(12) UK Patent (19) GB (11) 2 201 866 (13) B

(54) Title of Invention

Improvements in or relating to cellular telephone apparatus and a cellular communications system

(51) INT CL[4]; H04Q 7/04

(21) Application No
8705005.0

(22) Date of filing
04.03.1987

(43) Application published
07.09.1988

(45) Patent published
17.04.1991

(72) Inventor(s)
Michael Victor Rodrigues

(73) Proprietor(s)
Michael Victor Rodrigues
19 Fosse Way
Ealing
London W13 0BZ
United Kingdom

(74) Agent and/or
Address for Service
Michael Victor Rodrigues
19 Fosse Way
Ealing
London W13 0BZ
United Kingdom

(52) Domestic classification
(Edition K)
H4L LECX
U1S S2204 S2215

(56) Documents cited
GB2124454 A
EP0212761 A2
EP0148651 A1
US4562307 A
US4332981 A
US4039760 A

(58) Field of search

As for published application
2201866 A *viz:*
UK CL H4L
INT CL H04B, H04Q
updated as appropriate

2201869

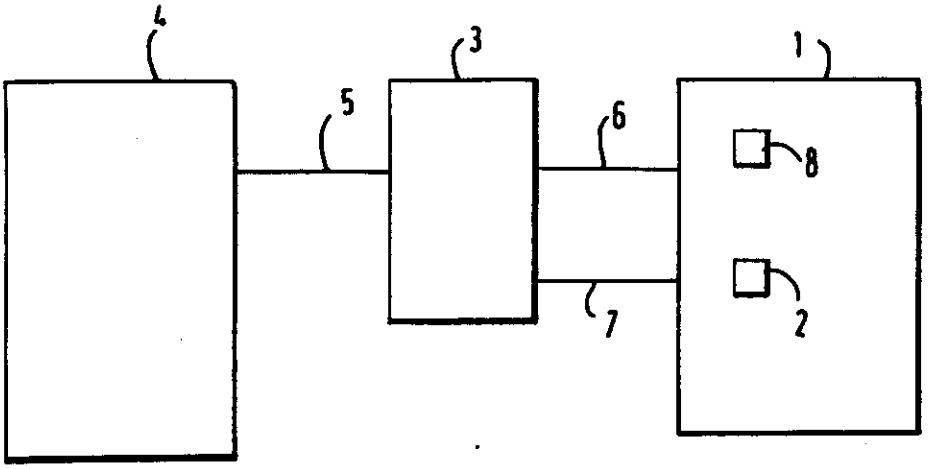

FIG 1

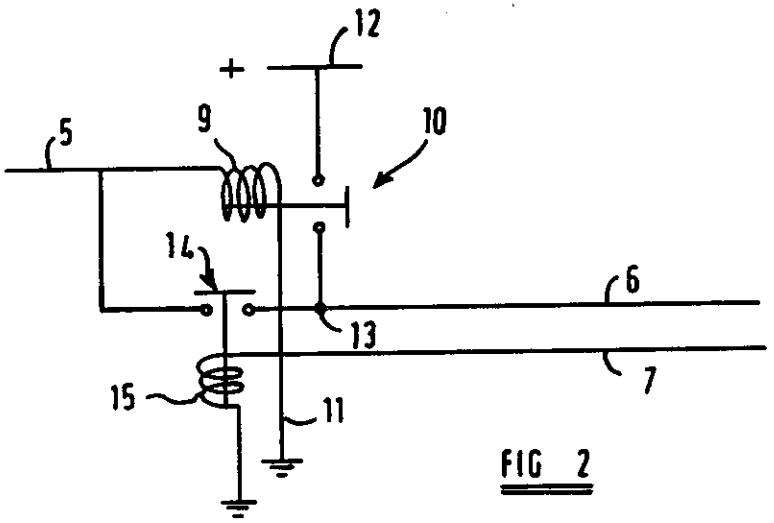

FIG 2

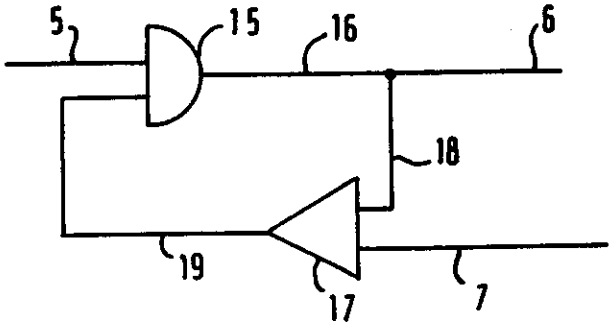

FIG 3

2201866

Improvements in or relating to cellular telephone apparatus and a cellular communication system

THE PRESENT INVENTION relates to a cellular telephone apparatus and a cellular communication system. More particularly the invention relates to a transportable or hand held portable cellular telephone apparatus, and a cellular communication system for use with such apparatus.

During recent years an extensive national public mobile radio telecommunications network has been established, enabling one to make or receive telephone calls from a phone in a vehicle, brief case or pocket, to any other telephone in the world, which works almost as conveniently as a home or office phone.

The network which is also known as "Cellular Communications" divides the area of a country into smaller areas called "cells". Each cell is served by a radio transmitting and receiving station known as a "base station", the range of which overlaps adjacent cells. Utilizing specially dedicated radio channels (of typical 25 KHz separation and 45 MHz duplex spacing) in the frequency bands of typically 890 - 915 MHz (for transmitting) and 935 - 960 MHz (for receiving), each cell phone (also known as a "mobile") is in communication with the cell area base station which in turn is (landline and microwave) linked back to a central computor controlled electronic "Mobile Switching Centre" (MSC) also known as an "Electronic Mobile Exchange" (EMX). The Electronic Mobile Exchange

provides the necessary telecommunication link with other mobiles in the same and other cells and also with the public national and international switched telephone network.

As cellphone users move from one cell area to another, the system automatically switches control of the call from the cells they are leaving to the cells they are entering. The process known as "Hand Off" enables the cell-phone users to continue their calls uninterrupted while moving around the country. The Computer Controlled Electronic Mobile Exchange is provided with complicated software to monitor and control the whole system.

At present, to scan the broad band frequency spectrum of Cellular Radio, and to Register, Monitor and Respond to EMX control commands each cell-phone apparatus is provided with monitoring electronic apparatus including typically:-

- a Central Processing Unit (CPU)
- a Synthesizer
- a Universal Asychronous Receiver/Transmitter (UART)
- A Decoder/Encoder Unit
- an Analogue to Digital Converter
- a Watchdog Circuit
- an Audio Path Circuit

all of which must be active or energized in the "Idle Mode" (the condition in which a cell-phone apparatus has registered its identity/presence and is ready to receive calls; but is neither being paged, nor making, nor receiving a telephone call).

The big drawback or disadvantage of present cell-phone apparatus/Cellular Systems is that in this

Idle Mode the electric current consumption (of the monitoring apparatus) is significantly high (typically 80 - 120 milliamps), largely because at this high frequency spectrum, the technology does not yet exist to manufacture low power, micro-chip integrated circuitory. This disadvantage is further aggravated by command signals from the EMX requiring mobiles to transmit periodically to register and reregister their presence, identification and cell area location.

Whilst this disadvantage is not so significant with cell-phones that are connected to a large source of energy, such as motor vehicle mounted units, (which can be driven by the vehicle battery), this particular difficulty can constitute a major problem with hand held portables, since such cell-phones at the present point in time only have a very limited battery life (typically 8 to 12 hours) before requiring a recharge or replacement. Consequently present day hand held portables are heavy and bulky and in the absence of battery energy conservation embodiments, further significant development towards miniaturization and weight reductions are bleak.

By contrast also during recent years a Digital Radio Paging Network has been established enabling a Radio Pager User to be alerted from any Telephone with access to the Public Telephone Network. By directly dialling the users Radio Paging Number (typically without charge); one is connected to an unmanned automatic Computer Controlled Radio Paging Centre which is (land-line and micro-wave) linked to Transmitting Stations covering most of the Country. Radio Pagers are typically very small and light have long battery life expectancies. This is largely because the radio frequencies they receive and operate on are relatively

lower (typically 150 MHz), enabling (with present day technology) the use of integrated micro-chip transistorized circuitry. Batteries energy conservation is also enhanced by micro-chip clock circuits which provide frequent periodic cyclic switching "On" and "Off" of the radio pager receiver. The "Off" period is typically substantially longer than the "On" period.

The object of this invention is to overcome the aforesaid major disadvantage of hand-held portable Cell-phone by providing embodiments where in its existing battery energy is significantly conserved when no calls are made or received, while still being contactable and available to receive a call.

According to this invention there is provided a cellular radio telephone apparatus, comprising means to establish connection with and receive electric power from a battery, VHF radio receiver circuit/control circuits, and duplex UHF cellular radio telephone electronic circuits driven by said electric power adapted to receive, monitor, process and transmit cellular telephone signals, there being a normally open controlled relay switch between the said battery and said duplex UHF cellular radio telephone electronic circuits, and means to close said relay switch in response to a specific VHF radio transmitted signal received by said VHF receiver in order to activate said duplex UHF cellular radio telephone electronic circuits.

Preferably said means to activate the relay switch comprise a radio receiver adapted to receive a digitally coded radio signal of a predetermined frequency, and a decoder circuit adapted to decode the signal and to respond to a specific digitally coded signal.

Conveniently the radio receiver is adapted to receive a radio signal having a frequency not below 138 MHz and not above 174 MHz.

Advantageously the radio receiver is adapted to receive a radio signal of a predetermined frequency having a bandwidth of 25 KHz.

Preferably said radio signal has a frequency of substantially 150 MHz.

Conveniently means are provided which, when said relay switch has been closed in response to said specific radio transmitted signal, maintain the relay switch in the closed condition at least until a predetermined time has elapsed.

Preferably the means to operate the relay switch are such that the relay switch is maintained closed until a predetermined signal is provided.

Conveniently ~~said~~ means provided to generate said predetermined signal are adapted to be ~~de~~activated at the termination of a call received by the apparatus.

Preferably the means to activate the normally off relay switch comprise a latching circuit adapted to be latched in a predetermined condition in response to said specific transmitted signal.

Conveniently said latching circuit incorporates a relay adapted to be closed in response to said specific transmitted signal, the relay closing a current path which maintains the relay in a closed condition, said current path incorporating a closed second relay, said closed second relay being adapted to open in response to said predetermined signal to release the latching circuit.

Advantageously said latching circuit incorporates an OR gate adapted to be provided with a pulse in response to said specific transmitted signal, the output of the OR gate being connected to one input of a NAND gate, the output of the NAND gate being connected to the other input of the OR gate, the output of the OR gate being connected to a switching arrangement adapted to activate the normally inactive receiver and transmitter, a lead being connected to the other input of the NAND gate adapted to provide a said predetermined signal to the NAND gate when it is desired to deactivate ~~the high frequency receiver.~~ said UHF circuits

The invention also relates to a cellular telecommunication system comprising a plurality of cellular telephones in accordance with the invention and a plurality of base stations, each base station comprising means to transmit signals to and receive signals from the said electronic circuits of the cellular telephone, the system further including means to transmit said specific radio signals to the cellular telephones.

Preferably each base station is provided with means to transmit said specific radio signals.

Conveniently the system comprises a mobile switching centre and/or an electronic mobile exchange adapted to control the transmission of said specific signals and being adapted to control the transmission of additional signals to the said electronic circuits of a cellular telephone, the arrangement being such that the predetermined signal is transmitted a predetermined period of time before said additional signals to said electronic circuits are transmitted.

Advantageously the means to transmit said specific signals transmit the signals at a frequency not below 138 MHz and not above 174 MHz.

In order that the invention may be more readily understood, and so that further features thereof may be appreciated, the invention will now be described by way of example with reference to the accompanying drawings in which:

FIGURE 1 is a block circuit diagram of a cellular telephone in accordance with the invention,

FIGURE 2 illustrates a switching circuit that forms part of the embodiment of Figure 1;

FIGURE 3 is a circuit diagram of an alternative switching arrangement which can form part of an alternative embodiment of the invention.

Referring initially to the drawings a conventional cellular telephone 1 is indicated by a simple block. The cellular telephone itself does not require a description for a full understanding of the present invention, but the cellular telephone is provided with monitoring electronic apparatus to enable the cellular telephone to communicate, via a base station, with the electronic mobile exchange or mobile switching station of the cellular communication system in order to register, monitor and respond to control commands. The cellular telephone is also provided with the usual circuits and facilities to enable the user of the telephone to make and receive calls.

At this stage it should be mentioned that the cellular telephone is provided with a reset button 2 which can be pressed, by the operator of the cellular

telephone, at the end of a call. In alternative types of cellular telephone different arrangements are provided, such as a magnetic rest for a handpiece of the cellular telephone, but means are always provided which are actuated at the end of a call on a cellular telephone to restore the cellular telephone to the idle condition.

In the present invention, the cellular telephone is associated with a switching circuit 3 which can effectively be used to switch on the main cellular telephone apparatus. Thus the cellular telephone is, in use, completely switched off until it is activated by the switching circuit 3.

The switching circuit 3, which is a relay switching circuit, is activated in response to a specific signal received by a low frequency narrow band signal receiving means 4. The low frequency narrow band signal receiving means 4 may comprise a circuit equivalent to a conventional digital radio pager which responds to a low frequency signal, typically of 150 MHz. Thus, such a signal receiving means may readily be fabricated utilising microchip technology, and consequently the narrow band signal receiving means 4 may be permanently activated whilst only consuming a relatively small amount of power. The amount of power consumption may be further reduced by cyclically switching the signal receiving means 4 on and off in a regular manner, so that during any period of time the receiving means 4 is only activated for relatively brief periods which are spaced apart.

In the present invention, when the appropriate allocated signal is received by the low frequency signal receiving circuit 4, instead of actuating a buzzer or bleeper, as in the case of a conventional radio pager, a signal is passed, over the lead 5, to the relay

switching arrangement 3. When it receives a signal over the lead 5, even if it is a transitory signal, the switching arrangement 3 switches on the main battery supply to the rest of the cellular telephone apparatus. The cellular telephone apparatus is thus fully activated and can register its presence, via the nearest base station, to the electronic mobile exchange or mobile switching centre. The cellular telephone may receive appropriate command signals, and an audio channel may then be opened to enable the cellular telephone to receive a call.

It will thus be understood that when a call is to be made to a particular cellular telephone initially the cellular telephone will receive a low frequency narrow band signal to be received by the receiving means 4, and this will serve to activate the main circuits of the cellular telephone. Subsequently, when the cellular telephone has been activated, the cellular telephone will receive the conventional signals to establish the required communication so that the person using the cellular telephone can receive the call.

When a call is accepted, and a conversation is in progress, an appropriate signal may be provided, from the cellular telephone 1, via the lead 7, to the switching arrangement 3, to maintain the switching arrangement 3 in such a condition that the main battery is kept connected to the rest of the cellular telephone apparatus. Thus the switching arrangement 3 can be considered to be a latching circuit.

Additionally, the switching arrangement 3 may be provided with a time delay arrangement so that, whenever the switching arrangement 3 is activated in response to a signal from the receiving means 4 over the lead 5, the switching arrangement will remain in a

condition in which it maintains the battery supply to the cellular telephone apparatus for at least a predetermined period of time which may, for example, be ten minutes. This should be quite sufficient to enable the user of the cellular telephone apparatus to accept the call, or if the call is lost due to interference or for some other unforeseen cause, to accept a second attempt made by the same caller.

It will be understood that the mobile switching centre or electronic mobile exchange will be so arranged, and will be provided with such software, that when it is desired to put a call through to a cellular telephone, initially a command is forwarded to a low frequency transmitter which transmits a digital signal to be received by the appropriate receiving means 4, and after a predetermined time delay, the normal high-frequency signals will be transmitted to the cellular telephone. It is envisaged that the existing radio paging transmitters may be utilised to transmit the initial low frequency signal, although it may be preferred to install additional low frequency transmitters to perform this function. These low frequency transmitters need not be located at the existing base stations, but may be so located if desired.

When a call made on a cellular telephone is terminated, a button such as the reset button 2 may be pressed. In the described embodiment, when the reset button 2 is pressed the signal transmitted over the lead 7 to the switching arrangement 3 is terminated and this acts to alter the state of the switching arrangement 3 such that a signal is no longer provided to the cellular telephone along the lead 6. The main circuits, including the receiver and transmitter, of the cellular telephone is thus effectively switched off, saving the batteries of the cellular telephone.

The cellular telephone may, of course, be provided with an override button 8 which serves to activate an appropriate by pass switch within the cellular telephone to ensure that the cellular telephone is always switched on and is thus always able to receive conventional high frequency broadband signals, should the person using the cellular telephone so desire. Also, of course, the cellular telephone will be provided with appropriate controls to enable the cellular telephone to be activated at will when it is desired to make a call from the cellular telephone.

Referring now to Figure 2 one example of the switching circuit 3 is illustrated. It can be seen that the lead 5 is connected, through the solenoid coil 9 of a normally open solenoid operated relay switch 10 to earth, via lead 11. The relay, when closed, serves to connect a positive rail 12, to a terminal 13 which is connected to the line 6 which extends to the cellular telephone 1. The terminal 13 is also connected, by means of the contacts of a normally closed solenoid operated relay 14 to the lead 5 and thus to the input of the coil 9 of the solenoid of the relay 10.

If the circuit is in the condition illustrated in Figure 2, when the circuit 4 receives the low frequency signal a pulse is passed through the lead 5 which energizes the coil 9, thus closing the relay 10. Current from the positive rail 12 is thus fed to the terminal 13. The current from the terminal 13 can then pass through the lead 6 to activate the switching arrangement within the cellular telephone 1. Also current from the terminal 13 flows through the normally closed contacts of the relay 14 to the coil 9 of the relay 10, thus ensuring that the relay 10 is kept closed, even when the pulse is no longer received from the low frequency circuit.

The lead 7 is connected through the coil 15 of the normally closed relay 14 to earth and the arrangement is such that when the reset button 8 is pressed on the cellular telephone a pulse passes through the lead 7, and through the coil 15, thus opening the normally closed relay 14. As the normally closed relay 14 opens the circuit from the positive rail 12, through the closed contacts of the relay 10, the terminal 13 and the coil 9 of the relay 10 is broken. Thus the relay 10 re-opens, thus breaking the contact between the rail 12 and the terminal 13. Thus the cellular telephone is then de-activated, and returned to the preliminary or idle condition.

Figure 3 illustrates a circuit which can be used in place of the circuit of Figure 2, the circuit of Figure 3 being a logic circuit. The lead 5 is connected to one input of an OR gate 15. The output 16 of the OR gate 15 is connected to the lead 6 and is also connected to one input of a NAND gate 17 by means of the lead 18. The other input of the NAND gate is connected to the lead 7. The output 19 of the NAND gate 17 is connected to the other input of the OR gate 15. When a signal is received by the low frequency circuit, a logic one appears on the lead 5 which is connected to the OR gate 15. This causes a logic one to appear on the lead 16 and thus on the lead 6. Since a logic one appears on the lead 16 the logic one also appears on the lead 18 and thus one input of the NAND gate 17 receives a logic one, thus causing the logic one to be present on the output 19 which is connected to the OR gate 15. The OR gate thus remains activated even if the initial signal provided on the lead 5 terminates. However, when the reset button 8 is pressed on the cellular telephone a second logic one is supplied, through the lead 7, to the NAND gate 17, thus causing that gate to switch off, thus causing the OR gate 15 to switch off, thus terminating

the logic one present on the lead 6.

The switching circuit 3 may, of course, be constructed in many other ways whilst providing the desired switching effect.

It is to be appreciated, therefore, that when the apparatus of the present invention is utilised the low frequency circuit is normally active, and since this is a low frequency circuit, which embodies integrated micro-circuitry, it is possible to run the circuit for a long period of time with only a minimum power consumption. When the low frequency circuit receives an appropriate signal, the main circuits, including the receiver and transmitter, of the cellular telephone are activated, the cellular telephone can then receive a conventional signal. Thus the low frequency circuit provides only a low current drain while the apparatus is in the quiescent or idle state, and the cellular telephone may operate in the manner of a conventional cellular telephone when it has been activated. Thus only a small battery may be needed to power the main circuits of the cellular telephone, since these circuits will only consume power when a call is in progress.

It is thus possible to provide a cellular telephone that is truly pocket sized, that incorporates only a relatively small battery, that will operate in the normal way for a substantial period of time before the battery needs replacing or recharging.

CLAIMS:

1. A cellular radio telephone apparatus, said apparatus comprising means to establish connection with and receive electric power from a battery, VHF radio receiver circuit/control circuits, and duplex UHF cellular radio telephone electronic circuits driven by said electric power adapted to receive, monitor, process and transmit cellular telephone signals, there being a normally open controlled relay switch between the battery and said duplex UHF cellular radio telephone electronic circuits, and means to close said relay switch in response to a specific VHF radio transmitted signal received by said VHF receiver in order to activate said duplex UHF cellular radio telephone electronic circuits.

2. An apparatus according to claim 1 wherein said means to activate the relay switch comprise a radio receiver adapted to receive a digitally coded radio signal of a predetermined frequency, and a decoder circuit adapted to decode the signal and to respond to a specific digitally coded signal.

3. An apparatus according to claim 2 wherein the radio receiver is adapted to receive a radio signal having a frequency not below 138 MHz and not above 174 MHz.

4. An apparatus according to claim 2 or 3 wherein the radio receiver is adapted to receive a radio signal of a predetermined frequency having a bandwidth of 25 KHz.

5. An apparatus according to claim 2, 3 or 4 wherein said radio signal has a frequency of substantially 150 MHz.

6. An apparatus according to any one of the preceding claims wherein means are provided which, when said relay switch has been closed in response to said

specific radio transmitted signal, maintain the relay switch in the closed condition at least until a predetermined time has elapsed.

7. An apparatus according to any one of the preceding claims wherein the means to operate the relay switch are such that the relay switch is maintained closed until a predetermined signal is provided.

8. An apparatus according to claim 7 wherein ~~said~~ means provided to generate said predetermined signal are adapted to be ~~de~~activated at the termination of a call received by the apparatus.

9. An apparatus according to any one of the preceding claims wherein the means to activate the normally off relay switch comprise a latching circuit adapted to be latched in a predetermined condition in response to said specific transmitted signal.

10. An apparatus according to claim 9, wherein said latching circuit incorporates a relay adapted to be closed in response to said specific transmitted signal, the relay closing a current path which maintains the relay in a closed condition, said current path incorporating a closed second relay, said closed second relay being adapted to open in response to said predetermined signal to release the latching circuit.

11. An apparatus according to claim 9 wherein said latching circuit incorporates an OR gate adapted to be provided with a pulse in response to said specific transmitted signal, the output of the OR gate being connected to one input of a NAND gate, the output of the NAND gate being connected to the other input of the OR gate, the output of the OR gate being connected to a switching arrangement adapted to activate the normally

inactive receiver and transmitter, a lead being connected to the other input of the NAND gate adapted to provide a said predetermined signal to the NAND gate when it is desired to deactivate ~~the high frequency receiver~~ said UHF circuits.

12. A cellular telephone apparatus substantially as herein described with reference to and as shown in Figure 1 of the accompanying drawings.

13. A cellular telephone apparatus substantially as herein described with reference to and as shown in Figure 1 of the accompanying drawings as mofidied by Figure 2.

14. A cellular telephone apparatus substantially as herein described with reference to and as shown in Figure 1 of the accompanying drawings as modified by Figure 3.

15. A cellular telecommunication system comprising a plurality of cellular telephones according to any one of claims 1 to 14 and a plurality of base stations, each base station comprising means to transmit signals to and receive signals from the said electronic circuits of the cellular telephone, the system further including means to transmit said specific radio signals to the cellular telephones.

16. A cellular telephone system according to claim 15 wherein each base station is provided with means to transmit said specific radio signals.

17. A cellular telephone system according to claim 15 wherein the system comprises a mobile switching centre and/or an electronic mobile exchange adapted to control the transmission of said specific signals and

being adapted to control the transmission of additional signals to the said electronic circuits of a cellular telephone, the arrangement being such that the predetermined signal is transmitted a predetermined period of time before said additional signals to said electronic circuits are transmitted.

18. A cellular telephone system according to any one of claims 15 to 17 wherein the means to transmit said specific signals transmit the signals at a frequency not below 138 MHz and not above 174 MHz.

19. A cellular telephone system according to any one of the preceding claims, wherein an additional manual "On/Off" bypass switch is provided to short circuit the contacts of the said normally open control relay switch.

REGISTER ENTRY FOR GB2201866

Form 1 Application No GB8705005.0 filing date 04.03.1987

Title IMPROVEMENTS IN OR RELATING TO CELLULAR TELEPHONE APPARATUS AND A CELLULAR COMMUNICATIONS SYSTEM

Applicant/Proprietor
MICHAEL VICTOR RODRIGUES, 19 Fosse Way, Ealing, London W13 0BZ, United Kingdom [ADP No. 01289347001]

Inventor
MICHAEL VICTOR RODRIGUES, 19 Fosse Way, Ealing, London W13 0BZ, United Kingdom [ADP No. 01289347001]

Classified to
H4L U1S
H04Q

Address for Service
MICHAEL VICTOR RODRIGUES, 19 Fosse Way, Ealing, London W13 0BZ, United Kingdom [ADP No. 01289347001]

Publication No GB2201866 dated 07.09.1988

Examination requested 25.05.1989

Patent Granted with effect from 17.04.1991 (Section 25(1)) with title IMPROVEMENTS IN OR RELATING TO CELLULAR TELEPHONE APPARATUS AND A CELLULAR COMMUNICATIONS SYSTEM

19.12.1989 Late filing of Patents Form 10/77 allowed by virtue of Rule 110(3A)
Entry Type 10.1 Staff ID. AGB1 Auth ID. F53

04.01.1993 Application under Section 32 filed on 24.12.1992
Entry Type 8.1 Staff ID. KH1 Auth ID. F21

06.01.1993 Notification of change of Address For Service name and address of
MICHAEL VICTOR RODRIGUES, 19 Fosse Way, Ealing, London W13 0BZ, United Kingdom [ADP No. 01289347001]
to
MOTOROLA, European Intellectual Property Operation, Jays Close, Viables Industrial Estate, BASINGSTOKE, Hampshire, RG22 4PD, United Kingdom [ADP No. 00001180001]
dated 06.11.1992. Official evidence filed on GB2201866
Entry Type 7.1 Staff ID. SA Auth ID. AO

14.01.1993 MOTOROLA INC, Incorporated in USA - Delaware, Corporate Offices, 1303 East Algonquin Road, Schaumburg, Illinois 60196, United States of America [ADP No. 00615336001]
registered as Applicant/Proprietor in place of
MICHAEL VICTOR RODRIGUES, 19 Fosse Way, Ealing, London W13 0BZ, United Kingdom [ADP No. 01289347001]
by virtue of deed of assignment dated 06.11.1992. Certified copy filed on GB2201866
Entry Type 8.4 Staff ID. SA Auth ID. F21

**** END OF REGISTER ENTRY ****

RENEWAL DETAILS

PUBLICATION NUMBER GB2201866

PROPRIETOR(S)

Motorola Inc, Incorporated in USA - Delaware, Corporate Offices, 1303 East Algonquin Road, Schaumburg, Illinois 60196, United States of America

DATE FILED	04.03.1987
DATE GRANTED	17.04.1991
DATE NEXT RENEWAL DUE	04.03.1994
DATE NOT IN FORCE	
DATE OF LAST RENEWAL	29.04.1993
YEAR OF LAST RENEWAL	07
STATUS	PATENT IN FORCE