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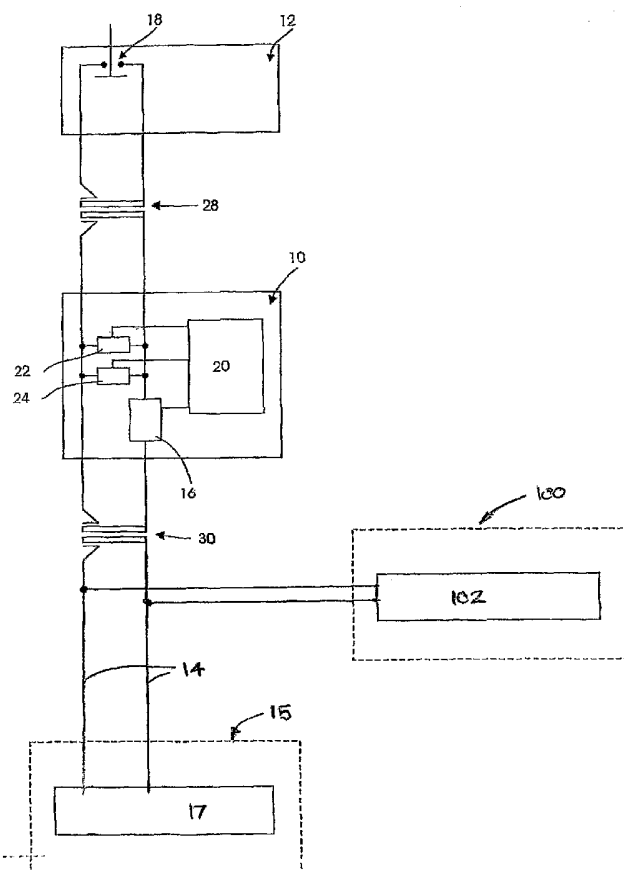
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[Continued on next page]

- (54) Title: METHOD AND MEANS OF ADMINISTERING COMMUNICATION ON A LINE



(57) Abstract: With conventional telephone line barring facilities, the line is normally barred and the line barring facility interrogates the normally barred line for an authorisation code when a communication is initiated with the use of a compatible telephone instrument. To unbar the line, the telephone user is required to enter an authorisation code by means of the telephone keypad. This process can be automated using the code transmission module 10 which is adapted for location closely adjacent a telephone instrument 12 and is interposed in the telephone line 14 between the telephone instrument 12 and the telephone exchange 15 (not shown) by way of telephone jacks 28 and 30. The code transmission module 10 may be provided with a code hopping facility. To manage the above mentioned process, a control centre 100 is located remotely of the code transmission module 10. The control centre 100 is connected to the network of which the line 14 forms a part and different authorisation codes can be transmitted periodically to one or more of the code transmission modules 10 on the network using transmission equipment 102 located at the control centre 100. The control centre 100 can be situated at the exchange 15 or exchanges serving the network of which the line 14 forms a part, but this is not necessary and it might be better for the control centre 100 to be located remotely of both the code transmission modules 10 on the network and the exchange or exchanges serving the code transmission modules 10, since this will further enhance the security of the system.



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METHOD AND MEANS OF ADMINISTERING COMMUNICATIONS ON A LINE

Background to the invention

This invention relates to a method and means of administering communications on a line and it will be described with specific reference to the administration of communication on a land-based telephone line. It will be appreciated, however, that this is not intended to restrict the application of the invention to landline telephone communications.

South African Patent No. 2002/4083 describes and claims line administration apparatus that, in effect automates the normally manual process of barring and unbarring telephone lines as a means, primarily, of reducing so-called "clip-on fraud" in which a perpetrator clips a telephone instrument onto an un-barred line and makes unauthorised calls at the expense of the subscriber in respect of that line.

This invention seeks to incorporate line maintenance and testing functionality into the line administration apparatus of South African Patent No. 2002/4083.

Summary of the invention

This invention provides a method of administering communications on a line extending between administration and user equipment, the method comprising the steps of:

barring the line against the transmission of unauthorised communication;

monitoring the line for the initiation of communication from the user equipment end of the line;

seizing the line on the initiation of such communication;

1
2 automatically transmitting an authorisation code from the user equipment end of
3 the line to the administration equipment;

4
5 determining, within the administration equipment, whether or not the authorisation
6 code that is valid for the user equipment;

7
8 releasing the line for communication if the received authorisation code is valid for
9 the user equipment; and

10
11 periodically changing the user equipment authorisation code by transmitting a
12 different user equipment authorisation code to the user equipment from a point
13 remotely of the user equipment.

14
15 The method of administering communications on a line relies on conventional means of
16 seizing and releasing a communications line such that no communication is possible on the
17 line when seized and communication is only possible once the line has been released for
18 communication.

19
20 Within the administration equipment, the authorisation code received is compared with the
21 administration equipment records in respect of the user equipment to determine whether or
22 not the authorisation code is valid for that user equipment.

23
24 The periodicity of the changes made to the authorisation code of a particular item of user
25 equipment may vary from nil to frequent. So, for instance, the authorisation code could
26 require changing only when an operator determines that the authorisation code for that
27 piece of user equipment may have been compromised. In this example, the user
28 equipment authorisation code will be changed to counter any possible breach of the
29 security of the user equipment authorisation code, but if no such breach occurs, then no
30 change will be necessary.

31
32 Alternatively, the user equipment authorisation code could be changed more frequently,
33 whether manually or automatically.

1
2 The system described and claimed in South African Patent No. 2002/4083 lends itself to
3 the use of code hopping techniques in which the user equipment authorisation codes are
4 changed with the use of an encryption algorithm embedded in the user equipment. The
5 user equipment authorisation code changes automatically from time to time, for instance,
6 each time the user equipment is used and the keys used to generate the changing user
7 equipment authorisation codes are duplicated or regenerated in the administration
8 equipment to enable the administration equipment to determine whether or not the
9 changing authorisation codes are valid for the user equipment concerned.

10
11 The method of this invention lends itself to use with such code hopping techniques in that
12 the method may include the step of periodically transmitting a different user equipment
13 authorisation code generating key to the user equipment and the administration equipment.

14
15 In each case, the user equipment authorisation codes are changed from a point or site
16 remotely of the item of user equipment concerned. To this end, the remote site may be
17 situated in the administration equipment, but this is not necessary and the remote site
18 could be located remotely of both the user equipment and the administration equipment,
19 thereby further enhancing the security of the system.

20
21 The invention includes apparatus for the administration of communications on a line
22 extending between administration and user equipment, the apparatus comprising:

23
24 means to bar the line against the transmission of unauthorised communication;

25
26 means to monitor the line for the initiation of communication from the user
27 equipment end of the line;

28
29 means to seize the line on the initiation of such communication;

30
31 means automatically to transmit an authorisation code from the user equipment
32 end of the line to the administration equipment;

33

means to determine, within the administration equipment, whether or not the authorisation code that is valid for the user equipment;

means to release the line for communication if the received authorisation code is valid for the user equipment; and

means located remotely of the user equipment that is adapted periodically to change the user equipment authorisation code by transmitting a different user equipment authorisation code to the user equipment.

The apparatus of this invention may be adapted for use with code hopping systems by the inclusion of means adapted periodically to transmit a different user equipment authorisation code generating key to the user equipment and the administration equipment.

The means to change the user equipment authorisation codes may be situated in the administration equipment, but in an alternative form of the invention the code changing means may be located remotely of both the user equipment and the administration equipment.

The communication line may conveniently be constituted by a physical line or cable normally intended for the transmission of communication signals. The invention is, however, intended to extend to a communication line constituted by a communication channel other than a physical line, such as, for instance, a radio frequency communication channel extending terrestrially, between terrestrial- and satellite-based communication equipment or both.

In the preferred form of the invention, the apparatus is intended for the administration of communications on a telecommunication line, the administration equipment being located at a telephone exchange and the user equipment being constituted by a code transmission device or module located in or near a telephone set.

In the event that the telephone set is a normal domestic or office telephone (not a pay phone), the code transmission module may be provided as a plug-in facility adapted for

1 location closely adjacent the telephone.

2
3 In the event, however, that the telephone is a pay phone, the code transmission module
4 may be located within the housing in which the pay phone apparatus is normally secured.
5 In this way, the pay phone and the line extending between the pay phone and the
6 exchange may be protected against fraudulent use.

7
8 In use in a telecommunications network, the code transmission module may be used to
9 perform a number of functions other than simply transmitting authorisation codes to the
10 administration equipment in the exchange and the method and apparatus of the invention
11 are intended to incorporate such additions.

12
13 To this end, the administration equipment may be adapted periodically to transmit a test
14 code to the code transmission module, which is adapted to switch to a test mode on receipt
15 of the test code, in which test mode the code transmission module is adapted to receive
16 one or more test signals transmitted to the code transmission module from the
17 administration equipment, to perform the test associated with each test signal and to
18 transmit the results of the test to the administration equipment.

19
20 Examples of these tests will be described in greater detail below.

21 22 23 **Brief description of the drawings**

24
25 The invention will be further described with reference to the accompanying drawings which
26 is a block diagram of a code transmission module according to the invention.

27 28 29 **Description of embodiments of the invention**

30
31 With the advent of digital telephone exchanges, a number of telephone service providers
32 have been able to provide digital telephone line barring facilities.

1
2 The existing line barring facility is incorporated in the equipment at the exchange. Using
3 such a facility, the line is normally barred and the line barring facility interrogates the
4 normally barred line for an authorisation code when a communication is initiated by a user
5 using user equipment such as a compatible telephone instrument. To unbar the line, the
6 telephone user is then required to enter the correct authorisation code by means of the
7 telephone keypad.

8
9 This normally requires a code that is correct for that line and the user equipment connected
10 to that line. The line will then only be unbarred and released for communication on receipt,
11 by the exchange equipment, of an authorisation code valid for that line and the user
12 equipment concerned.

13
14 In the process of unbarring a line, the exchange equipment is adapted to detect the change
15 in line current that occurs when the telephone handset is lifted and to await the receipt of
16 the authorisation code which will normally be transmitted as a series of Dual Tone Multi
17 Frequency (DTMF) tones from the telephone to the exchange.

18
19 On receipt of the appropriate authorisation code, the exchange equipment unbars the line.

20
21 When the telephone handset is replaced, the exchange equipment detects the change in
22 line current and automatically bars the line once again.

23
24 The code transmission module 10 forming part of the administration apparatus described
25 and claimed in South African Patent No. 2002/4083 is illustrated in the drawing. The code
26 transmission module 10 is adapted for location closely adjacent a telephone instrument 12
27 and is interposed in the telephone line 14 between the telephone instrument 12 and the
28 telephone exchange 15 (not shown) by way of telephone jacks 28 and 30.

29
30 It is also possible to integrate the code transmission module 10 in the instrument circuitry.

31
32 A current sensor 16 is used to detect the change in line current that occurs when the
33 telephone handset (not shown) is lifted off the handset cradle (indicated by a normally open

switch 18).

A processor unit 20 is programmed to seize the line 14 when the current sensor 16 detects current on the line 14 indicating that the handset has been lifted off the cradle 18. The line is seized by means of a line seizing mechanism 22.

Within the system described in South African Patent No. 2002/4083, once the line has been seized, the processor 20 activates a DTMF interface 24 that transmits a valid authorisation code, as a DTMF tone signal, to the exchange 15 by way of the line 14. When, at the end of the call, the handset is replaced on the cradle 18, the current sensor 16 senses the change in line current. In consequence, the processor seizes the line by means of the line seizing mechanism 22 and transmits a barring code down the line 14 by means of the DTMF interface 24. On receipt of the barring code, the line barring facility 17 in the exchange 15 bars the line against further use, thereby returning the line 14 to its normally barred state.

The code transmission module 10 is adapted for location closely adjacent the telephone instrument 12. This will ensure that that any person wishing to make unauthorised use of the line 14 must, of necessity, interrupt or clip onto the line downstream of the code transmission module 10, that is between the exchange 15 and the code transmission module 10. However, at any point between the exchange 15 and the code transmission module 10, the line 14 will have been secured, since a person clipping onto the line 14 will be met with a normally barred line and to unbar the line 14, it will of course be necessary to know and transmit the authorisation code down the line 14.

In order to further minimise the possibility of fraudulent use, the code transmission module 10 may be provided with a code hopping facilities, a code encryption technique adapted periodically to generate a different code, for instance, each time the telephone 12 is used. The line barring facility 17 at the exchange 15 will be provided with suitable decryption facilities. In this way, the line 14 can be secured against replay attacks - attempted fraudulent use of the line 14 in which a person tapping or listening in on the line 14 records the unbarring code and then replays or retransmits the code information to the exchange 15.

1
2 In a developed form of the invention of South African Patent No. 2002/4083, the system
3 may be used to secure pay phones.
4

5 This invention, which relates to an improvement in the invention described and claimed in
6 South African Patent No. 2002/4083 makes use of the code transmission module
7 described above and provides additional functionality by the provision of a control centre
8 100 located remotely of the code transmission module 10.
9

10 In use, the system of this invention can be used to administer communications on the
11 network of which the line 14 forms a part by maintaining all the lines 14 in a state in which
12 the lines 14 are barred against the transmission of normal communication on the lines 14.
13

14 Each code transmission module 10 is then used to monitor its line 14 for the initiation of
15 communication from the user handset situated at the code transmission module 10 end of
16 the line, the current sensor 16 being used to detect the change in line current that occurs
17 when the telephone handset is lifted off the handset cradle (indicated by a normally open
18 switch 18). The line is then seized by means of a line seizing mechanism 22, in the manner
19 described above and the code transmission module 10 then automatically transmits its pre-
20 programmed authorisation code to the exchange 15 serving the code transmission module
21 10.
22

23 Within the exchange 15 serving the code transmission module 10, the authorisation code
24 so transmitted is compared with the exchange's records in respect of the code
25 transmission module 10 to determine whether or not the authorisation code is valid for that
26 code transmission module 10 and its associated user equipment or handset. If it is, the
27 line is released for normal communication.
28

29 The control centre 100 is connected to the network of which the line 14 forms a part and
30 different authorisation codes can be transmitted periodically to one or more of the code
31 transmission modules 10 on the network using transmission equipment 102 located at the
32 control centre 100.
33

1 The control centre 100 can be situated at the exchange 15 or exchanges serving the
2 network of which the line 14 forms a part, but this is not necessary.

3
4 In fact, it might be better for the control centre 100 to be located remotely of both the code
5 transmission modules 10 on the network and the exchange or exchanges serving the code
6 transmission modules 10, since this will further enhance the security of the system.

7
8 The periodicity of the changes made to the authorisation codes of the code transmission
9 modules 10 on the network may vary from no changes in a given period of time to frequent
10 changes within that period, depending on the security regime required by the network
11 operator.

12
13 So, for instance, the code transmission module authorisation codes could be kept constant
14 and changed only when the operator determines that the authorisation code for a particular
15 piece of user equipment may have been compromised. In this example, the code
16 transmission module authorisation code will be changed to counter any possible breach of
17 the security of the user equipment or the authorisation code, but if no such breach occurs,
18 then no change will be necessary.

19
20 Alternatively, the code transmission module authorisation code could be changed more
21 frequently, preferably automatically by means of a predetermined programme of code
22 changes initiated from the control centre 100. This code changing programme does not
23 require code hopping and is simply a method of ensuring that the code transmission
24 modules 10 on the network have their authorisation codes updated regularly.

25
26 Where code hopping techniques are used, however, each of the code transmission
27 modules 10 on the network will be programmed with a key that is used within the code
28 hopping encryption algorithm so that, in use, the authorisation codes of the code
29 transmission modules 10 on the network change automatically from time to time, for
30 instance, each time the user equipment associated with a code transmission module 10 is
31 used.

32
33 The keys used to generate the changing code transmission module authorisation codes

1 are duplicated or regenerated in the exchange serving each code transmission module 10
2 to enable the exchange equipment to determine whether or not the changing authorisation
3 codes are valid for each of the code transmission modules 10 on the network.
4

5 The method of this invention lends itself to use with such code hopping techniques in that
6 the control centre 100 can now be used to periodically transmit a different key to one or all
7 of the code transmission modules 10 on the network.
8

9 At the same time, the control centre 100 will transmit duplicate or complementary keys to
10 the exchange serving the code transmission modules concerned, thereby providing
11 complementary keys to the barring facility 17 at the exchange 15 to enable synchronisation
12 of the code transmission modules 10 on the network with the barring facility 17.
13

14 In a telecommunications network, such as that described immediately above, the code
15 transmission module may be used to perform a number of functions other than simply
16 transmitting authorisation codes to exchange serving the code transmission module 10.
17

18 The code transmission modules 10 on the network are located at the end of the lines 14
19 associated therewith and the code transmission modules 10 are capable of communication
20 with the exchange 15 and the control centre 100. This enables the network operator to
21 monitor, test and undertake a number of maintenance functions on the entire line 14
22 associated with each code transmission module 10 and its associated subscriber
23 equipment.
24

25 By programming the code transmission module 10 to receive, recognise and respond to
26 one or more test codes transmitted either from the exchange serving the code transmission
27 module 10 or the control centre 100, the code transmission module 10 can be used to
28 perform useful remote administration of the network.
29

30 As an example, the code transmission module 10 can be programmed to switch to a
31 general test mode on receipt of a general test code transmitted to the code transmission
32 module 10 by the network operator, either from the exchange serving the code
33 transmission module 10 or from the control centre 100.

1
2 The code transmission module 10 can then be programmed to receive and respond to a
3 number of specific test signals.
4

5 Once in test mode, the network operator can, for instance, cycle the code transmission
6 module 10 through one or more tests by transmitting an appropriate test code to the code
7 transmission module 10.
8

9 For instance, the code transmission module 10 can, on receipt of the appropriate code, test
10 for:
11

12 OFF HOOK SIGNAL – simulate closing of the handset switch 18, which will allow
13 the exchange serving the code transmission module 10 to test the line Voltage;
14

15 ON HOOK SIGNAL – simulate re-opening of the handset switch 18, which will allow
16 the exchange serving the code transmission module 10 to test the line Voltage;
17

18 DC LOOP CURRENT - OFF HOOK SIGNAL – simulate closing of the handset
19 switch 18, which will allow the exchange serving the code transmission module 10
20 to test the line current;
21

22 DIALTONE LEVEL – monitor dial tone signal received from the exchange serving
23 the code transmission module 10 and report if not compliant with the network
24 operator's specifications (e.g. 400Hz modulated by 40Hz – in South Africa);
25

26 TONE RECEPTION AT VARIOUS FREQUENCIES - monitor tone signals
27 transmitted by the exchange serving the code transmission module 10 at a number
28 of frequencies (for instance, a predetermined number of fixed frequencies between
29 400Hz and 3500Hz, stepping up at predetermined multiples) and report if reception
30 fails to comply with the network operator's specifications (e.g. within 30db of signal
31 as transmitted by the exchange) – a particularly important test for data and fax lines
32 that rely on modem communication;
33

AVERAGE LINE NOISE LEVEL - monitor noise level on the line and report if not

1 compliant with the network operator's specifications

2

3

SIDETONE LEVEL - monitor for impedance mismatch and report if not compliant
with the network operator's specifications – a particularly important test for data and
fax lines that rely on modem communication.

4

5

6

1 It will be appreciated that these examples are not intended to limit the invention to specifics
2 but are given purely for the purpose of illustrating the functionality of the code transmission
3 module 10.

4
5 In telecommunications networks generally, the maintenance of the network and the lines
6 forming part of the network are the responsibility of the network operator. With the
7 functionality of this invention programmed into the code transmission module 10, it is
8 possible for the network operator to determine whether or not there are any faults on the
9 line 14 that might fall within its ambit of responsibility.

10
11 The tests described above as well as similar line tests, are made possible with the code
12 transmission module 10 of this invention since the code transmission module 10 is located
13 at the end of the line and it is capable of communication with the exchange serving the
14 code transmission module 10 and the control centre 100, thereby enabling a network
15 operator to discharge its network and line maintenance responsibilities remotely.

16

Claims

1. A method of administering communications on a communications line extending between administration and user equipment, the method comprising the steps of:
 - barring the line against the transmission of unauthorised communication;
 - monitoring the line for the initiation of communication from the user equipment end of the line;
 - seizing the line on the initiation of such communication;
 - automatically generating an authorisation code at the user equipment end of the line and transmitting the authorisation code to the administration equipment;
 - determining, within the administration equipment, whether or not the authorisation code is valid for the user equipment;
 - releasing the line for communication if the received authorisation code is valid for the user equipment; and
 - periodically changing the user equipment authorisation code by transmitting a different user equipment authorisation code to the user equipment from a point remote of the user equipment.
2. A method of administering communications according to claim 1 including the step of using a code hopping technique to change the user equipment authorisation codes automatically from time to time.
3. A method of administering communications according to claim 2 in which a code hopping technique to change the user equipment authorisation codes automatically each time the user equipment is used, the method including the steps of

1 duplicating the encryption keys used to generate the changing user equipment
2 authorisation codes in the administration equipment to enable the administration
3 equipment to determine whether or not the changing authorisation codes are valid
4 for the user equipment concerned.

5
6 4. A method of administering communications according to any one of the preceding
7 claims which includes the step of periodically transmitting a different user
8 equipment authorisation code generating key to the user equipment and the
9 administration equipment.

10
11 5. A method of administering communications according to claim 4 in which the user
12 equipment authorisation codes are changed from a point or site remotely of the
13 item of user equipment concerned.

14
15
16 6. Apparatus for the administration of communications on a communications line
17 extending between administration and user equipment, the apparatus comprising:

18
19 means to bar the line against the transmission of unauthorised
20 communication;

21
22 means to monitor the line for the initiation of communication from the user
23 equipment end of the line;

24
25 means to seize the line on the initiation of such communication;

26
27 means automatically to transmit an authorisation code from the user
28 equipment end of the line to the administration equipment;

29
30 means to determine, within the administration equipment, whether or not
31 the authorisation code that is valid for the user equipment;

32
33 means to release the line for communication if the received authorisation

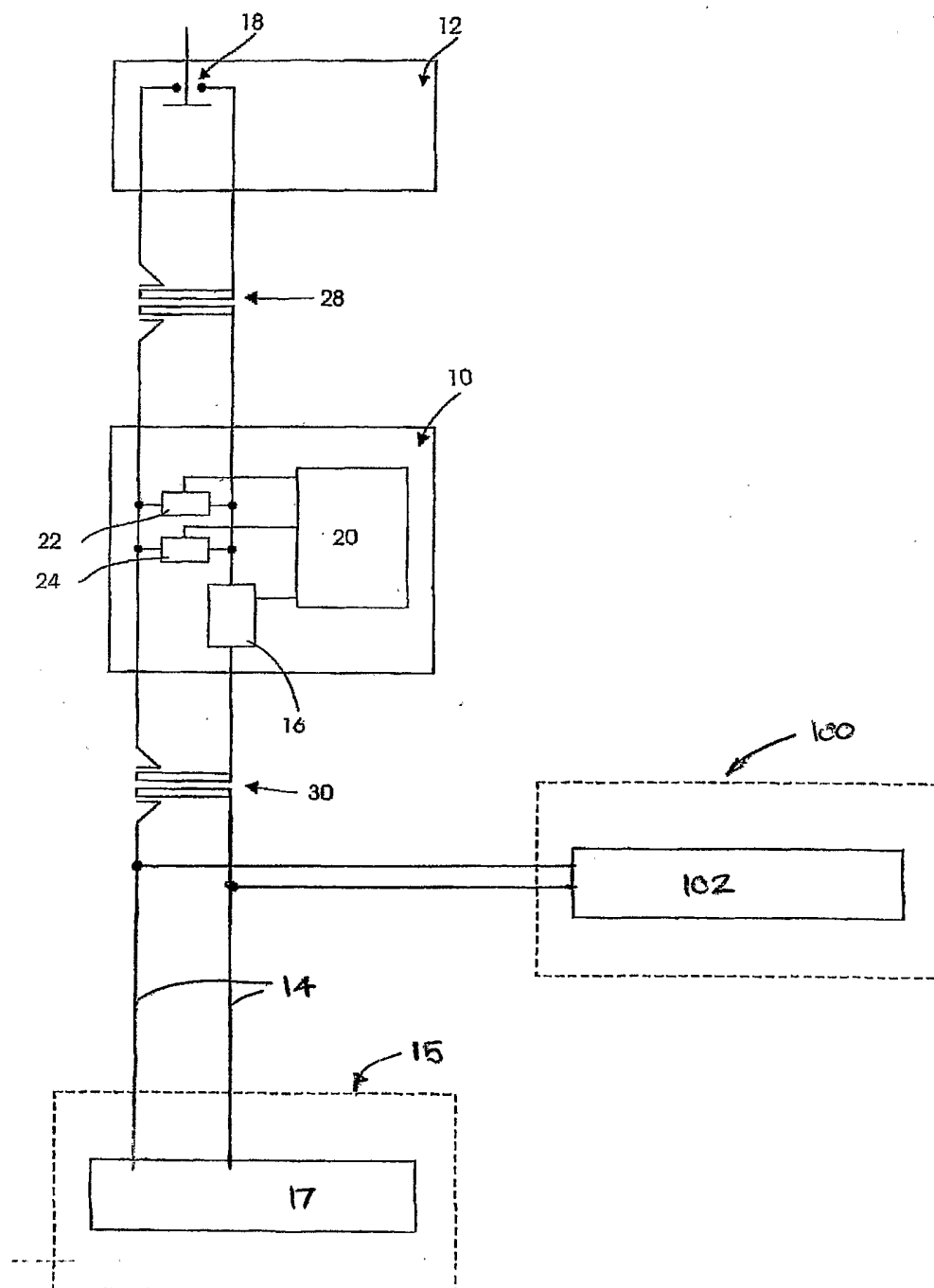
code is valid for the user equipment; and

means located remotely of the user equipment that is adapted periodically to change the user equipment authorisation code by transmitting a different user equipment authorisation code to the user equipment.

7. Apparatus for the administration of communications according to claim 6 that is adapted for use with code hopping systems by the inclusion of means adapted periodically to transmit a different user equipment authorisation code generating key to the user equipment and the administration equipment.
8. Apparatus for the administration of communications according to claim 6 in which the means to change the user equipment authorisation codes is situated in the administration equipment.
9. Apparatus for the administration of communications according to claim 6 in which the means to change the user equipment authorisation codes is located remotely of both the user equipment and the administration equipment.
10. Apparatus for the administration of communications according to any one of claims 6 to 9 in which the communication line is constituted by a physical line or cable normally intended for the transmission of communication signals.
11. Apparatus for the administration of communications according to any one of claims 6 to 10 that is intended for the administration of communications on a telecommunication line, the administration equipment being located at a telephone exchange and the user equipment being constituted by a code transmission device or module located in or near a telephone set.
12. Apparatus for the administration of communications according to claim 11 in which the telephone set is a pay phone, in which event the code transmission module is adapted for location within the housing in which the pay phone apparatus is normally secured.

- 1
2 13. Apparatus for the administration of communications according to claim 11 in which
3 the telephone set is not a pay phone, the code transmission module being
4 constituted by a plug-in facility adapted for location closely adjacent the telephone.
5
- 6 14. Apparatus for the administration of communications according to any one of claims
7 6 to 13 in which the code transmission module is adapted to perform one or more
8 equipment testing functions, the administration equipment being adapted to
9 transmit a test code to the code transmission module, which is adapted to switch to
10 a test mode on receipt of the test code, in which test mode the code transmission
11 module is adapted to receive one or more test signals transmitted to the code
12 transmission module from the administration equipment, to perform the test
13 associated with each test signal and to transmit the results of the test to the
14 administration equipment.
15
- 16 15. A method of administering communications substantially as described in this
17 specification with reference to the accompanying drawing.
18
- 19 16. Apparatus for the administration of communications substantially as described in
20 this specification with reference to the accompanying drawing.

1/1



INTERNATIONAL SEARCH REPORT

International Application No
PCT/ZA2004/000058

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04M3/38 H04M1/66 H04M1/82

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H04M

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

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

EPO-Internal, PAJ, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB 2 343 087 A (JW & LL ENTERPRISES PTY LTD) 26 April 2000 (2000-04-26) page 1, line 5 - line 6 page 2, line 8 - page 5, line 12 page 6, line 15 - page 14, line 13 figures 1,4,5	1-14
X	US 4 897 875 A (LEMIRE JAMES R ET AL) 30 January 1990 (1990-01-30) abstract column 1, line 9 - column 2, line 57 column 14, line 40 - column 18, line 6 figures 1,2,4,5	1-14
A	EP 0 841 828 A (NOKIA MOBILE PHONES LTD) 13 May 1998 (1998-05-13) column 1, line 3 - line 26 column 2, line 4 - column 3, line 45 figure 2	1-14

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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