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(54) Abstract Title: **Wireless communications device attachable to an electric light socket**

(57) A wireless communication device such as a repeater or WLAN access point has a housing with means to engage with an electrical lighting fitting, the electrical lighting fitting otherwise being operable to retain an electrically powered illumination device such as a light bulb. The device has means to retain an electric light bulb such that both the device and electric light bulb can be powered from the mains lighting circuit. The device and bulb can be operated independently. The device may contain a number of transmitting and receiving antennas or elements alternately arranged in a circular array. The wireless device may be a radio or infra-red device and comprise part of a home entertainment network. Also disclosed is an apparatus for restoring signal to noise ration in the device comprising means to amplify, synchronise, decode, regenerate and re-encode signals for re-transmission.

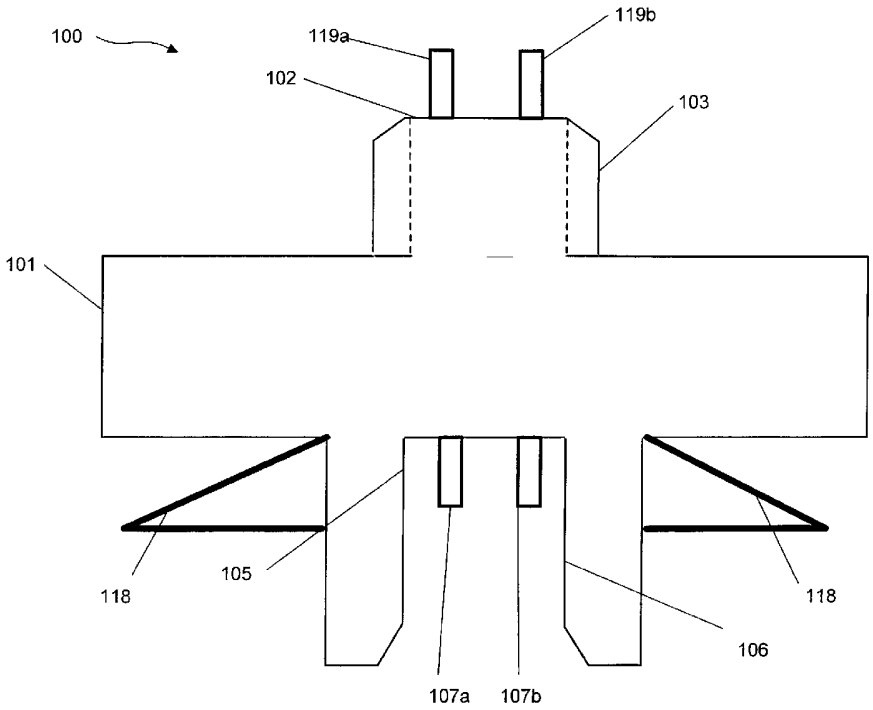

FIGURE 1

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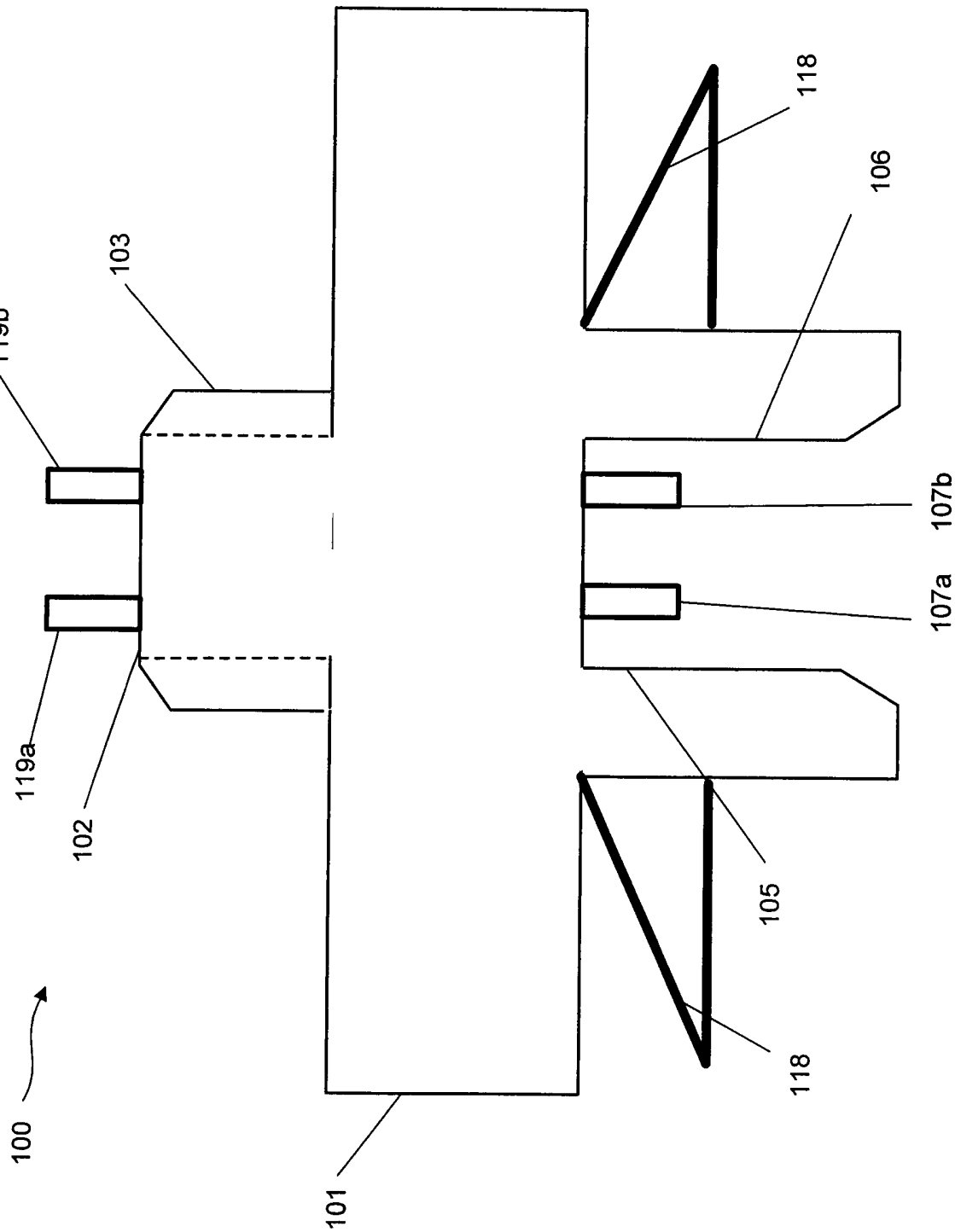


FIGURE 1

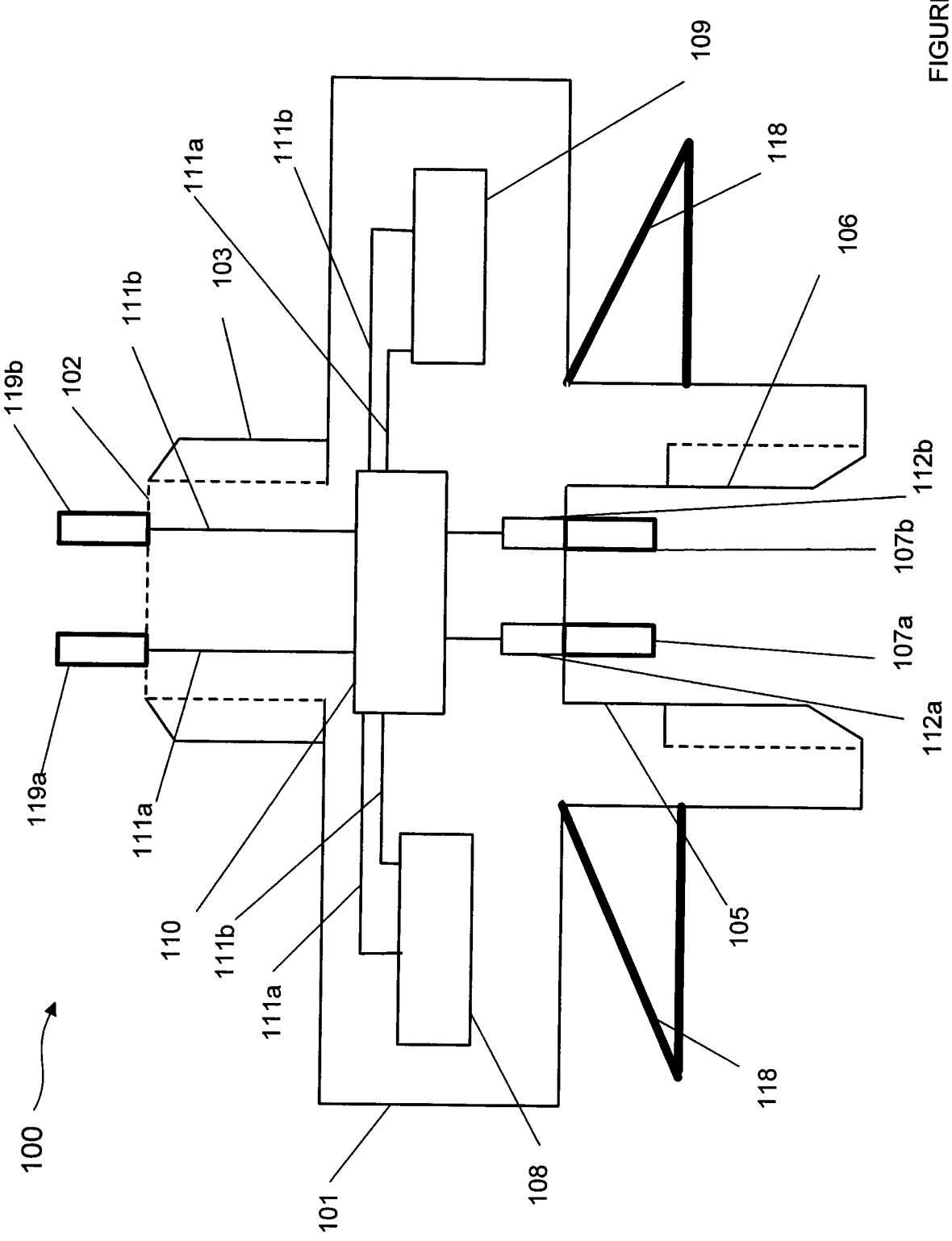

100
101
102
103
105
106
107a
107b
108
109
110
111a
111b
112a
112b
118
119a
119b

FIGURE 2

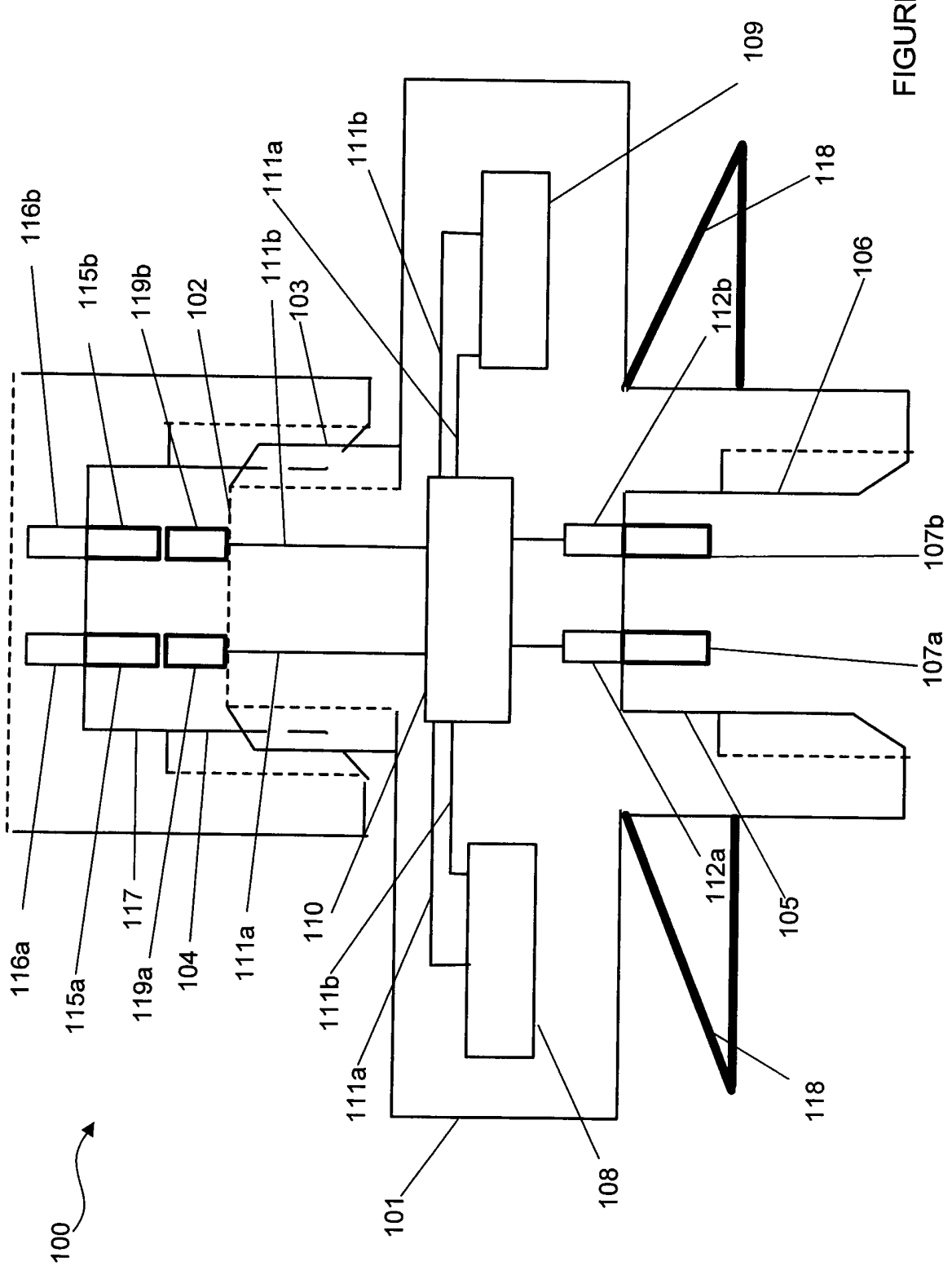

100
101
108
109
116b
115b
119b
102
111b
111a
103
111b
111a
118
112b
106
107b
107a
112a
105
118
116a
115a
119a
104
111a
117
110
111b
111a

FIGURE 3

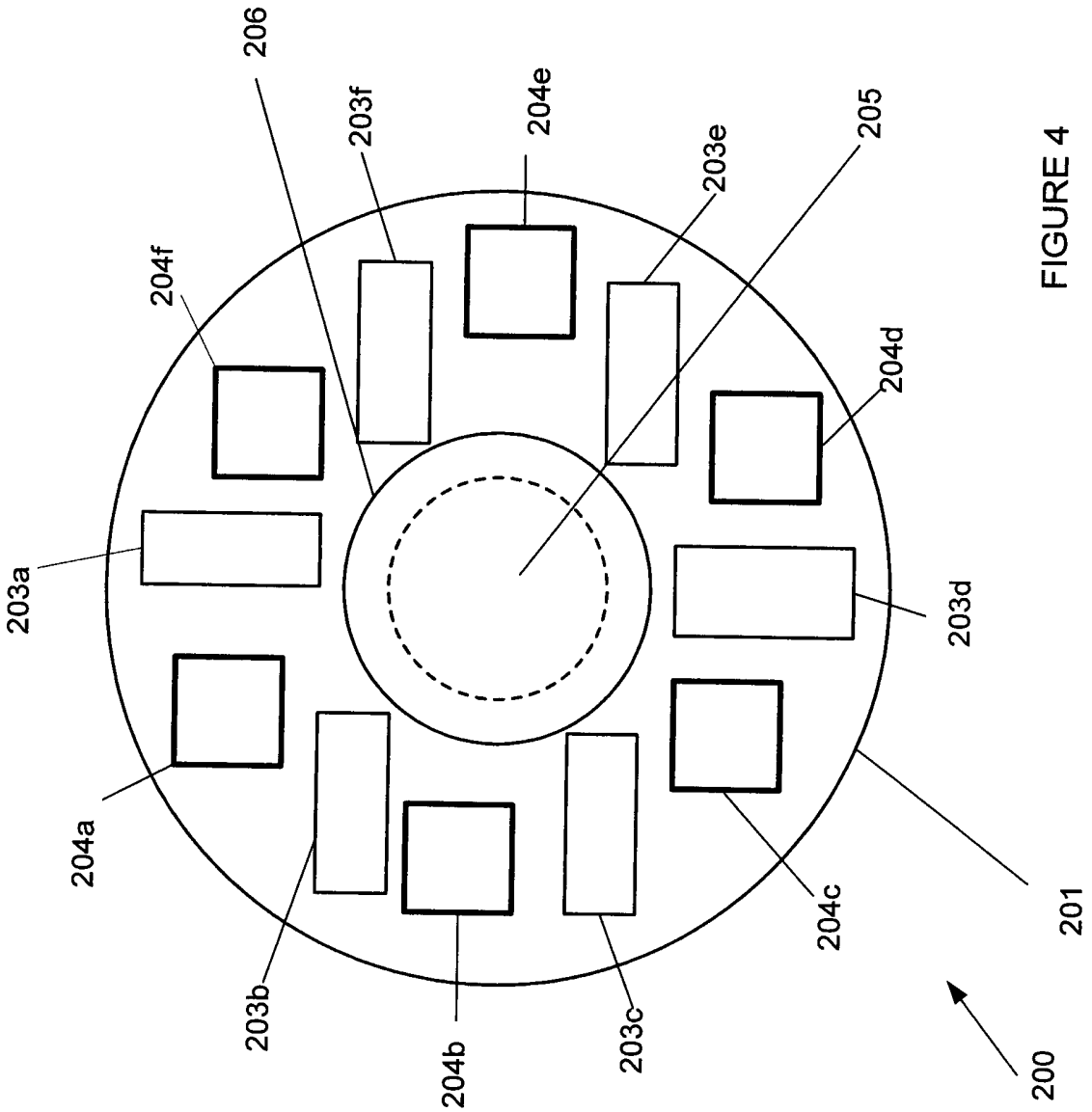
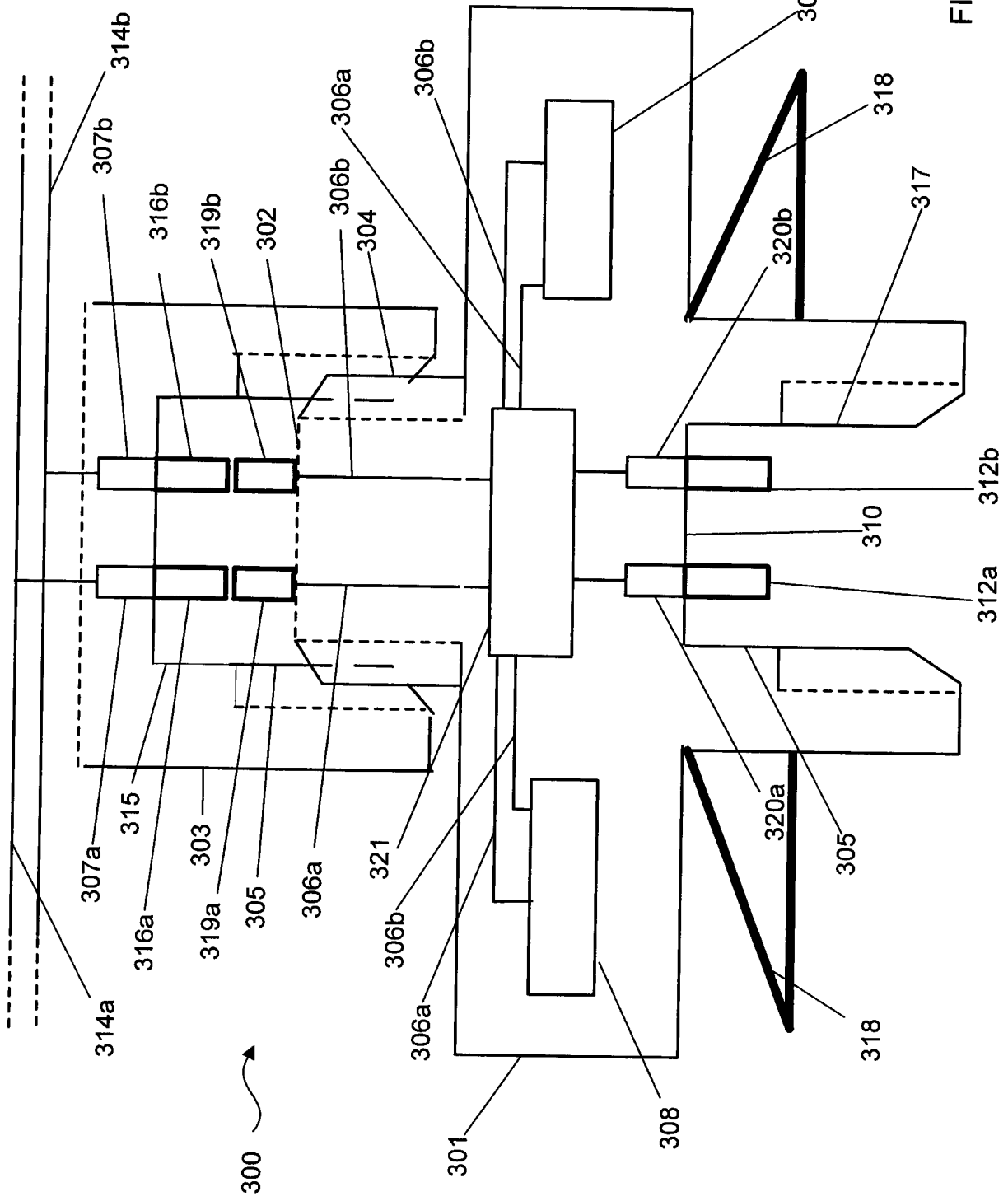

206
203f
204e
203e
205
204f
204d
203a
203d
204a
201
204c
203b
204b
203c
200

FIGURE 4


314b
307b
316b
319b
302
306b
304
306a
306b
309
318
317
320b
312b
310
312a
320a
305
318
308
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306a
306b
321
306a
305
319a
316a
303
315
307a
314a
300

FIGURE 5

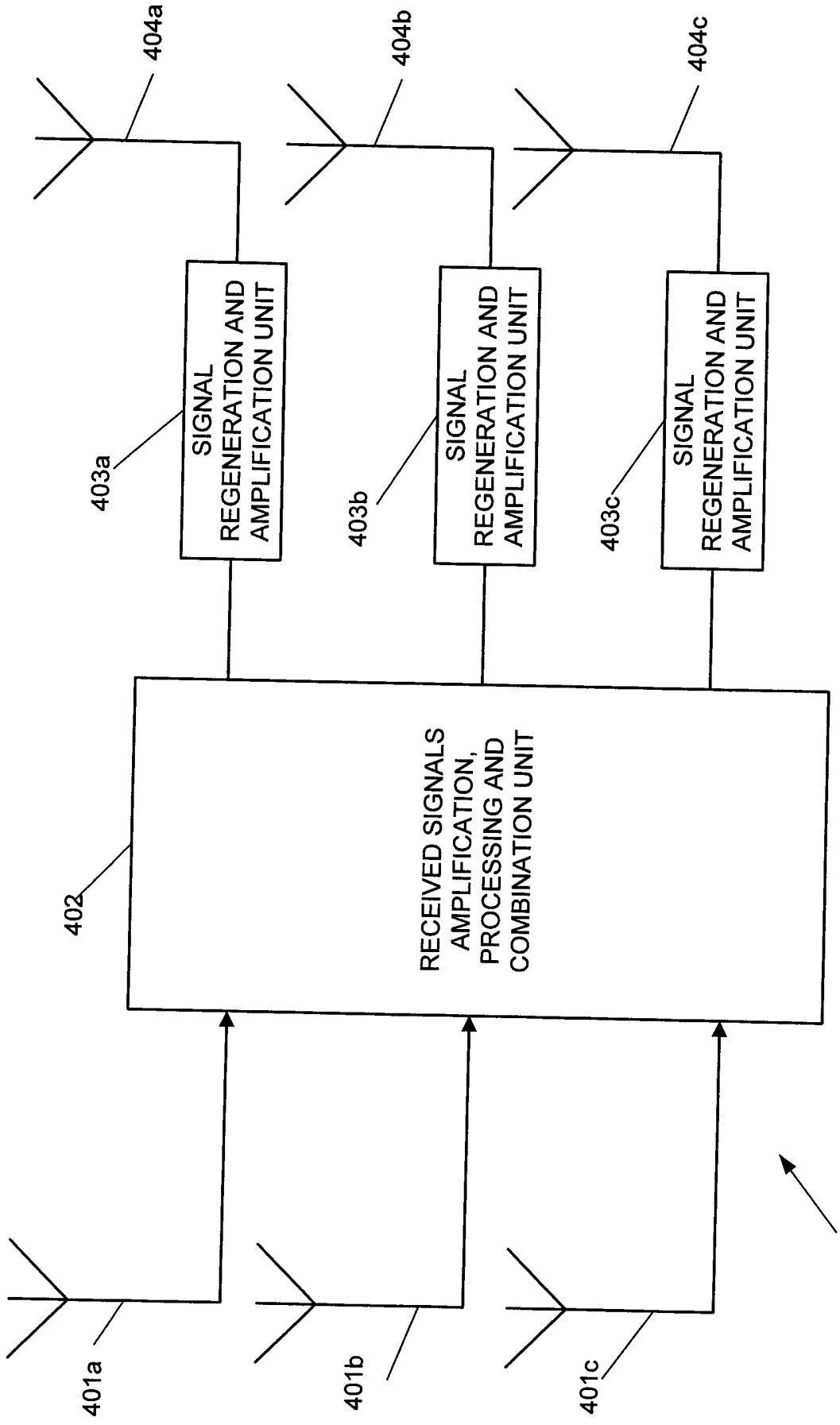
404a
404b
404c
SIGNAL REGENERATION AND AMPLIFICATION UNIT
SIGNAL REGENERATION AND AMPLIFICATION UNIT
SIGNAL REGENERATION AND AMPLIFICATION UNIT
403a
403b
403c
RECEIVED SIGNALS AMPLIFICATION, PROCESSING AND COMBINATION UNIT
402
400
401a
401b
401c

FIGURE 6

WIRELESS COMMUNICATIONS DEVICE

The present invention generally relates to a wireless communications device, particularly, but not exclusively, for use in a wireless network. It will be appreciated that the device, as will be described below, can be used in relation to any circumstances wherein a wireless communications transmitter, receiver or relay is useful.

It is becoming increasingly common to use wireless local area networks (WLANs) in home and office environments for applications such as home entertainment systems and communicating between devices such as computers and printers. The use of WLANs has the advantage that the need for cabling is drastically reduced, thus increasing the available space in a room or office, increasing the flexibility of the location of local area networks, reducing costs and reducing the complexity of the task of increasing the size of the network.

However, a problem with WLANs is that wireless links between devices tend not to be very robust, particularly when objects block the direct path between the transmitter and the receiver or when the distance between them is large. Consequently, communication between devices is compromised and the rate at which data is transmitted is reduced.

With the current rate of progression of WLAN technology, sizeable increases in throughput will necessitate the use of far larger bandwidths (in excess of 100 MHz). One technology that has been proposed for providing this level of improvement is ultra wideband (UWB). However, the range of UWB is limited due to legislation of the maximum transit power. Furthermore, it is desirable to minimise transmit power in wireless networks of mobile devices to maximise the battery life of products.

An alternative to UWB is to use a very high carrier frequency, for example 60 GHz, where large bandwidths are available in the spectrum. However, systems involving

such carrier frequencies also suffer range problems due to high propagation losses, reduced diffraction into shadowed regions and the small collecting aperture of the antenna that would have to be used.

Alternatively, relays can be positioned in wireless networks as repeaters to boost the signal and thereby reduce the transmit power needed at the mobile terminal, access point or piconet controller. A problem with existing devices performing this function is that they require mains power and are therefore powered from wall sockets, giving them a dedicated and potentially intrusive and unsightly location in the room.

One aspect of the present invention provides a wireless communications device that can be used, for example, in a wireless communications network, the device comprising a housing and wireless communication means provided in the housing, wherein the housing comprises engagement means operable to engage retainingly with an electrical lighting fitting, the electrical lighting fitting otherwise being operable to retain an electrically powered illumination device, for example a light bulb.

The engagement means can be removably engaged with the lighting fitting, so that the device can be installed and removed again as easily as a domestic light bulb. The engagement means can be operable to engage rotationally with the electrical lighting fitting, similarly to a domestic light bulb, and can be provided with a threaded fitting, screw threaded fitting or a bayonet fitting so as to be compatible with commonly used home or office electrical lighting fittings.

In one embodiment, the engagement means can comprise electrical connection means operable to engage, on engagement of the engagement means with the lighting fitting, with electrical contacts of the fitting. The wireless communications means is then able to receive electrical power by means of electrical connection through the electrical connection means.

In this embodiment, the housing can comprise a retaining means operable to removably retain the electrically powered illumination device. The retaining means can then be operable to receive electrical power by means of electrical connection through the

electrical connection means so as to provide power to the electrically powered illumination device when the electrically powered illumination device is retained by the retaining means. The device for wireless communications can therefore be used at the same time as the illumination device and receive permanent mains power, while still allowing the illumination device to be used at the same time.

Lighting switching arrangements can be provided which enable remote control of lighting, for example by means of a radio or infrared link between the traditional wall switch and the light, where the wall switch is activated in the usual manner or remotely by a handset using an infrared or radio link. The wall switch may also be activated by other user initiated actions (e.g. speech, presence detection), operating in conjunction with a receiver unit where a wall mounted switch would otherwise be provided. Alternatively, communication can be made directly with the switching device at the light without going via the wall mounted switch/transceiver. It is thus a specific embodiment of the presently described aspects of the invention that means can be provided for remotely controlling a switching means in the device, said switching means being operable to switch power supplied in use to the electrical lighting fitting and therefore to a light bulb connected thereto, without disrupting operation of the communications device itself.

In that way, the power supply to the communications device is not disrupted by physical switching of the lighting circuit which would otherwise require provision of battery or other backup supply.

In another embodiment, the wireless communication means can comprise one or more transmitting elements and one or more receiving elements. The same antenna elements may be used for both transmission and reception if appropriate switching is employed within the circuitry to swap between the transmit and receive chains. By ensuring that the receiver completes its reception before the transmitter begins relaying, 'deafening' of the receiver is avoided. Overlapping transmission and reception (with some finite lag between them) is possible if the transmitter and receiver operate in a manner to enable this to be implemented, such as rendering the transmitted and received beams orthogonal, for example by providing them on different frequency bands, or providing

electromagnetic shielding of the transmitted beam with respect to the receiver, possibly combined with beam forming. The signals may be radio, infrared or optical signals.

In another embodiment, the transmitting elements and the receiving elements may be arranged in a circular array within the housing, for example with the transmitting elements alternately interspersed with said one or more receiving elements. The elements may be used in this configuration to provide enhanced coverage by switching in the best transmit and receive elements for optimising the signal-to-noise ratio for the link. Alternatively, transmit or receive diversity schemes can be employed to improve link quality by using multiple transmit or receive elements simultaneously. Other multiple antenna multiple-input multiple-output MIMO techniques, such as spatial multiplexing, may also be used with this geometry to increase the rate of transmitted data.

When the embodiment is used for relaying, the received signal may be amplified and then retransmitted. However, it will be appreciated that this may give rise to some degradation in the signal due to noise introduced by the relaying. One arrangement to address this problem could involve decoding the digitally encoded information and quantising the received signal to the known alphabet before retransmission. Redundancy inherent in the received signal, introduced by a forward error error-correction code applied at the transmitter, may also be used to restore a degraded signal before remodulation and retransmission.

An alternative method would be to receive the transmitted signal on several antennas and then to combine them coherently to improve the signal-to-noise ratio (SNR). This may be less complex in implementation. In most channels it would be necessary to remove the effect of the channel from each received signal before the signals are combined. The integrated signal could then be transmitted from one or more antennas to provide transmit delay diversity or to form a beam in a desired direction.

Another aspect of the present invention provides an access point for a communications network, comprising a housing, and wireless communication means provided in the housing, wherein the housing comprises engagement means operable to engage

retainingly with an electrical lighting fitting, the electrical lighting fitting otherwise being operable to retain an electrically powered illumination device such as a light bulb, and the engagement means comprises electrical connection means operable to engage, on engagement of the engagement means with said lighting fitting, with electrical contacts of the fitting, and the wireless communications means being operable to receive electrical power by means of electrical connection through the electrical connection means.

In one embodiment, the electrical connection means can connect the access point to a mains electricity supply such that transmitting and receiving elements located in the housing can transmit and receive information carrying signals through a mains supply, which can be used as the network. In the preferred embodiment, this mains supply comprises a lighting main of a domestic or commercial electrical installation. The electrical connection means can also connect the device to a network of fibre optic cables so that data could be transmitted in the network via infrared signals. A retaining means operable to retain an electrically powered illumination device can also be provided in the access point so that an illumination device, for example a light bulb, can be used at the same time as the access point.

An advantage of placing a wireless networking device, such as a relay or access point, in an electrical lighting socket is that lighting sockets are positioned so that light bulbs fitted therein illuminate large areas of a room. A suitable and commonplace location for a lighting socket is thus central of a ceiling of a room. In the same way that a centrally located ceiling mounted light fitting allows uninterrupted illumination of large portions of a room, such a location is also appropriate for establishment of pathways for receiving and transmitting radio signals. A user will naturally orientate their working area so that it is well illuminated. Therefore, by providing a wireless communications device which is suitable for installation in an electrical light fitting (usually on or close to a ceiling), a positional and radio propagation advantage is achieved over a traditional device that must be near an electrical power socket and is likely to be near the floor and possibly obstructed by furniture and people. All embodiments of the invention can be used in any wireless network comprising equipment with wireless adaptors, for example a home entertainment network.

Any aspect of the present invention can be used with any other aspect and thus the present invention encompasses a device using any combination of the aspects briefly outlined above.

Embodiments of the invention will now be described with reference to the accompanying drawings, in which:

Figure 1 shows a partial cross sectional view of a device for use in a wireless communications network according to a first embodiment of the present invention;

Figure 2 shows a cross-section of a device for use in a wireless communication network according to a first embodiment of the present invention;

Figure 3 shows a cross-section of a device according to a first embodiment of the present invention, the device being engaged with an electrical lighting fitting, also shown in cross-section;

Figure 4 shows a plan view of a circular array of transmitting and receiving elements provided in a wireless communication device according to a second embodiment of the present invention;

Figure 5 shows a cross-section of an access point for use in a network according to a third embodiment of the present invention, the access point being engaged with an electrical lighting fitting connected to electrical power leads, also shown in cross-section; and

Figure 6 is a schematic diagram of an apparatus for restoring the signal to noise ratio of a signal in a wireless network.

Figure 1 shows a wireless relay device 100 for use in a wireless communications network in accordance with a first embodiment of the invention, which comprises a housing 101. The illustrated view will be understood as a partial cross section with a

lower, electrical light bulb receiving portion (to be described in full in due course) in cross section, the cross section being along a vertical plane, and the remaining portions (also to be described in due course) being in side elevation.

The housing 101 has a generally cylindrical engagement member 102 extending therefrom, provided with an external helical thread 103 operable to engage with a corresponding internal thread defined in the inner surface of a generally cylindrical blind aperture defined in an electrical lighting socket of an electrical lighting fitting. For reasons of clarity, the electrical lighting socket is not illustrated in Figure 1, but it will be appreciated that any conventional electrical light fitting allowing for threading engagement of a light bulb therewith will be applicable to the described embodiment.

The engagement member 102 is also provided with electrical contacts 119a and 119b, which are operable to make contact with corresponding electrical contacts provided at one end of the cylindrical blind aperture (not shown). The engagement member 102 can thus be rotationally engaged with or withdrawn from a lighting socket, thereby enabling attachment and detachment of the wireless relay device 100 with regard to the electrical lighting fitting.

The housing 101 also comprises a generally cylindrical blind aperture 105 provided with an internal helical thread 106 and electrical contacts 107a and 107b. The internal helical thread 106 is operable to engage with a corresponding external thread respectively. Thus the blind aperture 105 defines a socket operable to receive a light bulb having an external thread or bayonet fitting operable to engage with the internal thread 106.

It will be appreciated that, in the presently described embodiment, it is intended that the form, shape and dimension of the blind aperture 105 is consistent with the form shape and dimension of the engagement member 102. In that way, the wireless relay device 100 acts to interpose between the electrical lighting socket and a light bulb to be engaged in said socket. There is in this way no need to change selection of the light bulb for one with a smaller or larger fitting, or with a different form of engagement. It will be appreciated, though, that this is only one of many specific embodiments of the

invention and there may be circumstances in which it is appropriate to provide a wireless access device in accordance with the invention in which the light bulb fitting defined by the blind aperture 105 is different from that of the engagement member 102.

In addition, the housing 101 comprises a frustoconical heat shield 118, which is operable to protect the housing from the heat generated by a light bulb. The heat shield 118 in this example is of aluminium, but it will be appreciated that in alternatives to the described embodiment the heat shield could be made of any suitable material to achieve this purpose. If the heat shield is metallic then its shape should be designed so that it does not impede the propagation of signals to users thus defeating the favourable positioning of the relay.

It will be appreciated that other sufficiently thermally insulating barriers may be used that do not unduly obstruct passage of the signals, with heat dissipation from the radio device being provided by natural or forced convection (for example by a small fan).

As shown in Figure 1, electrical contacts 107a and 107b are located at the blind end of the aperture 105. Figure 2 illustrates these contacts in further detail, together with their function. As shown in figure 2, these contacts 107a and 107b are operable to retract into corresponding keying recesses 112a and 112b. The electrical contacts 107a and 107b are captive in the recesses 112a and 112b, though the means for captive retention are not illustrated in Figure 2 for reasons of clarity. Any suitable means of captive retention is contemplated, such as keying the contacts in place.

The electrical contacts 107a and 107b are resiliently urged into a first, extended position, and can be withdrawn against this resilience into the respective recesses. The means for provision of this resilience is also not shown in Figure 2, though it will be appreciated that any appropriate resilient means, such as a helical spring or leaf spring, would be suitable. This resilience tends to urge the contacts against a surface of a body inserted into the blind aperture, so that in the event that the surface of that body with which the electrical contacts make contact is electrically conducting, an electrical connection is established which is conductive to the extent necessary for the application concerned.

When a light bulb is engaged in the aperture 105, the connecting end of the light bulb contacts the electrical contacts 107a and 107b, which withdraw into the corresponding keying recesses 112a and 112b. In this way, the resilient means driving the contacts 107a and 107b towards the extended position will drive the contacts 107a and 107b into engagement with the adjacent, connecting, end of the light bulb.

A transmitting element 108 and a receiving element 109 are provided in the housing as wireless communication means. The receiving element 109 is operable to receive signals from a device in a wireless network and the transmitting element 108 is operable to transmit signals received by the receiving element 109 to another device in the wireless network. The transmitting element 108 and receiving element 109 are in this embodiment standard antennas suitable for use in a WLAN. The transmitting element 108 and the receiving element 109 are operable, respectively, to transmit and receive signals in the same frequency band. In this embodiment, they are elements of a MIMO system.

Alternatively, it will be appreciated that the transmitting and receiving elements can be configured such that transmission and reception can take place in different frequency bands. Further alternatively, it will be appreciated that the transmitting element 108 and receiving element 109 can be replaced by a single antenna, which is operable to be reconfigurably switched so as to act as a receive or a transmit antenna.

A transceiver 110 is interposed between the antennas 108, 109, and is operable to detect electrical signals in a receive antenna and to drive transmission of signals at a transmit antenna. Electrical connectors 111a and 111b, operable to convey electrical power, are provided in the housing 101 and the engagement member 102. The electrical connectors 111a and 111b are operable as signal and earth connections respectively to the respective antennas 108, 109, from the transceiver 110. With these connections, the transceiver is operable to perform detection, amplification, and processing functions.

When a light bulb is retained by the retaining member 110 and contacts the electrical contacts 112a and 112b, this allows the light bulb to receive electrical power and be

used to illuminate a room at the same time as the transmitting element 108 and the receiving element 109 are respectively transmitting and receiving signals in the wireless network. The electrical lighting fitting 103 can therefore be used for its conventional purpose, in place of that in which the wireless relay device 100 is engaged, at the same time as the relay 100 relays signals in a wireless communication network. Thus, the use of an available light bulb fitting to power the wireless relay device, which also has the advantage of siting the device in a position already located appropriately for the distribution of electromagnetic radiation, does not come at the cost of a location for a light bulb for illumination of the locality concerned.

The heat shield 118 allows the transmitting element 108 and the receiving element 109 to be protected from damage caused by the heat generated by the light bulb. Electrical power can be supplied to the contacts 107a and 107b through the electrical connectors 111a and 111b by means of conventional mains electricity or from a battery supply.

In an alternative embodiment, the relay 100 could be configured only to receive electrical power for powering a light bulb and not to power the transceiver 110. For example, the light bulb could be powered from the mains electricity supply, while the transceiver 110 was powered by a battery supply. This would allow the device to be used for relaying signals in a wireless network even when the mains supply to the light bulb is switched off. However, it will be appreciated that this embodiment would need to take account of the limitations of compact battery technology in enabling substantial transmission power.

In an enhancement of this arrangement, the battery supply could be rechargeable from the mains supply, so that in the event that the supply to the light bulb is available, the battery supply can be recharged, only to be used as a back up in the event that the mains supply is unavailable. Of course, this may be practical in the event that use of the wireless device is required whether or not the light bulb is illuminated.

In addition, in another alternative embodiment, power to the detection, amplification, and processing functions of the transceiver 110 can be controlled remotely using a wireless switch provided therein. This allows the relay 100 to be used even when the

light bulb is switched off. The wireless switch can be controlled by a transmitter provided in a conventional wall light switch or from a remote control handset, or by signals from the transmitting element 108. The transceiver 110 also comprises circuits for rectifying, smoothing and down converting mains voltage form a local supply to DC voltages suitable for WLAN components.

However, the circuitry required for this need not be located in the transceiver 110 itself and could be provided separately if more convenient.

When several of these wireless access devices 100 are placed in a wireless network, a signal can be relayed in a multi-stage fashion, which increases the effective range of the resultant wireless network relay infrastructure. This is useful in the case that, for technical (such as power consumption) or regulatory reasons, transmit power (and therefore effective range) of a wireless communications device is limited.

Figure 3 shows the relay device 100 of the first embodiment in cross-section engaged with an electrical lighting fitting 114, also shown in cross-section. An internal thread 104 is defined in the inner surface of a generally cylindrical blind aperture, comprising an electrical lighting socket 117, defined within the electrical lighting fitting 114. The external helical thread 103 of the engagement member 102 is operable to engage with the corresponding internal thread 104 of the electrical lighting socket 117.

In the blind end of the cylindrical aperture defining the lighting socket 117, electrical contacts 115a and 115b are positioned; operable to retract into corresponding keying recesses 116a and 116b. The electrical contacts 115a and 115b are captive in the recesses 116a and 116b, though the means for captive retention are not illustrated in Figure 3. The electrical contacts 115a and 115b are resiliently engaged in a first, extended position, and can be withdrawn against this resilience into the corresponding recesses 116a and 116b. The means for provision of this resilience is also not shown in Figure 3, though it will be appreciated that any appropriate resilient means, such as a helical spring or leaf spring would be suitable.

When the engagement member 102 is retained in the lighting fitting 114, electrical contacts 119a and 119b at the end of the engagement member 102 contact the electrical contacts 115a and 115b, which withdraw into the keying recesses 116a and 116b. In this way, the resilience driving the contacts 115a and 115b out of the withdrawn position will drive the contacts 115a and 115b into engagement with the adjacent ends of contacts 119a and 119b, to form respective electrical contacts

When the device 100 is to be installed as part of a wireless network, it can be fitted into the lighting socket 113 by rotating the engagement member 102, so that it is removably and rotationally engaged in the electrical lighting socket 113. The relay 100 is then able to receive electrical power through the electrical contacts 119a and 119b. The engagement member 102 is resiliently and removably engageable with the lighting socket 117 so that the relay device 100 can be installed in any type of electrical lighting socket defined in any electrical lighting fitting provided in a domestic or office environment, and removed again as required. The engagement member 102 can be operable to fit an electrical lighting fitting that fits directly onto a ceiling or that is suspended from the ceiling by an electric power cable.

Figure 4 shows a plan view of a second embodiment of the invention, comprising a relay device 200 for use in a wireless communications network. The relay device 200 comprises a cylindrical housing 201 provided with a coaxial cylindrical engagement member 205 of smaller diameter. The engagement member 205 is provided with an external thread 206, which is operable to engage retainingly with a corresponding fitting provided in an electrical lighting socket defined within an lighting fitting, as described with reference to the first embodiment above.

For reasons of clarity, internal components of the relay device are illustrated. It will be understood that these are located within the housing 201. Transmitting antenna elements 203a, 203b, 203d, 203e and 203f and receiving antenna elements 204a, 204b, 204c, 204d, 204e and 204f are provided in the housing 201 as a wireless communication means and are arranged in a substantially circular array. The transmitting antenna elements 203a, 203b, 203d, 203e and 203f and receiving antenna elements 204a, 204b,

204c, 204d, 204e and 204f are in this embodiment arranged so that they are alternately interspersed with each other in the array.

As with the first embodiment, when the engagement member 205 engages with electrical contacts provided in an electrical lighting socket, electrical power can be supplied to a central powered controller (not shown) which is connected with the transmitting antenna elements 203a, 203b, 203d, 203e and 203f and with the receiving antenna elements 204a, 204b, 204c, 204d, 204e and 204f. The underside of the housing 201 is also provided with a generally cylindrical blind aperture (not shown) for removably retaining a light bulb, which thus can also receive electrical power at the same time as the central controller, as described with reference to transceiver of the first embodiment. The light bulb receives electrical power through electrical contacts provided in the retaining member. The retaining member and the electrical contacts are not shown in Figure 3.

A circular array is one possible convenient shape for arrangement of the transmitting and receiving elements in the housing 201, but the array is not limited to being substantially circular and could, for example, be linear or a square. The transmitters and receivers are presented as being arranged alternately, but the invention is not limited to arrangement in this configuration. Transmitting elements 203a, 203b, 203d, 203e and 203f and receiving elements 204a, 204b, 204c, 204d, 204e and 204f can either transmit in the same frequency band if reception and subsequent retransmission are sequential, or in different frequency bands, which may be preferred if concurrent transmission and reception is used.

Alternatively, the generally circular array shown in Figure 4 could comprise antennas that are reconfigurably switched to act as receive or transmit antennas.

Figure 5 shows a cross-section of an access point 300 for use in a communications network according to a third embodiment of the invention, engaged with an electrical lighting fitting 303, also shown in cross-section. The shape and configuration of the body and external features of the access point is as shown in Figure 1 and as described with reference to the first embodiment. Where this is the case, reference numbers

correspond with the first embodiment except by a prefixed '3' rather than a '1' of the first embodiment.

Use of the access point is similar to the use previously described for the relay device above. The exception to this is the fact that the access point 300 is operable to establish, by means of the electrical connection with the lighting power supply circuit, communications connection with a wider network. When it is required to install the access point 300 so that it is operable to provide access to a network, it can be fitted into the lighting socket 315 by rotating the engagement member 302 into the lighting socket 315 so that the contacts 319a and 319b make contact with the electrical contacts 316a and 316b. The engagement member 302 can be provided with a fitting to allow it to be compatible with any type of domestic or office light fitting, which can be, for example threaded, screw threaded, bayonet fitting etc. The engagement member 302 is operable to facilitate removable engagement of the access point 300 with the lighting fitting 303 so that the access point 300 can be installed in a network and removed again as required. The engagement member 302 can be operable to fit an electrical lighting fitting that fits directly onto a ceiling or that is suspended from the ceiling by an electric power cable.

Wireless signals, for example radio or infrared signals, can then be received from the access point in a wireless network by the receiving element 309 and then be transmitted to another device in the wireless network by the transmitting antenna element 308. At the same time, a light bulb may be fitted into the aperture 310 so that the light bulb may receive electrical power and be used to illuminate a room wherever the device is placed. The transmitting antenna element 308 and the receiving antenna element 309 are protected from being damaged by the heat of the light bulb by the heat shield 318. This allows the lighting fitting 303 to be used for its conventional purpose at the same time as the access point 300 is operational in a network. Electrical power can be supplied to the contacts 319a and 319b by means of conventional mains electricity or from a battery supply.

Alternatively, the electrical connection means 306a and 306b can be adapted to supply power only to the contacts 312a and 312b provided in the aperture 310, and not to the

transmitting element 308 and the receiving element 309; i.e., the wireless communication means. For example a light bulb could be powered from the mains electricity supply, while the transmitting element 308 and the receiving element 309 are powered by a battery supply. This would allow the access point 300 to be used in the network even when the light bulb is switched off.

In addition, the transceiver 321, which controls access point communication via the transmitting antenna element 308 and the receiving antenna element 309, can be controlled remotely by a switch provided therein. The switch could be controlled by a transmitter provided in a conventional wall light switch or from a remote control unit (not shown). The transceiver 321 also comprises circuits for rectifying, smoothing and down-converting the voltage from a local AC supply to a DC voltage suitable for WLAN components. Again, these circuits could be provided separately if more convenient.

Radio signals from a device in a communications network can be received by the receiving antenna element 309 and thence to the transceiver 321. Then, the transceiver 321 is operable to communicate, via electrical connection means 306a and 306 and the electrical power cables 314a and 314b, with another device that is linked to the power cables 314a and 314b. In addition, radio signals from a device connected to the network by the power cable 314b can be received by the access point 300 through the power cables 314a and 314b, propagate through the electrical connection means 306a and 306b to the transceiver 321. The transceiver 321 can then control transmission of signals to a wireless device in the communications network. Therefore, the mains electricity cables in a building can form part of the communications network. Alternatively, signals can be received at the receiving antenna element 309, and be transmitted at the transmitting antenna element 308, to a wireless device in the network. Thus, the access point 300 of this embodiment can be used exclusively as a wireless relay device, exclusively as a device in a wired network, as a node on a power cable network, or as an interface between wireless and wired communications networks.

In addition, fibre optic cables can be provided to run alongside or instead of electrical power cables 314a and 314b and be arranged so as to connect to the transmitting

antenna element 308 and receiving antenna element 309. In this way, infrared signals could be received by the receiving antenna element 309 and propagate through a network of fibre optic cables to another device in the network. The access point 300 could then be employed as a node on a fibre optic network.

The access point 300 can also comprise a single antenna, in place of the transmitting antenna element 308 and the receiving antenna element 309, that can be reconfigurably switched to act as a receive and a transmit antenna.

The access point 300 of this embodiment, and the relay 100 of the first embodiment, can also comprise a substantially circular array of transmitting and receiving elements, as described above with reference to the second embodiment, so as to restore signal to noise ratio in the network in the analogue domain. In the array, the transmitting and receiving elements can be alternately interspersed with each other but they are not limited to this configuration. Transmitting elements and receiving elements can either transmit and receive signals in the same channel or frequency band, or in different channels or frequency bands.

Figure 6 shows an apparatus for restoring signal to noise ratio in a wireless communications network that can be used with any of the embodiments described above and provided in the housing of the device or access point for use in a communications network.

Receiving elements 401a, 402b and 402c receive signals from a device in a wireless network in a single channel. A received rapid processing unit 402 amplifies the received signals and down-converts them, then synchronises the signals in the time-frequency domain, estimates the channel, decodes the channel and then decodes the signals in the space-time domain. The processing means 402 uses powerful forward error corrections codes, which provide a coding gain that restores the signal and offsets any performance degradation arising from a reduction in the signal to noise ratio. Signal generation units 403a, 403b and 403c then re-encodes the signals before they are transmitted to another device in the network by transmitting elements 404a, 404b and 404c.

The device and access points described above can be used in a home entertainment network, computer network or any other network comprising devices having wireless adaptors.

Whereas the described embodiments show the engagement of the wireless communications devices each being engageable by means of helical threading engagement, other engagement can equally be provided, including a bayonet fitting or a push fit engagement, so as to be compatible with provided light socket fittings.

It will be appreciated that, in the alternative, the internal and external helical threads described above could each or both be replaced by male and female bayonet type engagement fittings respectively.

In an alternative embodiment therefore, a wireless access device could be provided to have the secondary advantage of adapting a threaded light fitting to receive a bayonet type light bulb.

In an alternative embodiment a switch can be provided in the retaining member to control power through the electrical connection means to the electrical illumination device and to provide operation of the wireless communication means independently of the electrically powered illumination device. For example, the switch could be remote and operable to be controlled using radio signals. Thus the device for wireless communications can also be used at the same time as the light bulb and receive permanent mains power, while still allowing the light bulb to be turned on or off independently. Standby batteries would then be unnecessary.

Thus an aspect of the present invention provides an advantage of a simple and convenient means of locating devices for use in wireless communication networks in rooms with minimal disruption and effort on the part of the user, without having to provide a dedicated and intrusive new location for the device. In addition, the positioning of the device in a light socket allows for better radio coverage of a room in a home or office with less likelihood of obstacles causing interruption of the signal.

Another aspect of the present invention provides the advantage of an access point that can be located in an existing conventional light socket and provide a bridge between a wireless and a wired network.

Although the present invention has been described hereinabove with reference to specific embodiments, the present invention is in no way limited to the specific embodiments and modifications will be apparent to a skilled person in the art which lie within the scope of the present invention.

CLAIMS:

1. A wireless communications device, the device comprising:

a housing; and

wireless communication means provided in said housing,

wherein said housing comprises engagement means operable to engage retainingly with an electrical lighting fitting, said electrical lighting fitting otherwise being operable to retain an electrically powered illumination device such as a light bulb.

2. The device of claim 1, wherein said engagement means is operable to engage removably with said electrical lighting fitting.

3. The device of claim 1 or claim 2, wherein said engagement means is operable to engage rotationally with said electrical lighting fitting.

4 The device of claim 3, wherein said engagement means comprises a threaded fitting operable to engage rotationally with said electrical lighting fitting.

5. The device of claim 4, wherein said engagement means comprises a screw threaded fitting operable to engage rotationally with said electrical lighting fitting.

6. The device of claim 4, wherein said engagement means comprises a bayonet fitting operable to engage rotationally with said electrical lighting fitting.

7. The device of any one of claims 1 to 6, wherein said engagement means comprises electrical connection means operable to engage, on engagement of the engagement means with said lighting fitting, with electrical contacts of said fitting, said wireless communications means being operable to receive electrical power by means of electrical connection through said electrical connection means.

8. The device of claim 7, wherein said housing comprises a retaining means operable to removably retain said electrically powered illumination device, said

retaining means being operable to receive electrical power by means of electrical connection through said electrical connection means so as to provide power to said electrically powered illumination device when said electrically powered illumination device is retained by said retaining means.

9. The device of claim 8, wherein said retaining means comprises a switch operable to control power through said electrical connection means to said electrically powered illumination device, so as to provide operation of said wireless communication means independently of said electrically powered illumination device.

10. The device of claim 9, wherein said switch is operable so as to be controlled remotely.

11. The device of claim 10, wherein said switch is controlled by signals from said wireless communication means.

12. The device of any one of claims 8 to 11, wherein said housing further comprises a heat shield operable to shield said wireless communication means from heat generated by said electrically powered illumination device when said electrically powered illumination device receives power through said electrical connection means.

13. The device of any one of claims 1 to 12, wherein said wireless communication means comprises one or more antennas for transmitting signals in a frequency band and receiving signals in said frequency band.

14. The device of any one of claims 1 to 12, wherein said wireless communication means comprises one or more antennas for transmitting signals in a first frequency band and receiving signals in a second frequency band.

15. The device of any one of claims 1 to 12, wherein said wireless communication means comprises one or more antennas for transmitting signals in a channel of a

wireless communications network and receiving signals in said channel of said wireless communications network.

16. The device of any one of claims 1 to 12, wherein said wireless communication means comprises one or more antennas for transmitting signals in a first channel of a wireless communications network and receiving signals in a second channel of said wireless network.

17. The device of any one of claims 13 to 16, wherein said one or more antennas are arranged in a substantially circular array.

18. The device of claim 17, wherein said circular array comprises said one or more antennas operable to be reconfigurably switched so as to receive signals and transmit signals.

19. The device of claim 17, wherein said circular array comprises said one or more antennas transmitting signals and receiving signals simultaneously.

20. The device of any one of claims 1 to 12, wherein said wireless communication means comprises one or more transmitting elements for transmitting signals in a frequency band and one ore more receiving elements for receiving signals in said frequency band.

21. The device of any one of claims 1 to 12, wherein said wireless communication means comprises one or more transmitting elements for transmitting signals in a first frequency band and one or more receiving elements for receiving signals in a second frequency band.

22. The device of any one of claims 1 to 12, wherein said wireless communication means comprises one or more transmitting elements for transmitting signals in a channel of said wireless communications network and one or more receiving elements for receiving signals in said channel of said wireless communications network.

23. The device of any one of claims 1 to 12, wherein said wireless communication means comprises one or more transmitting elements for transmitting signals in a first channel of said wireless communication network and one or more receiving elements for receiving signals in a second channel of said wireless communications network.

24. The device of any one of claims 20 to 23, wherein said one or more transmitting elements and said one or more receiving elements are arranged in a substantially circular array.

25. The device of claim 24, wherein said circular array comprises said one or more transmitting elements are alternately interspersed with said one or more receiving elements.

26. The device of any one of claims 13 to 25, wherein said signals are radio signals.

27. The device of any one of claims 13 to 22, wherein said signals are infrared signals.

28. The device of any preceding claim, wherein the device is operable to relay signals in a wireless communications network.

29. A home entertainment network comprising items of home entertainment equipment each having a wireless adaptor for cooperating with other wireless adaptors to form together a wireless network, and a device according to any one preceding claim.

30. An apparatus for restoring signal to noise ratio in the device of any one of claims 13 to 27, the apparatus comprising:

processing means operable to amplify, synchronise and decode received signals; and

regeneration means operable to re-encode said decoded signals.

31. A method for restoring signal to noise ratio in the device of any one of claims 13 to 27, the method comprising:

receiving wireless signals;

amplifying said signals;

down-converting said signals;

decoding said signals;

re-encoding said signals; and

transmitting said signals.

32. An access point for a communications network, the access point comprising:

a housing; and

wireless communication means provided in said housing,

wherein said housing comprises engagement means operable to engage retainingly with an electrical lighting fitting, said electrical lighting fitting otherwise being operable to retain an electrically powered illumination device such as a light bulb, and said engagement means comprises electrical connection means operable to engage, on engagement of the engagement means with said lighting fitting, with electrical contacts of said fitting, and said wireless communications means being operable to receive electrical power by means of electrical connection through said electrical connection means.

33. The access point of claim 32, wherein said engagement means is operable to engage removably with said electrical lighting fitting.

34. The access point of claim 32 or claim 33, wherein said engagement means is operable to engage rotationally with said electrical lighting fitting.

35. The access point of claim 34, wherein said engagement means comprises a threaded fitting operable to engage rotationally with said electrical lighting fitting.

36. The access point of claim 34, wherein said engagement means comprises a screw threaded fitting operable to engage rotationally with said electrical lighting fitting.

37. The access point of claim 34, wherein said engagement means comprises a bayonet fitting operable to engage rotationally with said electrical lighting fitting.

38. The access point of any one of claims 32 to 37, wherein said housing comprises a retaining means operable to removably retain said electrically powered illumination device, said retaining means being operable to receive electrical power by means of electrical connection through said electrical connection means so as to provide power to said electrically powered illumination device when said electrically powered illumination device is retained by said retaining means.

39. The access point of claim 38, wherein said retaining means comprises a switch operable to control power through said electrical connection means to said electrically powered illumination device, so as to provide operation of said wireless communication means independently of said electrically powered illumination device.

40. The access point of claim 39, wherein said switch is operable so as to be controlled remotely.

41. The access point of claim 40, wherein said switch is controlled by signals from said wireless communication means.

42. The access point of any one of claims 32 to 41, wherein said housing further comprises a heat shield operable to shield said wireless communication means from heat generated by said electrically powered illumination device.

43. The access point of any one of claims 32 to 42, wherein said wireless communication means comprises one ore more antennas for transmitting signals in a frequency band and receiving signals in said frequency band.

44. The access point of any one of claims 32 to 42, wherein said wireless communication means comprises one or more antennas for transmitting signals in a first frequency band and receiving signals in a second frequency band.

45. The access point of any one of claims 32 to 42, wherein said wireless communication means comprises one or more antennas for transmitting signals in a channel of a wireless communications network and receiving signals in said channel of said wireless communications network.

46. The access point of any one of claims 32 to 42, wherein said wireless communication means comprises one or more antennas for transmitting signals in a first channel of a wireless communications network and receiving signals in a second channel of said wireless communications network.

47. The access point of claim 46, wherein said electrical connection means is operable to receive power from a mains electricity supply through AC power cables and said first channel and said second channel are provided in said power cables.

48. The access point of any of claim 46, wherein said electrical connection means is operable to be connected to fibre optic cables and said first channel and said second channel are provided in said fibre optic cables.

49. The access point of any one of claims 43 to 48, wherein said one or more antennas are arranged in a substantially circular array.

50. The access point of claim 49, wherein said one or more antennas are operable to be reconfigurably switched so as to receive signals and transmit signals.

51. The access point of claim 49, wherein said array transmits signals and receives signals simultaneously.

52. The access point of any one of claims 32 to 42, wherein said wireless communication means comprises one or more transmitting elements for transmitting signals in a frequency band and one or more receiving elements for receiving signals in said frequency band.

53. The access point of any one of claims 32 to 42, wherein said wireless communication means comprises one or more transmitting elements for transmitting signals in a first frequency band and one or more receiving elements for receiving signals in a second frequency band.

54. The access point of any one of claims 32 to 42, wherein said wireless communication means comprises one or more transmitting elements for transmitting signals in a channel of said wireless communications network and one or more receiving elements for receiving signals in said channel of said wireless network.

55. The access point of any one of claims 32 to 42, wherein said wireless communication means comprises one or more transmitting elements for transmitting signals in a first channel of said wireless communications network and one or more receiving elements for receiving signals in a second channel of said wireless communications network.

56. The access point of claim 55, wherein said electrical connection means is operable to receive power from a mains electricity supply through AC power cables and said first channel and said second channel are provided in said power cables.

57. The access point of claim 55, wherein said electrical connection means is operable to be connected to fibre optic cables and said first channel and said second channel are provided in said fibre optic cables.

58. The access point of any one of claims 52 to 57, wherein said one or more transmitting elements and said one or more receiving elements are arranged in a substantially circular array.

59. The access point of claim 58, wherein said circular array comprises said one or more transmitting elements alternately interspersed with said one or more receiving elements.

60. The access point of any one of claims 32 to 56, wherein said signals are radio signals.

61. The access point of any one of claims 32 to 57, wherein said signals are infrared signals.

62. A home entertainment network comprising a number of items of home entertainment equipment each having a wireless adaptor for forming together a wireless network, and an access point according to any one preceding claim.

63. An apparatus for restoring signal to noise ratio in the access point of any one of claims 32 to 61, the apparatus comprising:

processing means operable to amplify, synchronise and decode received signals; and

regeneration means operable to re-encode said decoded signals.

64. A method for restoring signal to noise ratio in the access point of any one of claims 32 to 61, the method comprising:

receiving signals from a wireless network;

amplifying said signals;

down-converting said signals;

decoding said signals;

re-encoding said signals; and

transmitting said signals.

65. A wireless communications device substantially as described herein, with reference to the accompanying drawings.

66. An access point for use in a wireless communications network, substantially as described herein, with reference to the accompanying drawings.

Amendments to the claims have been filed as follows

1. A wireless communications device, the device comprising:

a housing;

wireless communication means provided in said housing,

engagement means operable to engage retainingly with an electrical lighting fitting, said electrical lighting fitting otherwise being operable to retain an electrically powered illumination device such as a lightbulb;

processing means operable to amplify, synchronise and decode received signals; and

regeneration means operable to re-encode said decoded signals.

2. The device of claim 1, wherein said engagement means is operable to engage removably with said electrical lighting fitting.

3. The device of claim 1 or claim 2, wherein said engagement means is operable to engage rotationally with said electrical lighting fitting.

4 The device of claim 3, wherein said engagement means comprises a threaded fitting operable to engage rotationally with said electrical lighting fitting.

5. The device of claim 3, wherein said engagement means comprises a screw threaded fitting operable to engage rotationally with said electrical lighting fitting.

6. The device of claim 3, wherein said engagement means comprises a bayonet fitting operable to engage rotationally with said electrical lighting fitting.

7. The device of any one of claims 1 to 6, wherein said engagement means comprises electrical connection means operable to engage, on engagement of the engagement means with said lighting fitting, with electrical contacts of said fitting, said wireless communications means being operable to receive electrical power by means of electrical connection through said electrical connection means.

8. The device of claim 7, wherein said housing comprises a retaining means operable to removably retain said electrically powered illumination device, said retaining means being operable to receive electrical power by means of electrical connection through said electrical connection means so as to provide power to said electrically powered illumination device when said electrically powered illumination device is retained by said retaining means.

9. The device of claim 8, wherein said retaining means comprises a switch operable to control power through said electrical connection means to said electrically powered illumination device, so as to provide operation of said wireless communication means independently of said electrically powered illumination device.

10. The device of claim 9, wherein said switch is operable so as to be controlled remotely.

11. The device of claim 10, wherein said switch is controlled by signals from said wireless communication means.

12. The device of any one of claims 8 to 11, wherein said housing further comprises a heat shield operable to shield said wireless communication means from heat generated by said electrically powered illumination device when said electrically powered illumination device receives power through said electrical connection means.

13. The device of any one of claims 1 to 12, wherein said wireless communication means comprises one or more antennas for transmitting signals in a frequency band and receiving signals in said frequency band.

14. The device of any one of claims 1 to 12, wherein said wireless communication means comprises one or more antennas for transmitting signals in a first frequency band and receiving signals in a second frequency band.

15. The device of any one of claims 1 to 12, wherein said wireless communication means comprises one or more antennas for transmitting signals in a channel of a wireless communications network and receiving signals in said channel of said wireless communications network.

16. The device of any one of claims 1 to 12, wherein said wireless communication means comprises one or more antennas for transmitting signals in a first channel of a wireless communications network and receiving signals in a second channel of said wireless network.

17. The device of any one of claims 13 to 16, wherein said one or more antennas are arranged in a substantially circular array.

18. The device of claim 17, wherein said circular array comprises said one or more antennas operable to be reconfigurably switched so as to receive signals and transmit signals.

19. The device of claim 17, wherein said circular array comprises said one or more antennas transmitting signals and receiving signals simultaneously.

20. The device of any one of claims 1 to 12, wherein said wireless communication means comprises one or more transmitting elements for transmitting signals in a frequency band and one ore more receiving elements for receiving signals in said frequency band.

21. The device of any one of claims 1 to 12, wherein said wireless communication means comprises one or more transmitting elements for transmitting signals in a first frequency band and one or more receiving elements for receiving signals in a second frequency band.

22. The device of any one of claims 1 to 12, wherein said wireless communication means comprises one or more transmitting elements for transmitting signals in a

channel of said wireless communications network and one or more receiving elements for receiving signals in said channel of said wireless communications network.

23. The device of any one of claims 1 to 12, wherein said wireless communication means comprises one or more transmitting elements for transmitting signals in a first channel of said wireless communication network and one or more receiving elements for receiving signals in a second channel of said wireless communications network.

24. The device of any one of claims 20 to 23, wherein said one or more transmitting elements and said one or more receiving elements are arranged in a substantially circular array.

25. The device of claim 24, wherein said circular array comprises said one or more transmitting elements are alternately interspersed with said one or more receiving elements.

26. The device of any one of claims 13 to 25, wherein said signals are radio signals.

27. The device of any one of claims 13 to 22, wherein said signals are infrared signals.

28. The device of any preceding claim, wherein the device is operable to relay signals in a wireless communications network.

29. A method for restoring signal to noise ratio in the device of any one of claims 13 to 27, the method comprising:

receiving wireless signals;

amplifying said signals;

down-converting said signals;

decoding said signals;

re-encoding said signals; and

transmitting said signals.

30. A home entertainment network comprising items of home entertainment equipment each having a wireless adaptor for cooperating with other wireless adaptors to form together a wireless network, and a device according to any one preceding claim.

31. An access point for a communications network, the access point comprising:

a housing; and

wireless communication means provided in said housing,

wherein said housing comprises engagement means operable to engage retainingly with an electrical lighting fitting, said electrical lighting fitting otherwise being operable to retain an electrically powered illumination device such as a light bulb, and said engagement means comprises electrical connection means operable to engage, on engagement of the engagement means with said lighting fitting, with electrical contacts of said fitting, and said wireless communications means being operable to receive electrical power by means of electrical connection through said electrical connection means;

processing means operable to amplify, synchronise and decode received signals; and

regeneration means operable to re-encoded said decoded signals.

32. The access point of claim 31, wherein said engagement means is operable to engage removably with said electrical lighting fitting.

33. The access point of claim 31 or claim 32, wherein said engagement means is operable to engage rotationally with said electrical lighting fitting.

34. The access point of claim 33, wherein said engagement means comprises a threaded fitting operable to engage rotationally with said electrical lighting fitting.

35. The access point of claim 33, wherein said engagement means comprises a screw threaded fitting operable to engage rotationally with said electrical lighting fitting.

36. The access point of claim 33, wherein said engagement means comprises a bayonet fitting operable to engage rotationally with said electrical lighting fitting.

37. The access point of any one of claims 31 to 36, wherein said housing comprises a retaining means operable to removably retain said electrically powered illumination device, said retaining means being operable to receive electrical power by means of electrical connection through said electrical connection means so as to provide power to said electrically powered illumination device when said electrically powered illumination device is retained by said retaining means.

38. The access point of claim 37, wherein said retaining means comprises a switch operable to control power through said electrical connection means to said electrically powered illumination device, so as to provide operation of said wireless communication means independently of said electrically powered illumination device.

39. The access point of claim 38, wherein said switch is operable so as to be controlled remotely.

40. The access point of claim 39, wherein said switch is controlled by signals from said wireless communication means.

41. The access point of any one of claims 31 to 40, wherein said housing further comprises a heat shield operable to shield said wireless communication means from heat generated by said electrically powered illumination device.

42. The access point of any one of claims 31 to 41, wherein said wireless communication means comprises one ore more antennas for transmitting signals in a frequency band and receiving signals in said frequency band.

43. The access point of any one of claims 31 to 41, wherein said wireless communication means comprises one or more antennas for transmitting signals in a first frequency band and receiving signals in a second frequency band.

44. The access point of any one of claims 31 to 41, wherein said wireless communication means comprises one or more antennas for transmitting signals in a channel of a wireless communications network and receiving signals in said channel of said wireless communications network.

45. The access point of any one of claims 31 to 41, wherein said wireless communication means comprises one or more antennas for transmitting signals in a first channel of a wireless communications network and receiving signals in a second channel of said wireless communications network.

46. The access point of claim 45, wherein said electrical connection means is operable to receive power from a mains electricity supply through AC power cables and said first channel and said second channel are provided in said power cables.

47. The access point of any of claim 45, wherein said electrical connection means is operable to be connected to fibre optic cables and said first channel and said second channel are provided in said fibre optic cables.

48. The access point of any one of claims 42 to 47, wherein said one or more antennas are arranged in a substantially circular array.

49. The access point of claim 48, wherein said one or more antennas are operable to be reconfigurably switched so as to receive signals and transmit signals.

50. The access point of claim 48, wherein said array transmits signals and receives signals simultaneously.

51. The access point of any one of claims 31 to 41, wherein said wireless communication means comprises one or more transmitting elements for transmitting signals in a frequency band and one or more receiving elements for receiving signals in said frequency band.

52. The access point of any one of claims 31 to 41, wherein said wireless communication means comprises one or more transmitting elements for transmitting signals in a first frequency band and one or more receiving elements for receiving signals in a second frequency band.

53. The access point of any one of claims 31 to 41, wherein said wireless communication means comprises one or more transmitting elements for transmitting signals in a channel of said wireless communications network and one or more receiving elements for receiving signals in said channel of said wireless network.

54. The access point of any one of claims 31 to 41, wherein said wireless communication means comprises one or more transmitting elements for transmitting signals in a first channel of said wireless communications network and one or more receiving elements for receiving signals in a second channel of said wireless communications network.

55. The access point of claim 54, wherein said electrical connection means is operable to receive power from a mains electricity supply through AC power cables and said first channel and said second channel are provided in said power cables.

56. The access point of claim 54, wherein said electrical connection means is operable to be connected to fibre optic cables and said first channel and said second channel are provided in said fibre optic cables.

57. The access point of any one of claims 51 to 56, wherein said one or more transmitting elements and said one or more receiving elements are arranged in a substantially circular array.

58. The access point of claim 57, wherein said circular array comprises said one or more transmitting elements alternately interspersed with said one or more receiving elements.

59. The access point of any one of claims 31 to 55, wherein said signals are radio signals.

60. The access point of any one of claims 31 to 56, wherein said signals are infrared signals.

61. A method for restoring signal to noise ratio in the access point of any one of claims 32 to 61, the method comprising:

receiving signals from a wireless network;

amplifying said signals;

down-converting said signals;

decoding said signals;

re-encoding said signals; and

transmitting said signals.

62. A home entertainment network comprising a number of items of home entertainment equipment each having a wireless adaptor for forming together a wireless network, and an access point according to any one preceding claim.

63. A wireless communications device substantially as described herein, with reference to the accompanying drawings.

64. An access point for use in a wireless communications network, substantially as described herein, with reference to the accompanying drawings.

INVESTOR IN PEOPLE

Application No: GB0506681.6 **Examiner:** Gareth Griffiths

Claims searched: 1 & 32 **Date of search:** 22 August 2005

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
X,E	1-29, 32-62	WO2005/057989 A1 (KATES) whole document
X	1-29, 32-62	WO2004/066539 A2 (SYMBOL) p.6 line 27 - p.10 line 6
X	1-29, 32-62	US2003/0199247 A1 (STRIEMER) paras 35-47 & abstract

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC[X] :

H4L

Worldwide search of patent documents classified in the following areas of the IPC[07]

H04B; H04L; H05B

The following online and other databases have been used in the preparation of this search report

WPI, EPODOC