



(51) International Patent Classification:

H04W 84/18 (2009.01) *H04W 28/06* (2009.01)
H04W 4/20 (2009.01) *H04W 52/02* (2009.01)

(21) International Application Number:

PCT/IB2012/056921

(22) International Filing Date:

3 December 2012 (03.12.2012)

(25) Filing Language:

English

(26) Publication Language:

English

(71) Applicant: **NOKIA CORPORATION** [FI/FI]; Keilalahdentie 4, FIN-02150 Espoo (FI).

(72) Inventor: **KERAI, Kanji**; 1 Boycroft Avenue, Kingsbury, London NW9 8AH (GB).

(74) Agent: **KHAN, Mohammed Saiful Azam**; The Belgrave Centre, Talbot Street, Nottingham Nottinghamshire NG1 5GG (GB).

(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, IS, JP, KE, KG, KM, 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, 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.

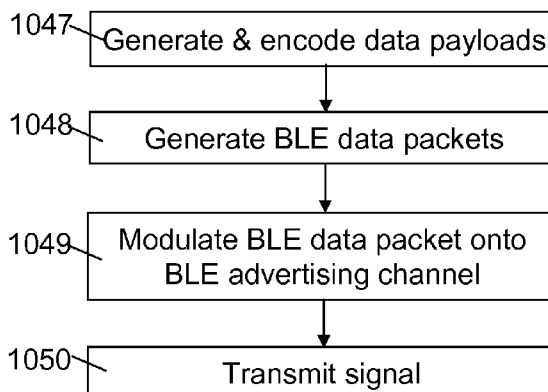
(84) Designated States (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, 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, ML, MR, NE, SN, TD, TG).

Published:

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

(54) Title: METHOD AND APPARATUS FOR TRANSMISSION OF A PARTIAL PORTION OF A DATA ITEM ON ONE OR MORE BLUETOOTH ADVERTISING CHANNELS

Figure 10



(57) Abstract: Method and apparatus for generating a data payload for transmission using one or more Bluetooth low energy channels. The data payload comprises a partial portion of a complete data item, and the complete data item comprises user appropriate data associated with a service or product.



Method and apparatus for transmission of a partial portion of a data item on one or more Bluetooth advertising channels.

Technical Field

5 The present disclosure relates to the field of Bluetooth™ Low Energy (BLE) Technology, associated methods and apparatus, and in particular concerns a data packet for transmission using a BLE advertising channel comprising a partial portion of a complete data item. Certain disclosed example aspects/embodiments relate to portable electronic devices, in particular, so-called hand-portable electronic devices which may be hand-
10 held in use (although they may be placed in a cradle in use). Such hand-portable electronic devices include so-called Personal Digital Assistants (PDAs) and tablet PCs.

The portable electronic devices/apparatus according to one or more disclosed example aspects/embodiments may provide one or more audio/text/video communication
15 functions (e.g. tele-communication, video-communication, and/or text transmission, Short Message Service (SMS)/ Multimedia Message Service (MMS)/emailing functions, interactive/non-interactive viewing functions (e.g. web-browsing, navigation, TV/program viewing functions), music recording/playing functions (e.g. MP3 or other format and/or (FM/AM) radio broadcast recording/playing), downloading/sending of data functions,
20 image capture function (e.g. using a (e.g. in-built) digital camera), and gaming functions.

Background

Communications channels are often established between devices to transfer data from
25 one electronic device to another. This may be achieved using a variety of different technologies. Whilst physical cables were traditionally used to link devices together, wireless connections are becoming increasingly common. Bluetooth™ is one such technology.

30 The listing or discussion of a prior-published document or any background in this specification should not necessarily be taken as an acknowledgement that the document or background is part of the state of the art or is common general knowledge. One or more aspects/embodiments of the present disclosure may or may not address one or more of the background issues.

35

Summary

According to a first aspect, there is provided an apparatus, the apparatus comprising:

at least one processor; and

at least one memory including computer program code,

5 the at least one memory and the computer program code configured to, with the at least one processor, cause the apparatus to perform at least the following:

generate a data payload for transmission using one or more Bluetooth™ low energy advertising channels, the data payload comprising a partial portion of a complete data item, the complete data item comprising user appropriate data associated with a service or product.

User appropriate data may comprise textual characters or strings, audio and/or image data. A textual character may comprise a combination of one or more of a word, a letter character (e.g. from the Roman, Greek, Arabic or Cyrillic alphabets), a graphic character
15 (e.g. a sinograph, Japanese kana or Korean delineation), a phrase, a syllable, a diacritical mark, an emoticon, and a punctuation mark. User appropriate data may be considered to be data which can be understood by the user.

The apparatus may be configured to generate a plurality of said data payloads comprising respective partial portions of the complete data item, the plurality of data
20 payloads being configured for transmission in a series of bursts of the one or more Bluetooth™ low energy advertising channels.

The apparatus may be configured to generate a plurality of data packets, each comprising the data payload of partial portions of the complete data item, each data
25 packet for transmission in a series of bursts of the one or more particular Bluetooth™ low energy advertising channels.

The series of bursts may be in the same Bluetooth™ low energy advertising channel or
30 across at least two different Bluetooth™ low energy advertising channels.

The apparatus may be configured to generate the data payload by splitting a complete data item into a plurality of partial data portions and using one or more of the partial portions as the data payload for transmission using the one or more low energy
35 Bluetooth™ low energy channels.

The apparatus may be configured to generate the data payload by splitting a complete data item into a plurality of partial data portions and using the respective partial portions as the respective data payload in a series of Bluetooth™ low energy channel transmission bursts.

5

The apparatus may be configured to modulate (e.g. using a modulator or modem) the data payload onto the one or more Bluetooth™ low energy advertising channels to generate a transmission signal for the data payload.

- 10 The apparatus may comprise at least one of a transmitter and modulator configured to transmit a series of bursts over one or more Bluetooth™ low energy channels, each burst comprising the data payload of a partial portion of the complete data item.

The apparatus may be configured to include a sequence order number for the partial
15 portion in the data payload, the sequence order number indicating the position of the partial portion in the complete data item.

The apparatus may be configured to include a total portion number in the data payload,
the total portion number indicating the total number of partial portions making up the
20 complete data item.

The apparatus may comprise at least one of a transmitter and modulator configured to enable transmission of the data payload to a remote apparatus.

- 25 The apparatus may be configured to autonomously control the transmission of the copies of the data payload without reference to receipt of the transmitted data payload.

The apparatus may be configured to generate data payload for repeated transmission using the Bluetooth™ low energy advertising channels.

30

The apparatus may be configured to generate a data packet comprising the data payload, the data packet including one or more of Bluetooth™ discovery information, Bluetooth™ connection establishment information and Bluetooth™ synchronization data.

- 35 The apparatus may be configured to modulate the Bluetooth™ Low Energy data packet onto a Bluetooth™ Low Energy channel to generate a transmission signal.

According to a further aspect, there is provided a Bluetooth™ low energy signal comprising a data payload, the data payload comprising a partial portion of a complete data item, the complete data item comprising user appropriate data associated with a service or product.

5

The Bluetooth™ low energy signal may comprise a data payload generated by the above described apparatus.

According to a further aspect, there is provided a Bluetooth™ low energy data payload forming part of a signal, the data payload comprising a partial portion of a complete data item, the complete data item comprising user appropriate data associated with a service or product.

The Bluetooth™ low energy signal data payload forming part of a signal may be generated by the above described apparatus.

According to a further aspect, there is provided a method, the method comprising:
generating a data payload for transmission using one or more Bluetooth™ low energy advertising channels, the data payload comprising a partial portion of a complete data item, the complete data item comprising user appropriate data associated with a service or product.

According to a further aspect, there is provided a computer program comprising computer program code, the computer program code being configured to perform at least the following:

generate data payload for transmission using one or more Bluetooth™ low energy advertising channels, the data payload comprising a partial portion of a complete data item, the complete data item comprising user appropriate data associated with a service or product.

30

According to a further aspect, there is provided an apparatus, the apparatus comprising:

at least one processor; and

at least one memory including computer program code,

the at least one memory and the computer program code configured to, with the at least one processor, cause the apparatus to perform at least the following:

construct a complete data item using multiple data payloads received using one or more Bluetooth™ low energy advertising channels, the respective multiple data

payloads comprising respective partial portions of a complete data item, the complete data item comprising user appropriate data associated with a service or product.

The apparatus may be configured to construct the complete data item by:

- 5 decoding the multiple payloads received from one or more Bluetooth™ low energy advertising channels; and
 combining the respective decoded multiple payloads for output as user appropriate data corresponding to the complete data item.
- 10 The apparatus may be configured to construct the complete data item using multiple received data payloads, wherein at least one of the multiple received data payloads was generated using the apparatus configured to generate and/or transmit the data payload described above. For example, the apparatus may be configured to receive the multiple received data payloads in a series of bursts of one or more Bluetooth™ low energy
15 advertising channels. The multiple data payloads may be received from the same Bluetooth™ low energy advertising channel or across at least two different Bluetooth™ low energy advertising channels.

- At least one of the multiple received data payloads may comprise a data portion formed
20 by splitting the complete data item into a plurality of partial data portions. At least one of the multiple received data payloads may have been modulated onto one or more Bluetooth™ low energy advertising channels. At least one of the multiple received data payloads may include a sequence order number for the partial portion in the data payload, the sequence order number indicating the position of the partial portion in the
25 complete data item. At least one of the multiple received data payloads may include a total portion number in the data payload, the total portion number indicating the total number of partial portions making up the complete data item. At least one of the multiple received data payloads may form part of a data packet, the data packet including one or more of Bluetooth™ discovery information, Bluetooth™ connection establishment
30 information and Bluetooth™ synchronization data.

According to a further aspect, there is provided a method, the method comprising:

- constructing a complete data item using multiple data payloads received using one or more Bluetooth™ low energy advertising channels, the respective multiple data
35 payloads comprising respective partial portions of a complete data item, the complete data item comprising user appropriate data associated with a service or product.

According to a further aspect, there is provided a computer program comprising computer program code, the computer program code being configured to perform at least the following:

- 5 construct a complete data item using multiple data payloads received using one or more Bluetooth™ low energy advertising channels, the respective multiple data payloads comprising respective partial portions of a complete data item, the complete data item comprising user appropriate data associated with a service or product.

10 The method may comprise demodulating the data packet from a Bluetooth™ Low Energy channel.

According to a further aspect, there is provided a apparatus, the apparatus comprising:

- at least one processor; and
 at least one memory including computer program code,
15 the at least one memory and the computer program code configured to, with the at least one processor, cause the apparatus to perform at least the following:
 receive multiple generated data payloads, each data payload comprising a respective partial portion of a complete data item, the complete data item comprising user appropriate data associated with a service or product; and
20 generate multiple Bluetooth™ low energy advertising channel transmission signals for transmission in a series of bursts, each burst comprising the data payload of a respective partial portion of the complete data item.

According to a further aspect, there is provided a method, the method comprising:

- 25 receiving multiple generated data payloads, each data payload comprising a respective partial portion of a complete data item, the complete data item comprising user appropriate data associated with a service or product; and
 generating multiple Bluetooth™ low energy advertising channel transmission signals for transmission in a series of bursts, each burst comprising a data payload of a
30 respective partial portion of the complete data item.

According to a further aspect, there is provided a computer program comprising computer program code, the computer program code being configured to perform at least the following:

- 35 receive multiple generated data payloads, each data payload comprising a respective partial portion of a complete data item, the complete data item comprising user appropriate data associated with a service or product; and

generate multiple Bluetooth™ low energy advertising channel transmission signals for transmission in a series of bursts, each burst comprising the data payload of a respective partial portion of the complete data item.

- 5 The apparatus may be a portable electronic device, a laptop computer, a mobile phone, a Smartphone, a tablet computer, a personal digital assistant, a digital camera, a watch, a server, a non-portable electronic device, a desktop computer, a monitor, a server, a wand, a pointing stick, a touchpad, a touch-screen, a mouse, a joystick or a module/circuitry for one or more of the same.

10

The steps of any method disclosed herein do not have to be performed in the exact order disclosed, unless explicitly stated or understood by the skilled person.

15

Corresponding computer programs (which may or may not be recorded on a carrier, such as a CD or other non-transitory medium) for implementing one or more of the methods disclosed herein are also within the present disclosure and encompassed by one or more of the described example embodiments.

20

The present disclosure includes one or more corresponding aspects, embodiments or features in isolation or in various combinations whether or not specifically stated (including claimed) in that combination or in isolation. Corresponding means and corresponding function units (e.g. a generator, a constructor) for performing one or more of the discussed functions are also within the present disclosure.

25

The above summary is intended to be merely exemplary and non-limiting.

Brief Description of the Figures

30

A description is now given, by way of example only, with reference to the accompanying drawings, in which:-

35

Figure 1 depicts an example apparatus embodiment according to the present disclosure comprising a number of electronic components, including memory and a processor;
Figure 2 depicts an example apparatus embodiment according to the present disclosure comprising a number of electronic components, including memory, a processor and a communication unit;

Figure 3 depicts an example apparatus embodiment according to the present disclosure comprising a number of electronic components, including memory, a processor and a communication unit;

Figures 4a-4b illustrate an example apparatus according to the present disclosure in communication with a remote server/cloud;

Figure 5 shows the periodic transmission of BLE advertising channel packets by an advertising device according to the present disclosure;

Figure 6 depicts an example embodiment of an advertising device according to the present disclosure;

Figure 7 shows the basic structure of a BLE advertising channel packet according to the present disclosure;

Figure 8 depicts a the signal transmitted by the advertising device and the duration of scanning by the scanning device according to the present disclosure;

Figure 9 depicts an example embodiment of an scanning device according to the present disclosure; and

Figure 10 shows the main steps of a method of transmitting a BLE advertising channel signal;

Figure 11 shows the main steps of a method of receiving a BLE advertising channel signal; and

Figure 12 a computer-readable medium comprising a computer program.

Description of Specific Aspects/Embodiments

Bluetooth™ was originally conceived with the aim of reducing the physical overhead of cabled connections and facilitating the ad-hoc connection of mobile battery-operated devices whose owners could not reasonably be expected to carry multiple cables and connectors about with them. It has since gained wide acceptance, particularly with users of mobile phones where elimination of physical cabling has spawned an industry devoted to the manufacture of associated peripherals. For mobile phone users, Bluetooth™ has also alleviated the burden of phone-to-phone and phone-to-computer file transfer.

Despite the above-mentioned benefits, Bluetooth™ has been found to be unsuitable for prolonged use with some battery-powered devices due to its associated power consumption. Bluetooth™ (BLE) has recently been developed to enable wireless connectivity with such energy-constrained devices but the amount of data which can be transmitted is limited.

BLE is a key feature of the Bluetooth™ 4.0 specification aimed at low-power applications for wireless devices within a range of between about 50m and about 100m. This facilitates a wide range of applications and smaller form factor devices in the healthcare, fitness, security and home entertainment industries.

5

BLE is fundamentally different from Classic Bluetooth™ in that it is configured for short data bursts instead of periodic data streaming. In order to reduce power consumption, a BLE device remains in sleep mode until a communication event is triggered. BLE operates in the same 2.4GHz ISM band as Classic Bluetooth™ but uses a different set of channels. In contrast to Classic Bluetooth™ which uses 79 channels with 1MHz spacing, BLE uses 40 channels (37 data channels and 3 advertising channels) with 2MHz spacing. BLE also uses adaptive frequency hopping (AFH) to achieve a robust transmission in noisy RF environments, but in contrast to Classic Bluetooth™, remains on each channel for a longer period of time and has more relaxed timing requirements.

15

A BLE device may operate in advertising, scanning or initiating modes depending on the required functionality. In advertising mode, the device periodically transmits advertising information (within one or more advertising channel packets) via one of the three advertising channels (37, 38 or 39) with a predefined interval between consecutive packets. In scanning mode, the device listens to an advertising channel for advertising information being transmitted by another device. In initiating mode, the device sends a connection request to another device to establish a dedicated BLE connection with the other device.

25

A BLE advertising packet making up a burst generally comprises a 1 byte Preamble, a 4 byte Access Address correlated with the channel number used, a Protocol Data Unit (PDU) of 2-39 bytes, and 3 bytes of Cyclic Redundancy Check (CRC) data. The shortest and longest BLE data packets are therefore 80 and 376 bits, respectively (see figure 7). The Preamble indicates the start of the packet, the Access Address indicates the type of packet and the CRC data enables the Payload data to be checked for transmission errors.

The PDU of an advertising channel packet generally comprises a 2 byte Header and up to 31 bytes of discovery information, connection establishment information synchronisation data and/or other data (Payload). The Header indicates the configuration of the Payload. The Payload contains the content data and any associated control information.

35

Because the payload is limited to 31 bytes, the amount of data that can be transmitted using BLE advertising channel packets is quite limited. Generally, if more data is to be transmitted, the scanning device initiates a dedicated connection with the advertising device via the Bluetooth™ data channels using the discovery, connection establishment and synchronisation data stored in the payload. The additional data is then transmitted using this dedicated data channel. Establishing a dedicated data channel may require additional energy (which may limit battery life) and requires information to be transmitted from the scanning device to the advertising device. The apparatus and methods disclosed herein may or may not address this issue.

The present disclosure relates to enabling the advertising channels of BLE to transmit larger data items by generating payload data for transmission, the payload data comprising a partial portion of a complete data item.

Other embodiments depicted in the figures have been provided with reference numerals that correspond to similar features of earlier described embodiments. For example, feature number 1 can also correspond to numbers 101, 201, 301 etc. These numbered features may appear in the figures but may not have been directly referred to within the description of these particular embodiments. These have still been provided in the figures to aid understanding of the further embodiments, particularly in relation to the features of similar earlier described embodiments.

Figure 1 shows an apparatus 101 comprising memory 145, a processor 144, input I and output O. In this embodiment only one processor and one memory are shown but it will be appreciated that other embodiments may utilise more than one processor and/or more than one memory (e.g. same or different processor/memory types). This apparatus may be used for generating payload data for transmission and/or constructing data items from received data payloads.

In this embodiment the apparatus 101 is an Application Specific Integrated Circuit (ASIC) for a portable electronic device. In other embodiments the apparatus 101 can be a module for such a device, or may be the device itself, wherein the processor 144 is a general purpose CPU of the device and the memory 145 is general purpose memory comprised by the device.

The input I allows for receipt of signalling to the apparatus 101 from further components (e.g. from a receiver), such as components of a portable electronic device (like a touch-sensitive display) or the like. The output O allows for onward provision of signalling from within the apparatus 101 to further components. In this embodiment the input I and
5 output O are part of a connection bus that allows for connection of the apparatus 101 to further components (e.g. to a transmitter or a display).

The processor 144 is a general purpose processor dedicated to executing/processing information received via the input I in accordance with instructions stored in the form of
10 computer program code on the memory 145. The output signalling generated by such operations from the processor 144 is provided onwards to further components via the output O.

The memory 145 (not necessarily a single memory unit) is a computer readable medium
15 (solid state memory in this example, but may be other types of memory such as a hard drive, ROM, RAM, Flash or the like) that stores computer program code. This computer program code stores instructions that are executable by the processor 144, when the program code is run on the processor 144. The internal connections between the memory 145 and the processor 144 can be understood to, in one or more example
20 embodiments, provide an active coupling between the processor 144 and the memory 145 to allow the processor 144 to access the computer program code stored on the memory 145.

In this example the input I, output O, processor 144 and memory 145 are all electrically
25 connected to one another internally to allow for electrical communication between the respective components I, O, 144, 145. In this example the components are all located proximate to one another so as to be formed together as an ASIC, in other words, so as to be integrated together as a single chip/circuit that can be installed into an electronic device. In other examples one or more or all of the components may be located
30 separately from one another.

Figure 2 depicts an apparatus 201 of a further example embodiment, such as a mobile phone. In other example embodiments, the apparatus 201 may comprise a module for a mobile phone (or PDA or audio/video player), and may just comprise a suitably
35 configured memory 245 and processor 244. The apparatus in certain embodiments could be a portable electronic device, a laptop computer, a mobile phone, a Smartphone, a tablet computer, a personal digital assistant, a digital camera, a watch, a server, a non-

portable electronic device, a desktop computer, a monitor, a server, a wand, a pointing stick, a touchpad, a touch-screen, a mouse, a joystick or a module/circuitry for one or more of the same.

5 The example embodiment of figure 2, in this case, comprises a display device 204 such as, for example, a Liquid Crystal Display (LCD) or touch-screen user interface. The apparatus 201 of figure 2 is configured such that it may receive, include, and/or otherwise access data. For example, this example embodiment 201 comprises a communications unit 203, such as a receiver, transmitter, and/or transceiver, in
10 communication with an antenna 202 for connecting to a wireless network and/or a port (not shown) for accepting a physical connection to a network, such that data may be received via one or more types of networks. This example embodiment comprises a memory 245 that stores data, possibly after being received via antenna 202 or port or after being generated at the user interface 205. The processor 244 may receive data
15 from the user interface 205, from the memory 245, or from the communication unit 203. It will be appreciated that, in certain example embodiments, the display device 204 may incorporate the user interface 205. Regardless of the origin of the data, these data may be outputted to a user of apparatus 201 via the display device 204, and/or any other output devices provided with apparatus. The processor 244 may also store the data for
20 later use in the memory 245. The memory 245 may store computer program code and/or applications which may be used to instruct/enable the processor 244 to perform functions (e.g. read, write, delete, edit or process data).

Figure 3 depicts a further example embodiment of an electronic device 301, such as a
25 tablet personal computer, a portable electronic device, a portable telecommunications device, a server or a module for such a device, the device comprising the apparatus 101 of figure 1. The apparatus 101 can be provided as a module for device 301, or even as a processor/memory for the device 301 or a processor/memory for a module for such a device 301. The device 301 comprises a processor 344 and a storage medium 345,
30 which are connected (e.g. electrically and/or wirelessly) by a data bus 380. This data bus 380 can provide an active coupling between the processor 344 and the storage medium 345 to allow the processor 344 to access the computer program code. It will be appreciated that the components (e.g. memory, processor) of the device/apparatus may be linked via cloud computing architecture. For example, the storage device may be a
35 remote server accessed via the internet by the processor.

The apparatus 101 in figure 3 is connected (e.g. electrically and/or wirelessly) to an input/output interface 370 that receives the output from the apparatus 101 and transmits this to the device 301 via data bus 380. Interface 370 can be connected via the data bus 380 to a display 304 (touch-sensitive or otherwise) that provides information from the apparatus 101 to a user. Display 304 can be part of the device 301 or can be separate. The device 301 also comprises a processor 344 configured for general control of the apparatus 101 as well as the device 301 by providing signalling to, and receiving signalling from, other device components to manage their operation.

The storage medium 345 is configured to store computer code configured to perform, control or enable the operation of the apparatus 101. The storage medium 345 may be configured to store settings for the other device components. The processor 344 may access the storage medium 345 to retrieve the component settings in order to manage the operation of the other device components. The storage medium 345 may be a temporary storage medium such as a volatile random access memory. The storage medium 345 may also be a permanent storage medium such as a hard disk drive, a flash memory, a remote server (such as cloud storage) or a non-volatile random access memory. The storage medium 345 could be composed of different combinations of the same or different memory types.

Figure 4a shows that an example embodiment of an apparatus in communication with a remote server. Figure 4b shows that an example embodiment of an apparatus in communication with a "cloud" for cloud computing. In figures 4a and 4b, apparatus 401 (which may be apparatus 101, 201 or 301 is in communication with a display 404). Of course, the apparatus 401 and display 404 may form part of the same apparatus/device, although they may be separate as shown in the figures. The apparatus 401 is also in communication with a remote computing element. Such communication may be via a communications unit, for example. Figure 4a shows the remote computing element to be a remote server 495, with which the apparatus may be in wired or wireless communication (e.g. via the internet, Bluetooth, a USB connection, or any other suitable connection as known to one skilled in the art). In figure 4b, the apparatus 401 is in communication with a remote cloud 496 (which may, for example, be the Internet, or a system of remote computers configured for cloud computing). It may be that the functions associated with the user interface elements are stored at the remote computing element 495, 496) and accessed by the apparatus 401 for display 404. The generating and/or constructing may be performed at the remote computing element 495, 496. The apparatus 401 may actually form part of the remote sever 495 or remote cloud 496. In

such embodiments, enablement of the provision of feedback may be conducted by the server or in conjunction with use of the server.

In order to allow for data transmission between two devices via an advertising channel, one device (the advertising device) must be in advertising mode and the other device (the scanning device) must be in scanning mode. This is illustrated in Figure 5. As mentioned above, the advertising device 501 transmits advertising channel packets 502 (Figure 5a). In this example, the scanning/initiating device 503 is within range of these transmitted advertising channel packets 502. The scanning/initiating device 503 scans for a desirable advertising channel packet 502. It will be appreciated that the advertising device may (or may not) transmit the advertising channel packets periodically (e.g. there may be regular or irregular time periods between successive bursts). It will be appreciated that the advertising device may transmit the advertising channel packets autonomously. That is, the advertising device may not require input from, for example, the scanning device to control the transmission. The advertising device may transmit the advertising channel packets repeatedly. This would allow a scanning device entering within the range of the transmitting device to receive the transmitted information regardless of when the scanning device entered the range.

Figure 6 shows an embodiment of an advertising device 601 comprising a BLE transmitter 638, a processor 644 and a storage medium 645, which are electrically connected to one another by a data bus 646. In certain embodiments, the device also includes a battery (not shown) or a connector for connecting to a power source.

The BLE transmitter 638 is configured to transmit BLE signals to the scanning device via one or more BLE advertising channels. The BLE transmitter 638 may or may not be configured to transmit Classic Bluetooth™ signals as well as the BLE signals (i.e. dual mode rather than single mode). In this case the processor is also configured to encode and modulate outgoing BLE signals (e.g. using a codec and modem).

30

The processor 644 is configured for general operation of the advertising device 601 by providing signalling to, and receiving signalling from, the other components to manage their operation. The storage medium 645 is configured to store computer code configured to perform, control or enable operation of the advertising device 601. The storage medium 645 may also be configured to store settings for the other components. The processor 644 may access the storage medium 645 to retrieve the component settings in order to manage the operation of the other components.

The storage medium 645 may be configured to store incoming payload data for later output. In this scenario, the storage may be permanent (e.g. stored as an text file) or temporary (e.g. streaming text). The processor 644 is also configured to generate BLE data packets comprising data payloads comprising a partial portion of a complete data item for transmission to the scanning device 603, and may or may not be configured to generate Classic Bluetooth™ data packets as well as the BLE data packets (i.e. dual mode rather than single mode).

In this example, the user is the proprietor of a café who wishes to advertise an offer to potential customers in the vicinity. In particular, he wishes to transmit the complete data item comprising the text "Buy a coffee, get a pastry free at 'Cafe Central'! Come and get it!". The complete data item, in this case, is 68 bytes when encoded using the ASCII system. This is too large to be contained within a single BLE advertising burst.

It will be appreciated that other text could make up the complete data item. For example, embodiments could be used, for example, to advertise product/service discounts, to provide train schedules, transmit event information to attendees (e.g. at a conference or exhibition) or to advertise upcoming films at a cinema. It will be appreciated that types of information other than text may also be transmitted (e.g. image data).

To transmit the data of the complete data item using the Bluetooth™ low energy advertising channels, the advertising device 601 is configured to generate data payloads for transmission using one or more Bluetooth™ low energy advertising channels, each payload data comprising a partial portion of a complete data item, the complete data item comprising user appropriate data associated with a service or product. In particular, the apparatus is configured to generate a plurality of successive partial portions of the complete data item, each partial portion for transmission in the payload data of successive bursts of one or more particular Bluetooth™ low energy advertising channels.

In this case, the apparatus is configured to generate the data payloads for transmission by splitting the complete data item into multiple data portions, wherein the size of each of the data portions is less than or equal to 31 bytes in size. In this case, the apparatus splits the complete data item into three partial portions: "Buy a coffee, get a pas" (23 bytes); "try free at 'Cafe Centr" (23 bytes) and "al! Come and get it!" (20 bytes). It will be appreciated that other splits are possible.

The apparatus in this case is also configured to encode each of the data payloads into a respective data packet for transmission using one or more Bluetooth™ low energy advertising channels.

- 5 Figures 7 show the structure of the created BLE advertising channel packets. Like conventional packets, the general structure of new BLE advertising packet comprises a 1 byte Preamble 708, a 4 byte Access Address 709 correlated with the channel number used, a Protocol Data Unit (PDU) 710 of 2-39 bytes, and 3 bytes of Cyclic Redundancy Check (CRC) data 711. The Preamble 708 indicates the start of the packet, the Access
10 Address 709 indicates the type of packet and the CRC data 711 enables the Payload data 713 to be checked for transmission errors.

- The PDU 710 of an advertising channel packet comprises a 2 byte Header 712 and up to 31 bytes for the data payload 713. The Header 712 indicates the configuration of the
15 Payload 713. The Payload 719 contains the content data and any associated control information. In this case, where the advertising channel is not necessarily being used to enable initiation of a dedicated data channel, the data payload data may or may not comprise connection establishment information.

- 20 As noted above, unlike existing BLE data packets, the advertising channel packets shown in Figure 7 comprises a partial portion of a complete data item within the data payload, the complete data item comprising user appropriate data associated with a service or product. This allows the data corresponding to a complete data item to be split over multiple data packets. This may allow larger data items to be transmitted using
25 the BLE advertising channels (e.g. without requiring a dedicated data communication channel).

- In this case, for each packet, the payload is configured to include a sequence order number for the partial portion, the sequence order number indicating the position of the
30 data partial portion in the complete data item. For example, the data packet comprising the payload “Buy a coffee, get a pas” would include the sequence order number 1; “try free at ‘Cafe Centr”, the sequence order number 2; and “al! come and get it!”, the sequence order number 3. The payload for each packet, in this embodiment, is also configured to include a total portion number to indicate the total number of partial
35 positions making up the complete data item. In this case, each packet will include the total number 3 (as there are three partial portions making up the complete data item). It will be appreciated that more or less numbers of partial portions may be created as

required/desired (e.g. a 250 byte data item could be split into 10 partial portions for transmission).

It will be appreciated that the order of the constituent data portions may be transmitted to the scanning device in different ways. For example, other embodiments may be configured to send a partial portion order payload comprising the first few (i.e. one or more) characters in each of the partial portions. For example, the partial portion order payload for the above example would comprise the text "Bu/tr/al" (the slashes delimiting the characters of each data portion). Using the partial portion order payload, the device could determine that three separate partial portions are required to make up the complete data item: the first beginning with the character string 'Bu'; the second beginning with the character string 'tr'; and the third beginning with the character string 'al'. Other embodiments may include overlapping characters at the beginnings and/or ends of subsequent partial portions (e.g. such that the last one or more characters of the first data payload are the same as the first one or more characters in the second data payload).

The apparatus is also configured to transmit the encoded data packets by modulating the data payload onto the one or more Bluetooth™ low energy advertising channels to generate a transmission signal for the data payload. In this case, the apparatus is configured to repeatedly, periodically transmit the packets in consecutive order. As the data packets contain information on the order and total number of packets, it will be appreciated that other embodiments may not transmit the packets in consecutive order. For example, the scanning device could simply scan until it had received a copy of each of the packets up to the total number of packets.

In this case, the data packets are transmitted using a broadcast transmission such that any scanning device within the range of the transmission would be able to receive the data. It will be appreciated that, in this example embodiment, the transmission is unidirectional in that the scanning device does not need to transmit information to the advertising device. In this case there are no security provisions, but it will be appreciated that in other cases security could be added (e.g. to limit the recipients to those registered to receive the service (e.g. with a username and password)).

It will be appreciated that in other embodiments, the same apparatus may not generate the data payload and transmit the data payload. For example, an embodiment may comprise a separate apparatus for generating each of the data payloads, and for transmitting the generated data payload. That is the transmitting apparatus may be

configured to receive the multiple generated data payloads (from one or more sources) and generate corresponding multiple Bluetooth™ low energy advertising channel transmission signals for transmission in a series of bursts, each burst comprising a data payload of a partial portion of the complete data item.

5

Figure 8 shows a signal 875 of several embodiments of the packets being transmitted, each packet forming a transmission burst. In this example, the device is configured to repeatedly transmit the three data packets consecutively in bursts. That is, the first packet is transmitted first, then the second packet, then the third packet, and then this order is repeated.

10

Figure 8 also shows the time period 876 in which a scanning device is active to download all of the packets required to construct the complete data item. The duration of the period in which the scanning device is actively scanning is predetermined in this case.

15

In other embodiments, the apparatus may be configured to determine the duration required from the total portion number encoded in a received payload and the separation between successive bursts. For example, if the advertising device was configured to transmit one burst per second, and the scanning device determined from the total portion number contained in the first received payload that there were three partial portions making up the complete data item, the scanning device would calculate that the scanning period should last for 2 seconds after the first received burst (i.e. $(\text{total portion number} - 1) \times \text{burst separation}$). In other embodiments, the apparatus may be configured to continue scanning until it has received copies of each of the packets up to the total number of packets.

25

Figure 9 shows a system comprising the scanning device/apparatus 903 according to one embodiment. The scanning device 903 in this case is a mobile phone. The scanning device 903 comprises a network receiver 928, a BLE receiver 929 (which may or may not be combined with the network receiver 928), a processor 935 and a storage medium 936, which are electrically connected to one another by a data bus 937. It will be appreciated that the receivers of the scanning device may also be configured to enable transmission of data (i.e. they may be transceivers).

30

The network transceiver 928 is configured to transmit telecommunication signals to, and receive telecommunication signals from, a remote device via a telecommunications network, whilst the BLE receiver 929 is configured to receive BLE signals from, the

35

advertising device 501 via one or more BLE advertising and/or data channels. The BLE receiver 929 may or may not be configured to transmit and receive Classic Bluetooth™ signals as well as the BLE signals (i.e. dual mode rather than single mode).

- 5 The processor 935 is configured for general operation of the scanning/initiating device 903 by providing signalling to, and receiving signalling from, the other components to manage their operation. The storage medium 936 is configured to store computer code configured to perform, control or enable operation of the scanning/initiating device 903. The storage medium 936 may also be configured to store settings for the other
10 components. The processor 935 may access the storage medium 936 to retrieve the component settings in order to manage the operation of the other components.

The storage medium 936 may be configured to store incoming data for later output. In this scenario, the storage may be permanent (e.g. stored as a text file) or temporary
15 (streaming text). The processor 935 is also configured to generate BLE data packets comprising payload data for transmission to the advertising device 901, and may or may not be configured to generate Classic Bluetooth™ data packets as well as the BLE data packets (i.e. dual mode rather than single mode).

- 20 The processor 935 may be a microprocessor, including an Application Specific Integrated Circuit (ASIC). The storage medium 936 may be a temporary storage medium such as a volatile random access memory. On the other hand, the storage medium 936 may be a permanent storage medium such as a hard disk drive, a flash memory, or a non-volatile random access memory.

25

In this case, when the apparatus/device has received and decoded the received signal, the apparatus/device is configured to construct the complete data item using the received multiple data payloads. In this case, the apparatus/device is configured to use the sequence order numbers contained in each payload to arrange the partial portions in
30 the correct order. It will be appreciated that the sequence order numbers may remove the requirement that the partial portions are received in order (as is the case in this example where the second partial portion was received first).

The apparatus is then configured to enable display of the constructed data item on the
35 display of the mobile phone electronic device such that the user can read the complete data item.

It will be appreciated that using BLE advertising channels to transmit information may lower power consumption and extend battery life. Use of the BLE data channels may not be required as data is provided in the payload of a BLE advertising channel.

- 5 In the above described embodiment, the advertising channels transmit the same content. It will be appreciated that different data packets may be transmitted on different advertising channels. For example, respective partial portions of a complete data item could be transmitted sequentially over different advertising channels 37, 38 and 39. Also different channels could be used by neighbouring retailers to advertise their wares.
- 10 Different advertising channels could be used for different products/services from the same retailer.

The main steps 1047-1050 of a method of using the above-mentioned system for transmitting a BLE advertising signal are illustrated schematically in Figure 10. The

15 advertising device generates and encodes 1047 the data payloads each comprising a partial portion of a complete data item, generates 1048 BLE data packets comprising the generated data payloads, modulates 1049 the BLE data packets onto BLE advertising channel channels to create a BLE signal, and transmits 1050 the BLE signal to the scanning device.

20

The main steps 11151-1054 of a method of using the above-mentioned system for transmitting a BLE advertising signal are illustrated schematically in Figure 11. The scanning device then receives 1151 the BLE signal (e.g. the signal having been transmitted using the method shown in figure 10), demodulates 1152 the BLE data

25 packets from the BLE advertising channels, decodes 1153 the data, and finally outputs 1054 the decoded data as user appropriate data corresponding to the complete data item.

Figure 12 illustrates schematically a computer/processor readable medium 1255

30 providing a computer program according to one embodiment. In this example, the computer/processor readable medium 1255 is a disc such as a digital versatile disc (DVD) or a compact disc (CD). In other embodiments, the computer/processor readable medium 1255 may be any medium that has been programmed in such a way as to carry out an inventive function. The computer/processor readable medium 1255 may be a

35 removable memory device such as a memory stick or memory card (SD, mini SD or micro SD).

The computer program may comprise computer code configured to perform, control or enable one or more of the method steps 1047-1054 of Figure 10. In this respect, the computer program may be stored on the storage medium of the scanning/initiating device, the storage medium of the advertising device or the storage media of both devices.

It will be appreciated to the skilled reader that any mentioned apparatus/device and/or other features of particular mentioned apparatus/device may be provided by apparatus arranged such that they become configured to carry out the desired operations only when enabled, e.g. switched on, or the like. In such cases, they may not necessarily have the appropriate software loaded into the active memory in the non-enabled (e.g. switched off state) and only load the appropriate software in the enabled (e.g. on state). The apparatus may comprise hardware circuitry and/or firmware. The apparatus may comprise software loaded onto memory. Such software/computer programs may be recorded on the same memory/processor/functional units and/or on one or more memories/processors/functional units.

In some embodiments, a particular mentioned apparatus/device may be pre-programmed with the appropriate software to carry out desired operations, and wherein the appropriate software can be enabled for use by a user downloading a “key”, for example, to unlock/enable the software and its associated functionality. Advantages associated with such embodiments can include a reduced requirement to download data when further functionality is required for a device, and this can be useful in examples where a device is perceived to have sufficient capacity to store such pre-programmed software for functionality that may not be enabled by a user.

It will be appreciated that any mentioned apparatus/circuitry/elements/processor may have other functions in addition to the mentioned functions, and that these functions may be performed by the same apparatus/circuitry/elements/processor. One or more disclosed aspects may encompass the electronic distribution of associated computer programs and computer programs (which may be source/transport encoded) recorded on an appropriate carrier (e.g. memory, signal).

It will be appreciated that any “computer” described herein can comprise a collection of one or more individual processors/processing elements that may or may not be located on the same circuit board, or the same region/position of a circuit board or even the same device. In some embodiments one or more of any mentioned processors may be

distributed over a plurality of devices. The same or different processor/processing elements may perform one or more functions described herein.

It will be appreciated that the term "signalling" may refer to one or more signals transmitted as a series of transmitted and/or received signals. The series of signals may comprise one, two, three, four or even more individual signal components or distinct signals to make up said signalling. Some or all of these individual signals may be transmitted/received simultaneously, in sequence, and/or such that they temporally overlap one another.

10

With reference to any discussion of any mentioned computer and/or processor and memory (e.g. including ROM, CD-ROM etc), these may comprise a computer processor, Application Specific Integrated Circuit (ASIC), field-programmable gate array (FPGA), and/or other hardware components that have been programmed in such a way to carry out the inventive function.

15

The applicant hereby discloses in isolation each individual feature described herein and any combination of two or more such features, to the extent that such features or combinations are capable of being carried out based on the present specification as a whole, in the light of the common general knowledge of a person skilled in the art, irrespective of whether such features or combinations of features solve any problems disclosed herein, and without limitation to the scope of the claims. The applicant indicates that the disclosed aspects/embodiments may consist of any such individual feature or combination of features. In view of the foregoing description it will be evident to a person skilled in the art that various modifications may be made within the scope of the disclosure.

20

25

While there have been shown and described and pointed out fundamental novel features as applied to different embodiments thereof, it will be understood that various omissions and substitutions and changes in the form and details of the devices and methods described may be made by those skilled in the art without departing from the spirit of the invention. For example, it is expressly intended that all combinations of those elements and/or method steps which perform substantially the same function in substantially the same way to achieve the same results are within the scope of the invention. Moreover, it should be recognized that structures and/or elements and/or method steps shown and/or described in connection with any disclosed form or embodiment may be incorporated in any other disclosed or described or suggested form or embodiment as a general matter

30

35

of design choice. Furthermore, in the claims means-plus-function clauses are intended to cover the structures described herein as performing the recited function and not only structural equivalents, but also equivalent structures. Thus although a nail and a screw may not be structural equivalents in that a nail employs a cylindrical surface to secure
5 wooden parts together, whereas a screw employs a helical surface, in the environment of fastening wooden parts, a nail and a screw may be equivalent structures.

CLAIMS

1. An apparatus, the apparatus comprising:
at least one processor; and
5 at least one memory including computer program code,
the at least one memory and the computer program code configured to, with the
at least one processor, cause the apparatus to perform at least the following:
generate a data payload for transmission using one or more Bluetooth™ low
energy advertising channels, the data payload comprising a partial portion of a complete
10 data item, the complete data item comprising user appropriate data associated with a
service or product.
2. The apparatus of claim 1, wherein the apparatus is configured to generate a
plurality of said data payloads comprising respective partial portions of the complete data
15 item, the plurality of data payloads being configured for transmission in a series of bursts
of the one or more Bluetooth™ low energy advertising channels.
3. The apparatus of claim 1, wherein the apparatus is configured to generate a
plurality of data packets, each comprising the data payload of partial portions of the
20 complete data item, each data packet for transmission in a series of bursts of the one or
more particular Bluetooth™ low energy advertising channels.
4. The apparatus of claim 2 or 3, wherein the series of bursts is in the same
Bluetooth™ low energy advertising channel or across at least two different Bluetooth™
25 low energy advertising channels.
5. The apparatus of claim 1, wherein the apparatus is configured to generate the
data payload by splitting a complete data item into a plurality of partial data portions and
using one or more of the partial portions as the data payload for transmission using the
30 one or more low energy Bluetooth™ low energy channels.
6. The apparatus of claim 1, wherein the apparatus is configured to generate the
data payload by splitting a complete data item into a plurality of partial data portions and
using the respective partial portions as the respective data payload in a series of
35 Bluetooth™ low energy channel transmission bursts.

7. The apparatus of claim 1, wherein the apparatus is configured to modulate the data payload onto the one or more Bluetooth™ low energy advertising channels to generate a transmission signal for the data payload.
- 5 8. The apparatus of claim 1, wherein the apparatus comprises at least one of a transmitter and modulator configured to transmit a series of bursts over one or more Bluetooth™ low energy channels, each burst comprising the data payload of a partial portion of the complete data item.
- 10 9. The apparatus of claim 1, wherein the apparatus is configured to include a sequence order number for the partial portion in the data payload, the sequence order number indicating the position of the partial portion in the complete data item.
10. The apparatus of claim 1, wherein the apparatus is configured to include a total
15 portion number in the data payload, the total portion number indicating the total number of partial portions making up the complete data item.
11. The apparatus of claim 1, wherein the apparatus comprises at least one of a transmitter and modulator configured to enable transmission of the data payload to a
20 remote apparatus.
12. The apparatus of claim 1, wherein the apparatus is configured to autonomously control the transmission of the copies of the data payload without reference to receipt of the transmitted data payload.
- 25 13. The apparatus of claim 1, wherein the apparatus is configured to generate the data payload for repeated transmission using the Bluetooth™ low energy advertising channels.
- 30 14. The apparatus of claim 1, wherein the apparatus is configured to generate a data packet comprising the data payload, the data packet including one or more of Bluetooth™ discovery information, Bluetooth™ connection establishment information and Bluetooth™ synchronization data.
- 35 15. The apparatus of claim 1, wherein the apparatus is configured to operate in a Bluetooth™ low energy advertising mode to allow for generation of the data payload.

16. A Bluetooth™ low energy signal comprising a data payload, the data payload comprising a partial portion of a complete data item, the complete data item comprising
5 user appropriate data associated with a service or product.

17. A Bluetooth™ low energy data payload forming part of a signal, the data payload comprising a partial portion of a complete data item, the complete data item comprising
10 user appropriate data associated with a service or product.

18. A method, the method comprising:
generating a data payload for transmission using one or more Bluetooth™ low
energy advertising channels, the data payload comprising a partial portion of a complete
data item, the complete data item comprising user appropriate data associated with a
15 service or product.

19. A computer program comprising computer program code, the computer program
code being configured to perform at least the following:
generate data payload for transmission using one or more Bluetooth™ low
20 energy advertising channels, the data payload comprising a partial portion of a complete
data item, the complete data item comprising user appropriate data associated with a
service or product.

20. An apparatus, the apparatus comprising:
25 at least one processor; and
at least one memory including computer program code,
the at least one memory and the computer program code configured to, with the
at least one processor, cause the apparatus to perform at least the following:
construct a complete data item using multiple data payloads received using one
30 or more Bluetooth™ low energy advertising channels, the respective multiple data
payloads comprising respective partial portions of a complete data item, the complete
data item comprising user appropriate data associated with a service or product.

21. An apparatus of claim 20, the apparatus configured to construct the complete
35 data item by:
decoding the multiple payloads received from one or more Bluetooth™ low
energy advertising channels; and

combining the respective decoded multiple payloads for output as user appropriate data corresponding to the complete data item.

22. The apparatus of claim 20, wherein the apparatus is configured to operate in a Bluetooth™ low energy scanning mode to allow for decoding and constructing the multiple data payloads.

23. The apparatus of claim 20, the apparatus being configured to construct the complete data item using the multiple received data payloads, wherein at least one of the multiple received data payloads was generated using the apparatus of any of claims 1-15.

24. A method, the method comprising:
constructing a complete data item using multiple data payloads received using one or more Bluetooth™ low energy advertising channels, the respective multiple data payloads comprising respective partial portions of a complete data item, the complete data item comprising user appropriate data associated with a service or product.

25. A computer program comprising computer program code, the computer program code being configured to perform at least the following:
construct a complete data item using multiple data payloads received using one or more Bluetooth™ low energy advertising channels, the respective multiple data payloads comprising a partial portion of a complete data item, the complete data item comprising user appropriate data associated with a service or product.

26. An apparatus, the apparatus comprising:
at least one processor; and
at least one memory including computer program code,
the at least one memory and the computer program code configured to, with the at least one processor, cause the apparatus to perform at least the following:
receive multiple generated data payloads, each data payload comprising a respective partial portion of a complete data item, the complete data item comprising user appropriate data associated with a service or product; and
generate multiple Bluetooth™ low energy advertising channel transmission signals for transmission in a series of bursts, each burst comprising the data payload of a respective partial portion of the complete data item.

27. A method, the method comprising:

receiving multiple generated data payloads, each data payload comprising a respective partial portion of a complete data item, the complete data item comprising user appropriate data associated with a service or product; and

5 generating multiple Bluetooth™ low energy advertising channel transmission signals for transmission in a series of bursts, each burst comprising the data payload of a respective partial portion of the complete data item.

28. A computer program comprising computer program code, the computer program code being configured to perform at least the following:

10 receive multiple generated data payloads, each data payload comprising a respective partial portion of a complete data item, the complete data item comprising user appropriate data associated with a service or product; and

generate multiple Bluetooth™ low energy advertising channel transmission signals for transmission in a series of bursts, each burst comprising the data payload of a
15 respective partial portion of the complete data item.

29. The apparatus of any preceding apparatus claim, wherein the apparatus is a portable electronic device, a laptop computer, a mobile phone, a Smartphone, a tablet computer, a personal digital assistant, a digital camera, a watch, a server, a non-portable
20 electronic device, a desktop computer, a monitor, a server, a wand, a pointing stick, a touchpad, a touch-screen, a mouse, a joystick or a module/circuitry for one or more of the same.

Figure 1

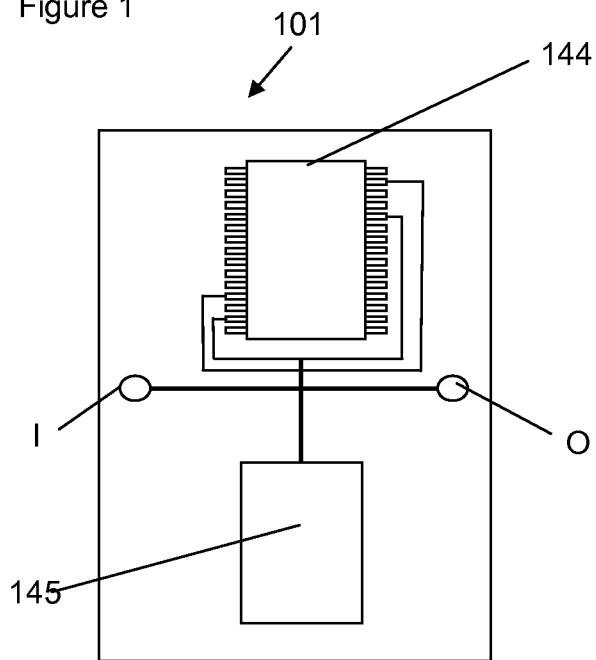


Figure 3

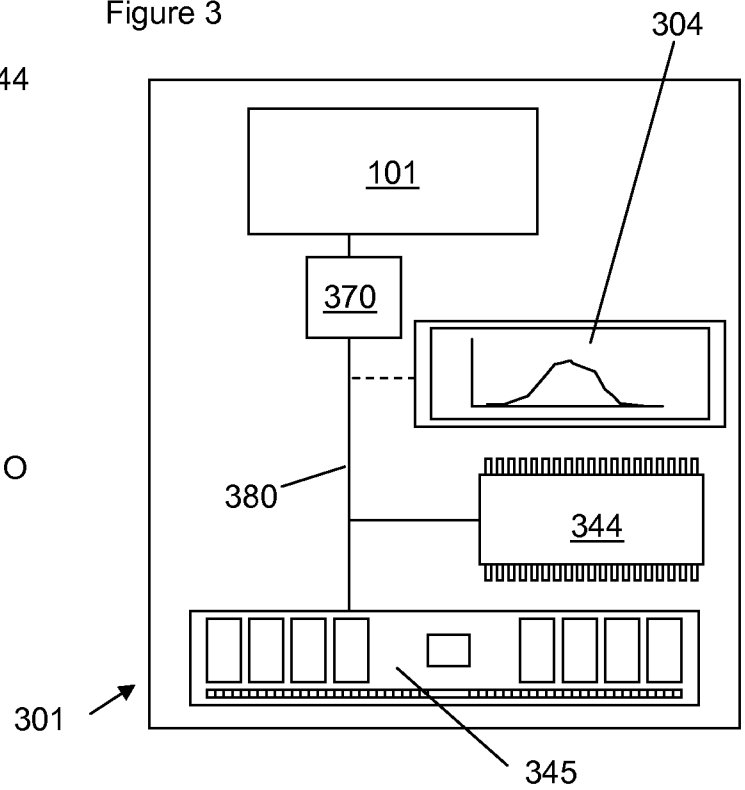


Figure 2

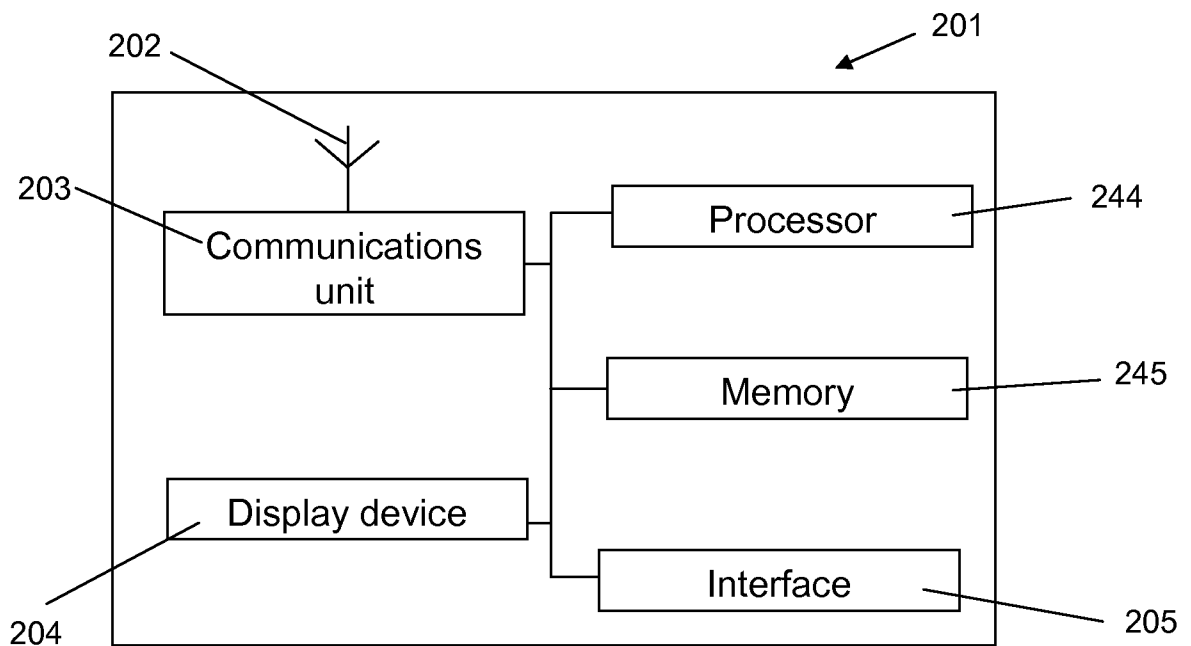


Figure 4a

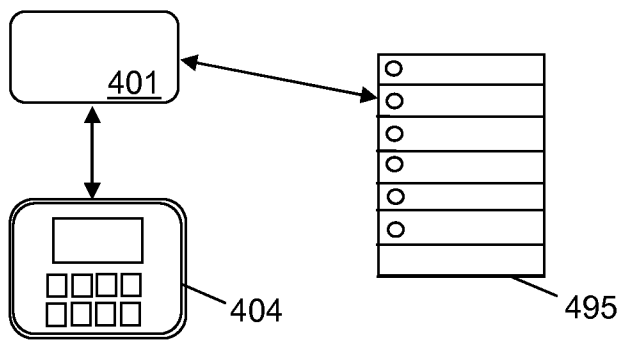


Figure 4b

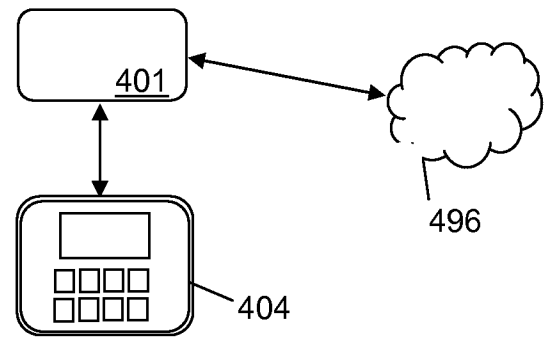


Figure 5

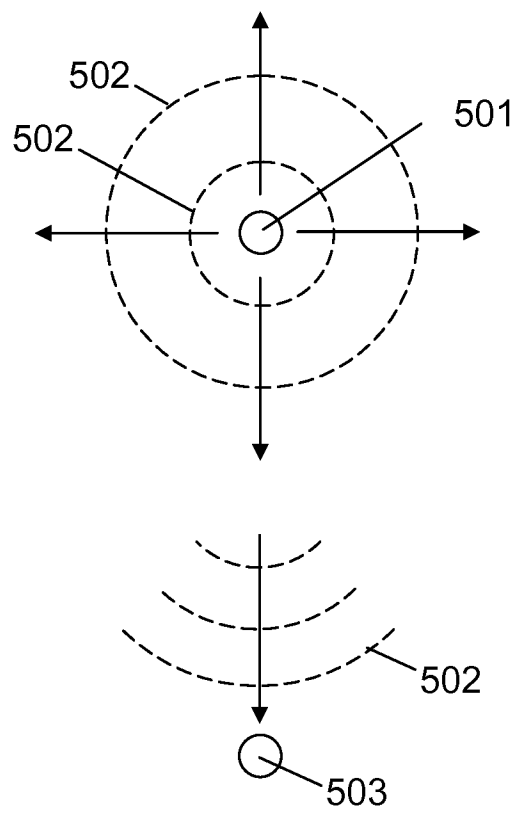


Figure 6

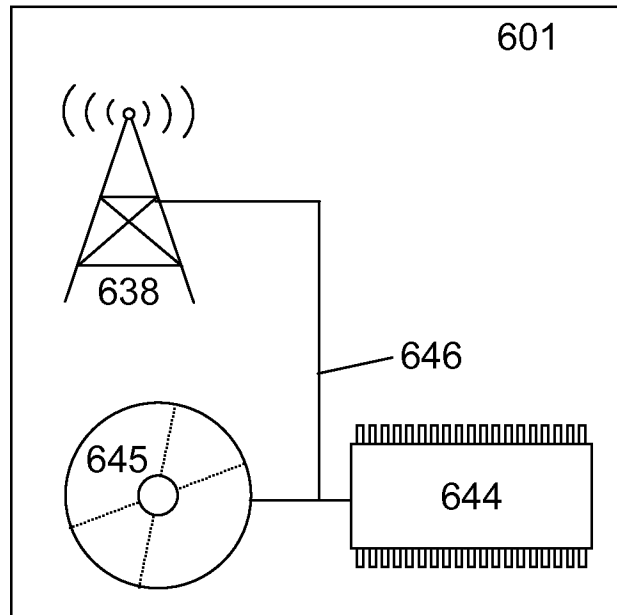


Figure 7

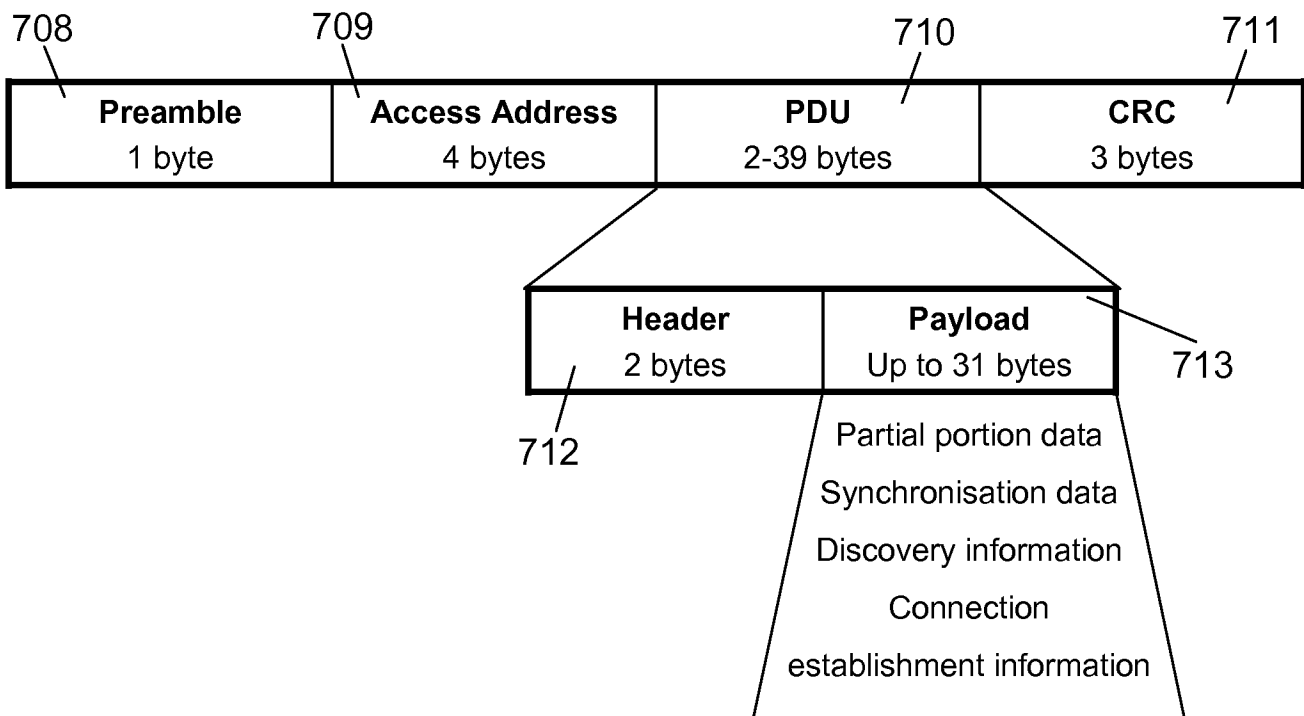


Figure 8

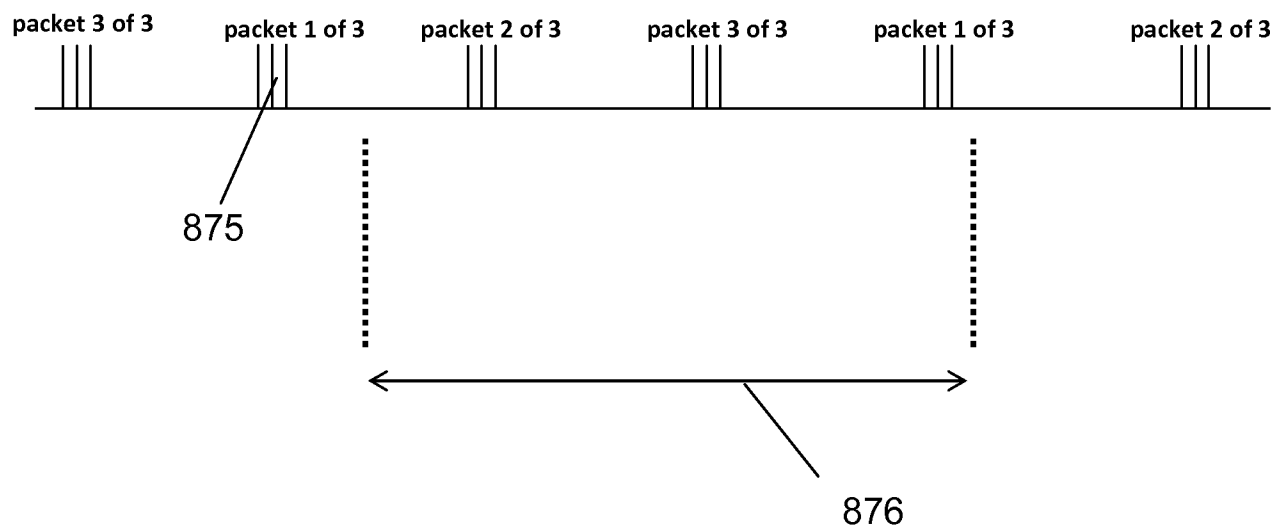


Figure 9

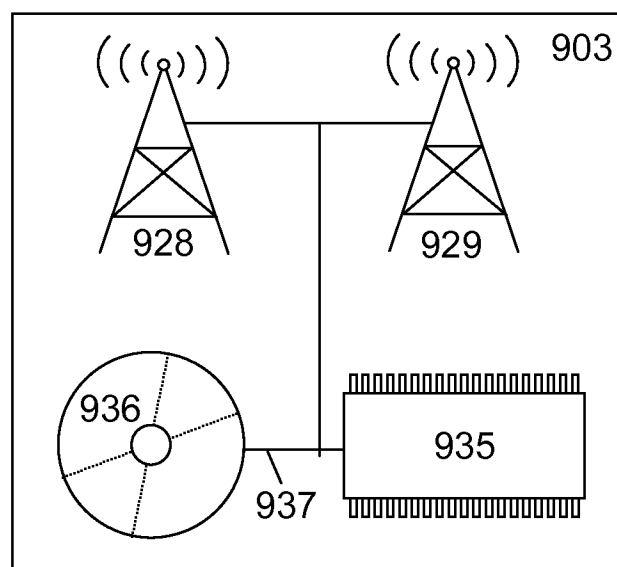


Figure 10

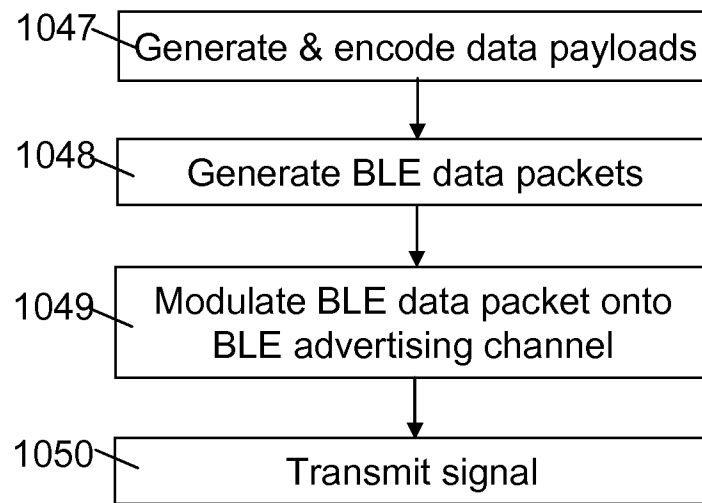


Figure 11

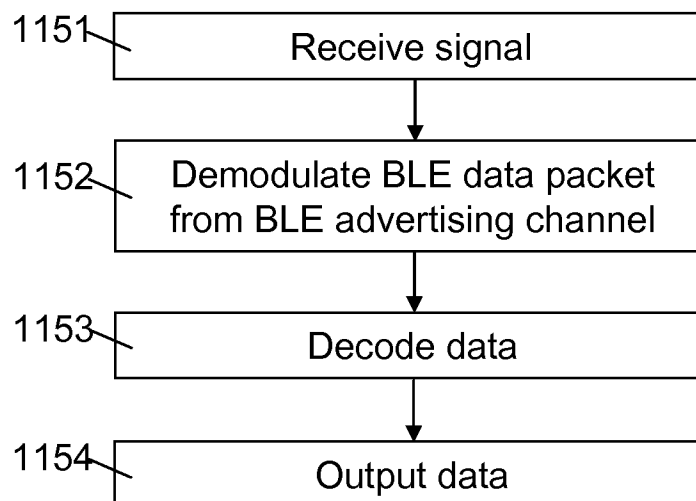
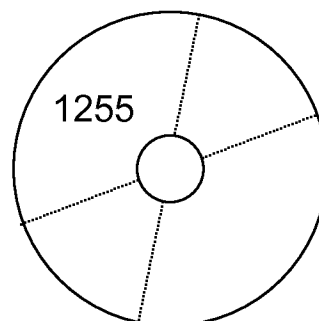


Figure 12



INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB2012/056921

A. CLASSIFICATION OF SUBJECT MATTER

IPC: see extra sheet

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: H04W

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

SE, DK, FI, NO classes as above

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

EPO-Internal, PAJ, WPI data, COMPENDEX, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 20110110229 A1 (HIMAYAT NAGEEN ET AL), 12 May 2011 (2011-05-12); abstract; paragraph [0017] --	16-17
X	US 20030091067 A1 (EMERSON DAVID ET AL), 15 May 2003 (2003-05-15); abstract; paragraph [0018] --	16-17
A	US 20120196534 A1 (KASSLIN MIKA ET AL), 2 August 2012 (2012-08-02); abstract -- -----	1-29



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

“A” document defining the general state of the art which is not considered to be of particular relevance

“E” earlier application or patent but published on or after the international filing date

“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)

“O” document referring to an oral disclosure, use, exhibition or other means

“P” document published prior to the international filing date but later than the priority date claimed

“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

“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

“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

“&” document member of the same patent family

Date of the actual completion of the international search

17-12-2013

Date of mailing of the international search report

17-12-2013

Name and mailing address of the ISA/SE

Patent- och registreringsverket
Box 5055
S-102 42 STOCKHOLM
Facsimile No. + 46 8 666 02 86

Authorized officer

Ralf Boström

Telephone No. + 46 8 782 25 00

Continuation of: second sheet

International Patent Classification (IPC)

H04W 84/18 (2009.01)

H04W 4/20 (2009.01)

H04W 28/06 (2009.01)

H04W 52/02 (2009.01)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/IB2012/056921

US	20110110229 A1	12/05/2011	CN	102137501 A	27/07/2011
			DE	102010050272 A1	09/06/2011
			GB	2475157 B	04/04/2012
			JP	2011155634 A	11/08/2011
US	20030091067 A1	15/05/2003	US	7414991 B2	19/08/2008
US	20120196534 A1	02/08/2012	NONE		