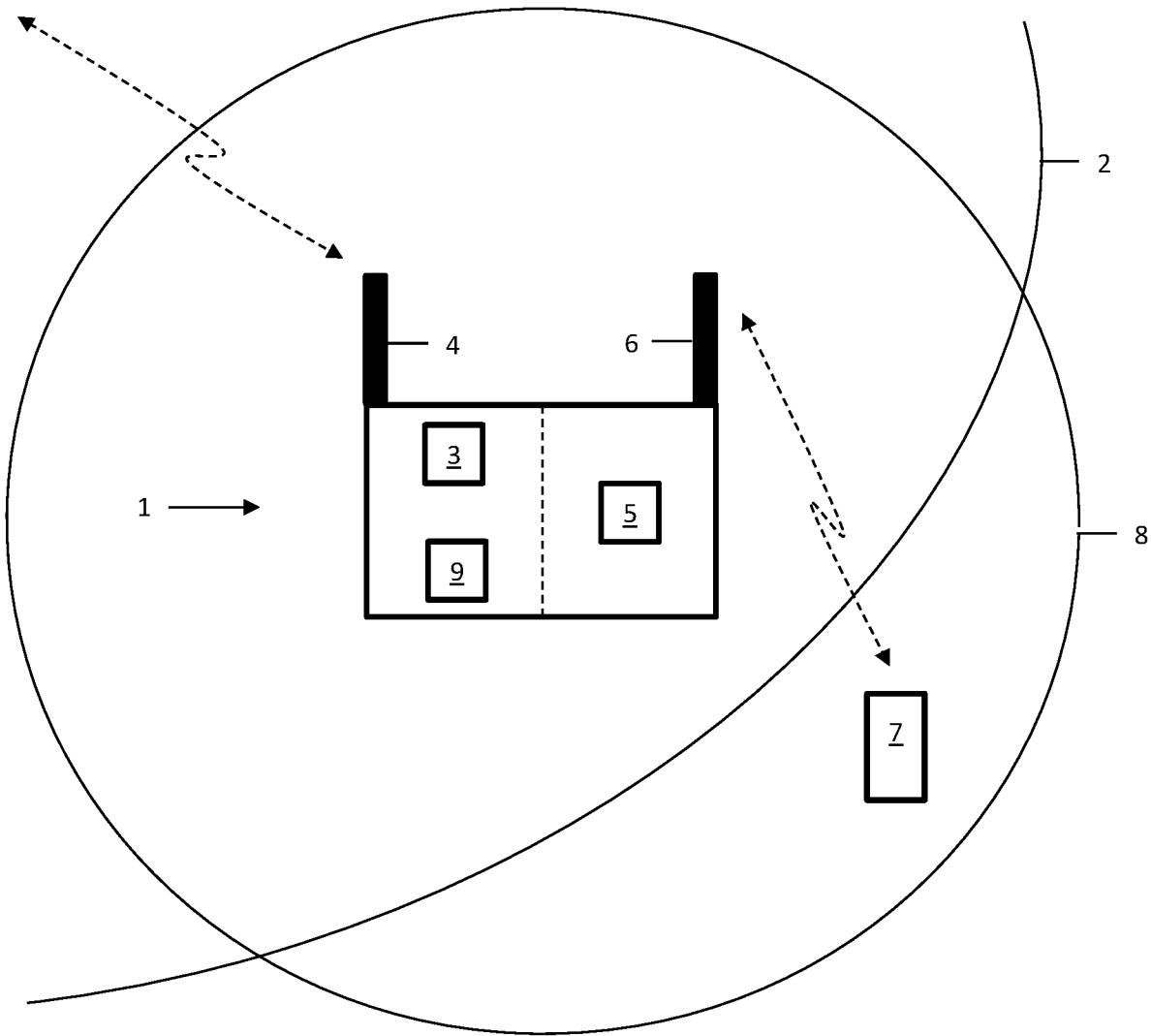


FIG.1

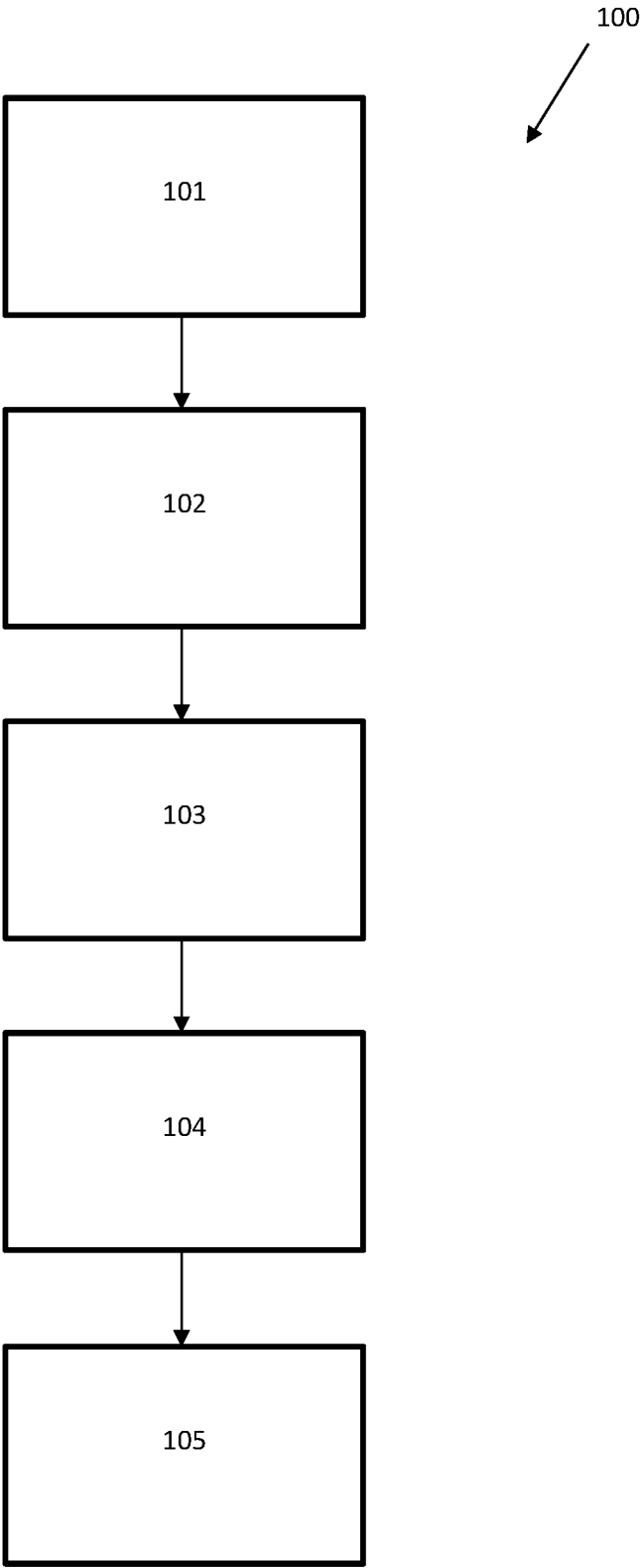


FIG.2

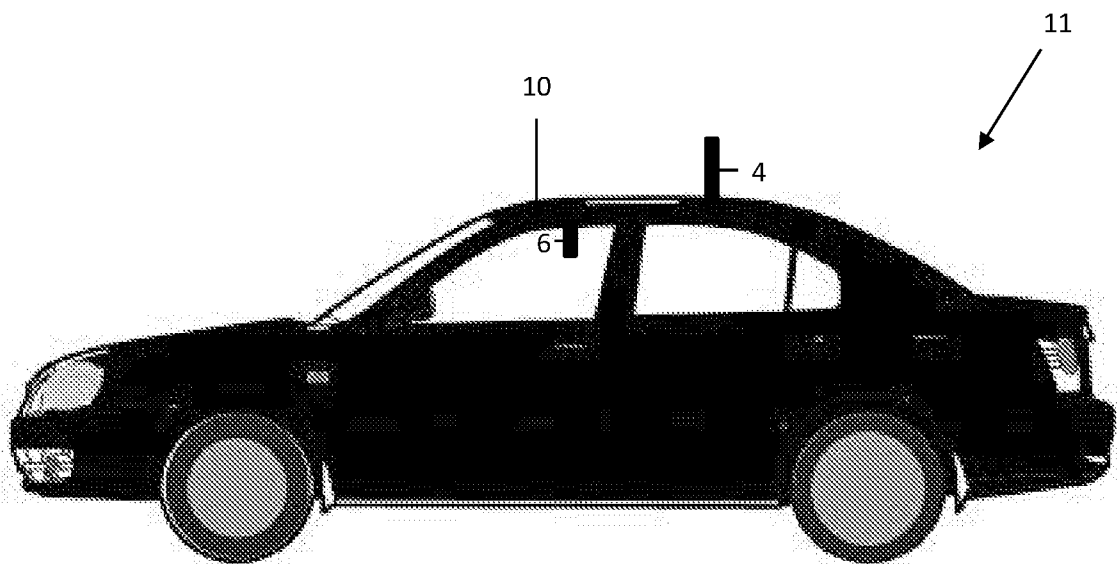


FIG.3

INTERNATIONAL SEARCH REPORT

International application No.

PCT/DK2016/050031

A. CLASSIFICATION OF SUBJECT MATTER H04W 84/00 (2009.01) , H04W 88/06 (2009.01) , H04W 36/16 (2009.01) 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) IPC & CPC: H04W		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched DK, NO, SE, FI: Classes as above.		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) EPODOC, WPI, FULL TEXT: ENGLISH		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2014/0066046 A1 (KESHAVDAS et al.) 2014.03.06, see paragraphs [0014] – [0016], [0020] – [0023], [0039], [0044], [0075], [0078] – [0082]	1 – 19
X	US 2006/0286984 A1 (BONNER) 2006.12.21, see paragraphs [0006] – [0017], [0044] – [0056], [0084] – [0105]	1, 17
X	US 2013/0171937 A1 (OKSANEN et al.) 2013.07.04	1, 17
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<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.		
<p>* Special categories of cited documents:</p> <p>“A” document defining the general state of the art which is not considered to be of particular relevance</p> <p>“E” earlier application or patent but published on or after the international filing date</p> <p>“L” document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>“O” document referring to an oral disclosure, use, exhibition or other means</p> <p>“P” document published prior to the international filing date but later than the priority date claimed</p> <p>“T” later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>“X” document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone</p> <p>“Y” document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</p> <p>“&” document member of the same patent family</p>		
Date of the actual completion of the international search	Date of mailing of the international search report	
16/04/2016	28/04/2016	
Name and mailing address of the ISA Nordic Patent Institute Helgeshøj Allé 81 DK - 2630 Taastrup, Denmark. Facsimile No. + 45 43 50 80 08	Authorized officer Pierre Grønbæk Telephone No. +45 43 50 81 91	

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