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NOTICE OF ENTITLEMENT

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being authorised by the Applicant(s)/Nominated Person(s) in respect of an application entitled:

Method for Reacting to Disturbance in a Mobile Communication System
 state the following:-

1. The Applicant(s)/Nominated Person(s) has/have, for the following reasons, gained entitlement from the actual inventor(s):- The Applicant/Nominated Person, by virtue of a Contract between the actual inventors as employees and the Applicant/Nominated Person as employer, is a person which would be entitled to have the patent assigned to it if a patent were granted on an application made by the actual inventors.

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(57) Claim

1. A method for reacting to a disturbance on an uplink frequency in a mobile communication system which comprises a mobile communication network which includes at least one base station and a mobile services switching centre, as well as at least one mobile station which communicates with said base station on an uplink, i.e. receive, frequency, and on a downlink, i.e. transmit frequency of said base station, the method comprising the steps of:

detecting by a mobile communication network of the disturbance on the uplink frequency,

informing by the mobile communication network of a mobile station regarding said disturbance by using a downlink frequency,

commanding the mobile station to listening mode in which the mobile station stays on the same downlink frequency and receives information from the base station, and

shifting by the mobile station to listening mode.

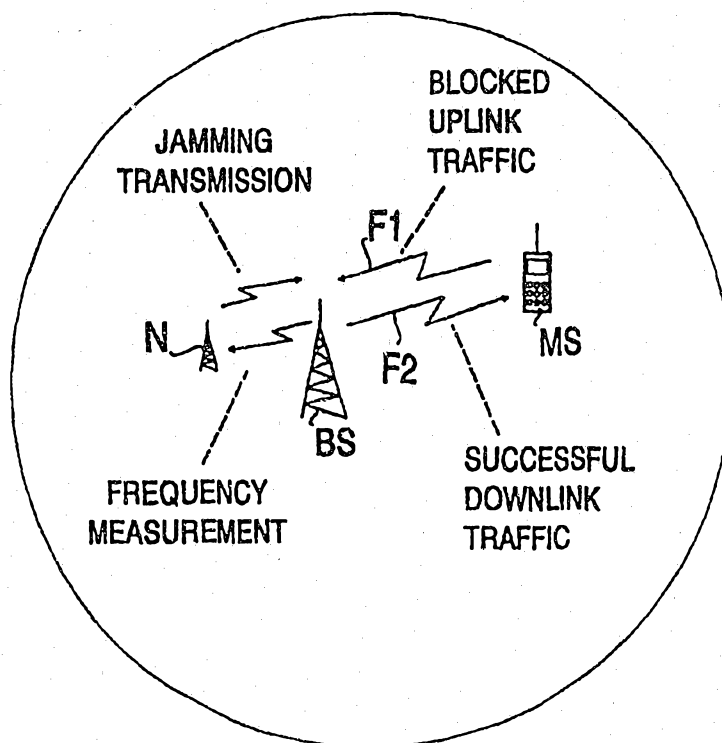


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(54) Title: METHOD FOR REACTING TO DISTURBANCE IN A MOBILE COMMUNICATION SYSTEM

(57) Abstract

A method for reacting to disturbance (N) on an uplink frequency (F1) in a mobile communication system which comprises a mobile communication network which includes at least one base station (BS) and a mobile services switching centre, as well as at least one mobile station (MS) which communicates with said base station (BS) on an uplink, i.e. receive, frequency (F1), and on a downlink, i.e. transmit, frequency (F2) of said base station. In order to react advantageously to an uplink disturbance, the following procedure will be followed: a mobile communication network detects said disturbance (N) on an uplink frequency (F1), the mobile communication network informs a mobile station (MS) of said disturbance by using a downlink frequency (F2) and commands the mobile station (MS) to listening mode in which the mobile station stays on the same downlink frequency (F2) and receives information from the base station (BS), the mobile station (MS) shifts to listening mode.



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Method for reacting to disturbance in a mobile communication system

Field of the Invention

5 The invention relates to a method for reacting to disturbance on an uplink frequency in a mobile communication system which comprises a mobile communication network which includes at least one base station and a mobile services switching centre, as well as at least one
10 mobile station which communicates with said base station on an uplink, i.e. receive, frequency, and on a downlink, i.e. transmit, frequency of said base station.

 The invention relates to mobile communication systems and especially trunked mobile radio systems which
15 comprise control centres, base stations as well as mobile stations, typically radiotelephones, and which systems are cellular, and which system has in each cell one or more radio channels on certain frequencies and which channels are possibly split into time slots. In each cell, i.e. base
20 station, one or more radio channels are used for signalling, while the rest are in traffic channel use.

Background of the Invention

 Present mobile communication systems have a feature according to which mobile stations do not accept a
25 control channel which does not respond to their signalling messages. In cases mobile stations do not receive a response to messages they have transmitted to base stations, they begin to search for a new control channel to use. Furthermore, in the present mobile communication
30 systems, mobile stations are not at all informed of failures in the uplink communication, nor of reasons causing these failures, but they themselves simply notice that a base station and/or a system is not able to respond in a sensible manner to messages and signalling transmitted
35 by the mobile station.

In such a case, as a mobile station notices that signalling between it and the system is not working, the mobile station can not always in all cases independently infer the reasons causing the break. If a base station transmission is interpretable at a mobile station, but the mobile station does not receive any response to its signalling, the mobile station can only identify that the failure occurs in the uplink traffic. Uplink communication is so called, because it is carried out on the receive frequency of a base station.

In cases a mobile station is in normal mode although uplink communication does not work, the phone can not at all utilize those services of a radio system that require acknowledgements or uplink signalling. If, for example, a mobile station is turned on in the service area of such a base station whose uplink radio frequency, typically system frequency or channel, does not work, and the system requires a successful registration of the mobile station to the system before any actual user information can be transmitted, the mobile station is completely useless to its user as the base station is not able to receive registration messages transmitted by the mobile station. The same holds true in cases a mobile station moves from coverage areas of other base stations to an uplink disturbance area. In such a case, a mobile station such as a radiotelephone, cannot update its location information to the system and, thus, is not able in any way to utilize the system services. In such a case, the mobile station begins to scan the frequencies and channels of other base stations in an effort to find a new base station. It is possible that a handover and a base station switch, i.e roaming, succeed, or it may also happen that the base station is not able to find a working base station and its control channel at all, and, as a result, is not

able to utilize the services of the mobile communication system.

Figure 1 shows a situation in which the transmitting power of a mobile station MS is considerably lower than that of a base station BS. In such a case, there may be a prior break in the uplink connection due to differences between up/downlink coverage areas. The figure shows the coverage area of a base station BS by curve C1, and the coverage area of a mobile station MS by curve C2. The aforementioned means that the transmission of the base station BS carries further than from where vehicle-mounted and hand-held mobile stations MS can successfully transmit a radio signal to the base station BS. In this prior art example, the base station does not hear the mobile station MS although the mobile station MS hears the base station BS, the mobile station MS begins to search for a new channel, for example, a control channel. If other channels are available, the mobile station moves to them and drops the original call, but if other frequencies or channels are not available, the mobile station cannot utilize the services of the mobile communication network.

In the prior art analog PMR systems (PMR = Private Mobile Radio), criminals have been able to listen to police communications without authorization, and, thus, it has not been necessary to jam the radio transmitter. If, however, such analog, open channel uplink traffic of a mobile communication system or a mobile radio system has been jammed, the mobile stations have remained on the channel whose uplink frequency is jammed and have been able to receive commands from the system dispatcher on a downlink frequency.

In the prior art trunked systems, which are often networks used by the authorities, for example, police radio networks, a high-grade encryption can be implemented, which makes it impossible to listen to traffic between mobile

stations and base stations. It is, however, certain that these systems will be jammed by criminals in order to, for example, hinder the police command communications. Technically, it is much easier to jam an uplink than a downlink frequency. As the systems used by the authorities only have a limited number of frequencies, a situation can emerge in which a certain base station can only use one frequency, and the signals of other base stations do not reach all parts of the service area of said base station. Furthermore, it is easy to build a jammer which monitors the used frequencies by scanning. For these reasons, disturbance elimination mechanisms that are based on channel circulation are ineffective.

The operation of a radio system can be jammed by a jamming transmitter by way of transmitting on the frequencies in use a radio signal which is more powerful than the utility signal. Jamming can occur both on the transmit (downlink) frequency and the receive (uplink) frequency of a base station. Close to a base station, the downlink radio signal is far stronger than the uplink signal, because of the high transmitting power of a base station, and because the radio signal transmitted by the base station is not significantly attenuated. The level of an uplink radio signal transmitted by a mobile station is lower even at transmission, and, depending on the location of the mobile station, the signal strength may be considerably attenuated close to the base station. Thus, it is much easier to jam an uplink than a downlink signal by a jammer. In practise, the jamming of an uplink signal is the only way to try to hinder the operation of a mobile communication system by way of blocking radio frequencies.

If the spacing of transmit and receive frequencies, the so-called duplex-spacing, i.e. the spacing of uplink and downlink frequencies, is constant, it is possible to efficiently block all the uplink traffic of the

base station by an intelligent jammer. And intelligent jammer measures on which downlink channel the base station is transmitting and immediately blocks the corresponding uplink frequency by a jamming transmission, the uplink frequency being at a duplex-spacing distance from the transmit frequency. In such a case, it does not help that the base station changes its transmit/receive frequency if it suspects jamming, because the new frequency will be jammed, too.

Figure 2 illustrates a possible scenario of jamming of a base station. A gang of criminals robs a bank in an urban area, and they know the location of the base station BS of the police radio network, and set a jammer N on the uplink frequency F1 of the base station BS. The jammed uplink frequency F1 or channel is inoperative, but the corresponding downlink F2 is not. There are police units in the coverage area of the base station BS, and additional units are ordered to the crime scene from elsewhere. The network dispatcher notices a break in uplink frequency F1 in the crime area. The situation may be such that the mobile communication system is economically planned so that the radio cells only have a sufficient enough overlap, i.e. the coverage areas of the base stations overlap as little as possible, and because the crime area is not in the overlap zone, the mobile stations can not search for a channel to use in the coverage area of some other base station.

In the scenario above, the usual analog, so-called open channel system, functions in the following way: the roaming of mobile stations MS, i.e. handover, is carried out by a manual handover performed by the mobile station user. In an open system, no registration of a mobile station MS to the system is required. In such a case, although the uplink frequency F1 or channel is jammed, the dispatcher can transmit commands to mobile stations MS in

the area on the downlink channel or frequency F2 even if it does not receive a response from them. In an open channel system, then, a break in the uplink frequency F1 does not influence the downlink traffic F2. Thus, an open channel
5 has a good jamming resistance.

In the scenario above, a digital trunked system without the operation of the present invention functions as follows. At least an adequate level of security is required of systems used by the authorities, i.e. it is required
10 that mobile stations MS which roam, i.e. switch to a new base station BS, register or at least update their location information to the system. So, in the scenario above, as the registration and location updating requests do not reach the base station BS due to a break in the uplink
15 frequency F1, the mobile stations MS do not accept the channel, but try to search for other control channels of which there are none, because the mobile stations MS are not located in the overlap zone of the base stations BS. As no registration is carried out, the mobile stations MS
20 cannot in any way communicate with the system. The situation above is naturally a serious fault in systems used by the authorities.

Another possible factor blocking uplink traffic is a breakdown of the base station BS receiver or of the
25 mobile station MS transmitter.

Description of the Invention

The aim of this invention is to avoid the problems of the prior art solutions described above.

The aim is to offer a method according to which a
30 mobile communication system can function in the best possible way in cases the functioning of an uplink frequency or channel of a base station breaks due to, for example, disturbance or a technical fault. The aim is to make it possible that mobile stations on the downlink
35 frequency of the base station can still receive information

from the system, and that other mobile stations possibly entering the coverage area of the base station can utilize the services of the mobile communication network.

Therefore, the invention discloses a method for reacting to a disturbance on an uplink frequency in a mobile communication system which comprises a mobile communication network which includes at least one base station and a mobile services switching centre, as well as at least one mobile station which communicates with said base station on an uplink, i.e. receive, frequency, and on a downlink, i.e. transmit frequency of said base station, the method comprising the steps of:

detecting by a mobile communication network of the disturbance on the uplink frequency,

informing by the mobile communication network of a mobile station regarding said disturbance by using a downlink frequency,

commanding the mobile station to listening mode in which the mobile station stays on the same downlink frequency and receives information from the base station, and

shifting by the mobile station to listening mode.

The invention is based on the idea that as disturbance occurs on an uplink frequency of a base station of a mobile communication system, i.e. on the receive frequency of the base station, the system, for example, a base station, informs the mobile station or radiotelephones of the break in the uplink traffic and, if desired, also the reason for it by a failure report message. In the same context, the mobile communication system orders the mobile station to listening mode. In listening mode, a roaming sequence, i.e. the sequence of a base station change and a handover sequence, alter. In such a case, the mobile station exceptionally stays tuned to the downlink frequency corresponding to the jammed uplink frequency although it does not receive any responses to its signalling because the base station is unable to hear the mobile station due to the disturbance. It should be noted that the mobile station which is requested to shift to listening mode can also behave in another way than to shift directly to listening mode. In a failure report message, a mobile station can also be



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requested to behave differently. In listening mode, the mobile station does not have to respond

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to the signalling of the system. In such a case, the services which use both-way traffic of the system in its normal mode can be used as one-way services. The mobile station detects on the basis of the failure report message, or lack of it, the reason for the uplink break and informs the user of it, who can react in an appropriate way on the basis of that report.

An advantage of this kind of a method for reacting to disturbance in a mobile communication system is that the disadvantages of the prior art solution are avoided by this method.

The present invention provides the advantage that a mobile communication system can detect a disturbance situation on an uplink frequency and react to it in the best possible way.

In addition, it is an advantage of the present invention that a mobile station, after it has received a failure report message, shifts to listening mode in which it can receive signalling and user information from the system on the downlink frequency without the normally required both-way signalling with the system. If the mobile station does not receive a failure report message as it detects the break, it can infer that the mobile equipment is faulty, or the break is caused by an inadequate uplink service range, and inform the user of these factors.

It is an advantage of the method of the invention that the mobile station user is always aware of the reason causing the uplink failure. For example, if the failure is caused by jamming, it is not necessary for the user to try to replace his unit with a properly working one, because he will know that the failure is caused by jamming.

In addition, it is an advantage of the present invention that not only can listening mode be used during a break in the uplink connection but also in cases only downlink traffic is required due to operational needs. In

such a case, the power consumption of mobile stations can be reduced, and, for example, wireless silence can be ensured.

5 It is, furthermore, an advantage of the present invention that it is easier to locate the jammer, as the jammer is the only transmitting device apart from the base station in cases the mobile stations are in listening mode.

10 In addition, it is an advantage of this invention that, if followed, the services of the mobile communication system in its normal mode can be utilized in the downlink direction even if the uplink frequency of channel were useless.

List of Drawings

15 In the following, the invention will be described in closer detail with reference to the accompanying drawings in which

20 figure 1 shows the coverage areas of the transmitters of a base station and a hand-held mobile phone in a situation in which the base station has a larger coverage area than the hand-held mobile phone; this figure 1 is already described in the general section of the application,

25 figure 2 shows a jamming situation in the operation of a radio system, in which situation the uplink frequency is jammed, and in which a jammer measures the downlink frequency and transmits a jamming signal on an uplink frequency which is at a duplex-spacing distance from the downlink signal; this figure 2 is already described in the general section of the application,

30 figure 3 shows a system diagram of a situation in which a mobile station communicates with a base station,

figure 4 shows a block diagram of a failure report message of the invention,

35 figure 5 shows a flowchart of operation of a mobile station of the invention during jamming.

Detailed Description of the Invention

Figure 3 shows a system diagram of a situation in which a mobile station communicates with a base station. The figure shows a trunking system controller TSC to which
5 a base station BS is connected by data links. A mobile station MS is tuned to the downlink frequency F3 of the base station. There is disturbance on the uplink frequency or channel F4 between the base station BS and the mobile station MS.

10 As the mobile communication system notices a break in the uplink traffic, it tries to infer the reason for the break. It can be jamming, a breakdown of a radio receiver or some other piece of equipment required in the reception, or some other reason. The break may affect the entire
15 system or just a certain radio frequency or channel.

Here, a break in the uplink traffic detected by the system is understood to refer to a break which affects the mobile stations in the coverage area of the base station.

20 The system can detect disturbance in the uplink traffic by measuring the strength of the received signal and comparing it to the bit error ratio. The radio system recognizes that the strength of the received signal and the bit error ratio depend on each other. The mobile
25 communication network, i.e. a mobile station or a mobile services switching centre, can detect a jamming transmission if a bit error ratio of a signal received at the base station at a predetermined field strength exceeds the corresponding bit error ratio of a corresponding field
30 strength in an undisturbed situation. A digital demodulator can also detect jamming on the basis of different than normal behaviour of the received signal.

According to the invention, a mobile communication system couples the information on the break and the reason
35 for it to a broadcast message which it transmits on its

downlink frequency or channel in order to inform all or some of the mobile stations of it. This information is called a failure report message. Figure 4 shows a block diagram of a failure report message of an embodiment. The failure report message can also be signalled to the radiotelephones by unit/group specific signalling instead of, or in addition to, broadcast signalling.

The fields of a failure report message:

- 41. message identifier: the system failure report message
- 42. address of a mobile station such as a mobile station or a group
- 43. failure description: no disturbance, or jamming or a failure in the base station receiver or other disturbance
- 44. mode command: listening mode or normal mode
- 45. test field

A failure report message can either be sent continuously or more seldom. The message includes a mode command field which determines the mode of the radiotelephones.

As uplink breaks occur, the mobile station may shift to listening mode. The command to shift to listening mode is included in said failure report message. In listening mode, the system does not require any kinds of acknowledgements from the mobile stations. Registrations are no longer performed, and signalling only takes place in the downlink direction. In such a case, the services of the mobile communication system in its normal mode can be used in the downlink direction. It is also possible to act in such a way that the mobile station user himself upon receiving a request to shift to listening mode gives a manual command that switches the mobile station to listening mode. Before switching a mobile station to listening mode, the right of a mobile station to shift to listening mode can be checked.

As the mobile station in the search sequence of a calling channel has accepted a calling channel and moves



onto that, the mobile station reads the identifier information from the calling channel. On the basis of this information, the mobile station knows if it has to update its location information or not. It is useless for the mobile station to transmit location area updating information to the system in a disturbance situation, because there is disturbance on the uplink frequency or channel of the base station. So, the mobile communication network, i.e. the base station, the trunking controller or the mobile communication system does not acknowledge anything to the mobile station. The present, prior art, mobile stations retransmit a failed signalling for a few times. Thus, the mobile communication system has to be familiar with the retransmission algorithm, and it has to retransmit a failure report message often enough so that the mobile station does not have time to begin to search for a new calling channel. The transmission rate of a failure report message naturally depends on the length of the time-out which controls the change of a mobile station onto a new frequency. If it is unnecessary for the mobile station to update its location area, the phone receives a failure report message without problems as it listens to a control channel transmitted by the jammed base station.

The following describes the operation of a mobile station which is in listening mode. The mobile communication system determines the mode of the mobile station (listening mode or normal mode). The mobile station functions in a predetermined mode in the mode command field 44 of the failure report message. The mobile station user can be informed of the switch to listening mode and of its reasons by text, sound, and/or indicator lamp signals.

In normal mode, a mobile station searches for a control channel by following a special control channel search sequence. A channel having a high enough field strength, the correct identifier information and which

responses to the mobile station signalling is accepted as a control channel. In listening mode, the mobile station discontinues the search sequence of a normal control channel and accepts the control channel even if it does not receive a response to its signalling. The mobile station, then, remains on the interfered channel, but listens to the downlink channel transmitted by the base station, on which downlink channel there is no disturbance.

In listening mode, a mobile station does not have to transmit acknowledgement messages as a response to the system signalling, nor traffic channel information or speech. The mobile station can skip all those procedures which are not essential as far as the reception of downlink traffic is concerned. Such procedures include, for example, all the tasks required for the transmitting of a radio signal.

While in listening mode, a mobile station normally follows the system control, and, for example, shifts to conversation mode as it receives a call initialization message, and thus the mobile station goes to the traffic channel on which a mobile services switching centre or a base station directs it.

The mobile communication system informs the mobile stations of jamming and sets the phones to listening mode. In such a case, the mobile stations do not have to register in order to hear downlink traffic. The system dispatcher can give commands to the mobile stations within the area even if it does not receive a response from them. Locating the jammer is also made easier, because it is the only device that is transmitting.

The mobile communication system returns the mobile station or the radiotelephones from listening mode to normal mode by transmitting a failure report message (figure 4) in which the value of the mode field 44 is "normal mode". A mobile station can also be programmed to

return to normal mode after a predetermined time from the last failure report command.

The mobile station, furthermore, returns to normal mode if its power is turned off; the phone always starts in normal mode.

It is, in addition, possible to return the mobile station from listening mode to normal mode so that the mobile station is returned from listening mode to normal mode by a manual command given by the mobile station user.

In cases the signalling of the mobile station with the system is prevented although the mobile station is still able to receive signals from the base station, the mobile station aims at finding out the reason for the break and informing the user of it. On the basis of failure report information, or lack of it, the mobile station can infer whether the reason for the uplink disturbance is in the system, in the mobile station itself, or in the differences between coverage areas. The inference sequence is illustrated in figure 5.

In step 51 of the flow chart of figure 5, the mobile station determines whether it can hear transmission from the system. If the mobile station does not hear it, the mobile station makes the estimate that the downlink traffic of the system in question is not operational as the mobile station can not hear the system. The reason for this can be that the base station transmitter does not work, or that the mobile station receiver does not work, or that the mobile station is outside of the coverage area of the base station of the system. If, however, the mobile station does hear transmission from the system, the mobile station estimates whether the system responds to the signalling the mobile station transmits. If the system responds, the mobile station knows that it can communicate with the system in the normal manner.

If, however, the system does not respond to the mobile station signalling 58 in an acceptable way, the mobile station begins to observe 59 whether it receives a failure condition message. If the mobile station does not
5 60 receive a failure condition message, it will know 67 that the system is not faulty and that the system is not jammed. In such a case, the mobile station knows that the uplink break is caused by reasons beyond control of the system. If, however, the mobile station does receive 61 a
10 failure condition message, the mobile station checks 62 whether the failure condition message contains a command to shift to listening mode. If the failure condition report does not contain 63 said message, the operation of the mobile station proceeds as per step 67.

15 If, however, the failure condition message contains a command to shift to listening mode 64, the mobile station shifts to listening mode 65 and knows that no transmission to the base station in acknowledgement of the messages it has received is necessary. In the same
20 context, the mobile station user is informed 66 similarly to above of the switch to listening mode and the reason for it.

The drawings and their description are only meant to illustrate the idea of the invention. The method of the
25 invention for reacting to disturbance in a mobile communication system may vary in details within the scope of the invention. Although the invention is above described especially in connection with trunked mobile radio systems, the invention can be utilized in other
30 kinds of mobile communication systems as well.



The claims defining the invention are as follows:

1. A method for reacting to a disturbance on an uplink frequency in a mobile communication system which comprises a mobile communication network which includes at least one base station and a mobile services switching centre, as well as at least one mobile station which communicates with said base station on an uplink, i.e. receive, frequency, and on a downlink, i.e. transmit frequency of said base station, the method comprising the steps of:

detecting by a mobile communication network of the disturbance on the uplink frequency,

informing by the mobile communication network of a mobile station regarding said disturbance by using a downlink frequency,

commanding the mobile station to listening mode in which the mobile station stays on the same downlink frequency and receives information from the base station, and

shifting by the mobile station to listening mode.

2. A method as claimed in claim 1, comprising the further steps of:

detecting by a mobile communication network of disturbance on an uplink frequency by the fact that the receiver of the base station in the mobile communication network, receiving on said uplink frequency, is found faulty.

3. A method as claimed in claim 1, comprising the further steps of:

detecting by a mobile communication network of disturbance on an uplink frequency on the basis of jamming transmission being detected on said uplink frequency.

4. A method as claimed in claim 3, comprising the further steps of:



detecting said jamming transmission if a bit error ratio of a signal received at the base station at a predetermined field strength exceeds the corresponding bit error ratio of a corresponding field strength in an undisturbed situation.

5 5. A method as claimed in claim 3, comprising the further steps of:
detecting said jamming transmission by a digital demodulator of the receiver of the base station on the basis of the received jamming transmission behaving differently than a normal transmission.

10 6. A method according to any one of the previous claims, comprising the further steps of:
informing by a mobile communication network to a mobile station regarding disturbance on the uplink frequency of the network by transmitting a failure report message.

15 7. A method as claimed in claim 6, whereby
said failure report message at least contains information on the meaning of the message, information about the receiving mobile station or mobile stations, information on the nature of the failure, and a command to shift to listening mode.

20 8. A method as claimed in claim 6 or 7, comprising the further steps of:
informing by a mobile station to its user regarding disturbance detected on an uplink frequency.

25 9. A method as claimed in claim 8, comprising the further steps of:
informing by a mobile station to its user regarding disturbance detected on an uplink frequency and the reason for it by a text message on the mobile station display.

10. A method as claimed in claim 8, comprising the further steps of:



informing by a mobile station to its user regarding disturbance detected on an uplink frequency and the reason for it by a sound signal.

11. A method as claimed in claim 8, comprising the further steps of:

5 informing by a mobile station to its user regarding disturbance detected on an uplink frequency and the reason for it by an indicator lamp.

12. A method as claimed in any one of the previous claims, comprising the further steps of:

10 shifting by a mobile station to listening mode as a result of a manual command given by its user.

13. A method as claimed in claim 12, comprising the further steps of:

checking the right of the mobile station to shift to listening mode before
15 manually switching a mobile station to listening mode.

14. A method as claimed in any one of claims 1 - 11, comprising the further steps of:

receiving by the mobile station of said command to shift to listening mode
20 from the network, and
shifting by a mobile station to listening mode.

15. A method as claimed in any one of the previous claims, comprising the further steps of:

25 commanding by a mobile communication network of the mobile station to return to normal mode, and
returning by a mobile station from listening mode to normal mode.

16. A method as claimed in claim 15, comprising the further steps of:



commanding by a mobile communication network of a mobile station to return to normal mode by transmitting said failure report message which includes information that the mobile station is to shift to normal mode.

5 17. A method according to any one of the previous claims, comprising the further steps of:

giving of a manual command by the mobile station user, and
returning by a mobile station from listening mode to normal mode.

10 18. A method of reacting to a disturbance substantially as described herein with reference to accompanying drawing numbers 3 to 5.

DATED this Third Day of July 1998

Nokia Telecommunications OY

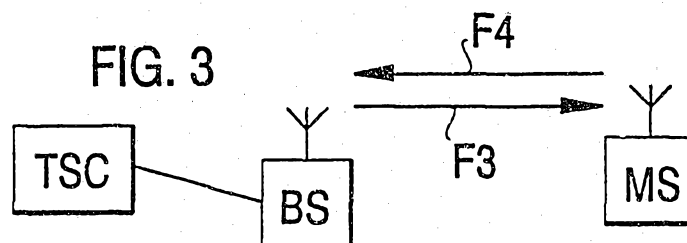
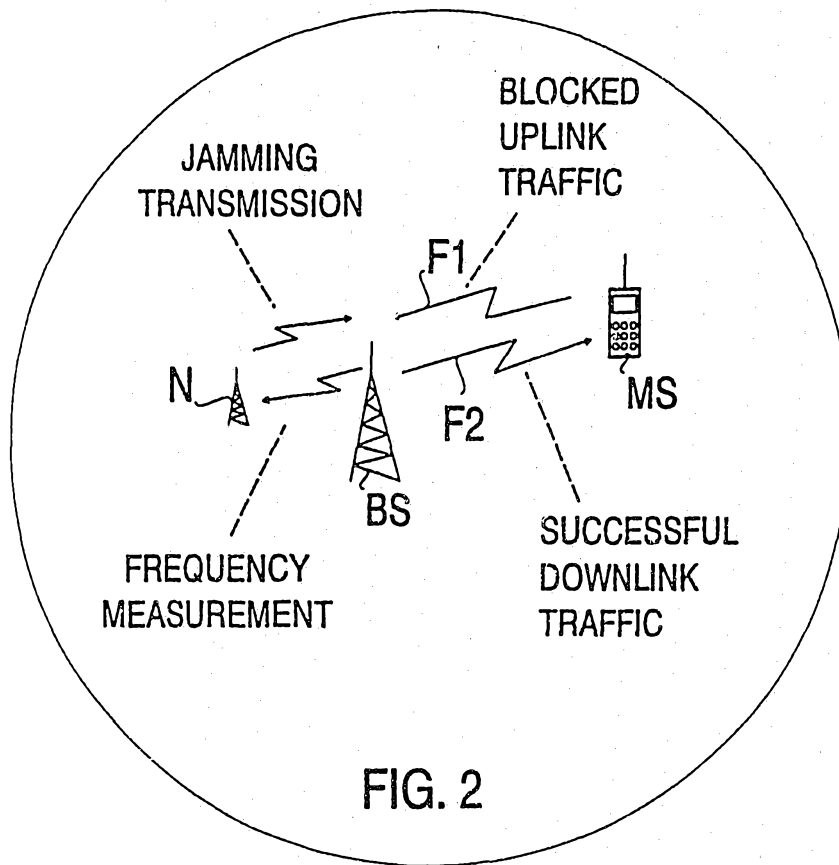
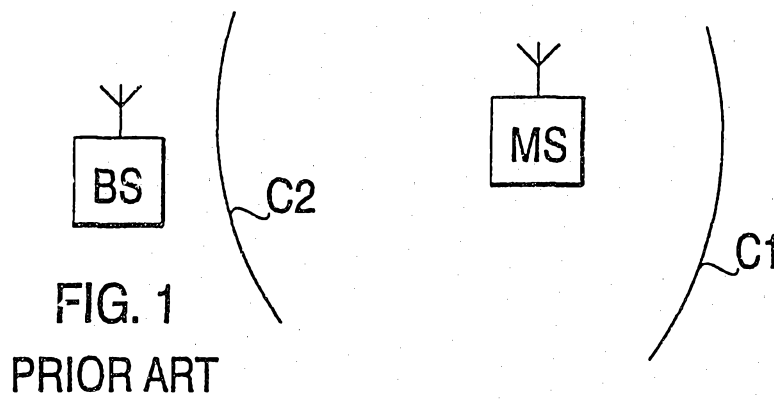
Patent Attorneys for the Applicant

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41	42	43	44	45
MESSAGE IDENTIFIER	ADDRESS OF MOBILE STATION OR GROUP	FAILURE DESCRIPTION	MODE COMMAND	TEST FIELD

FIG. 4

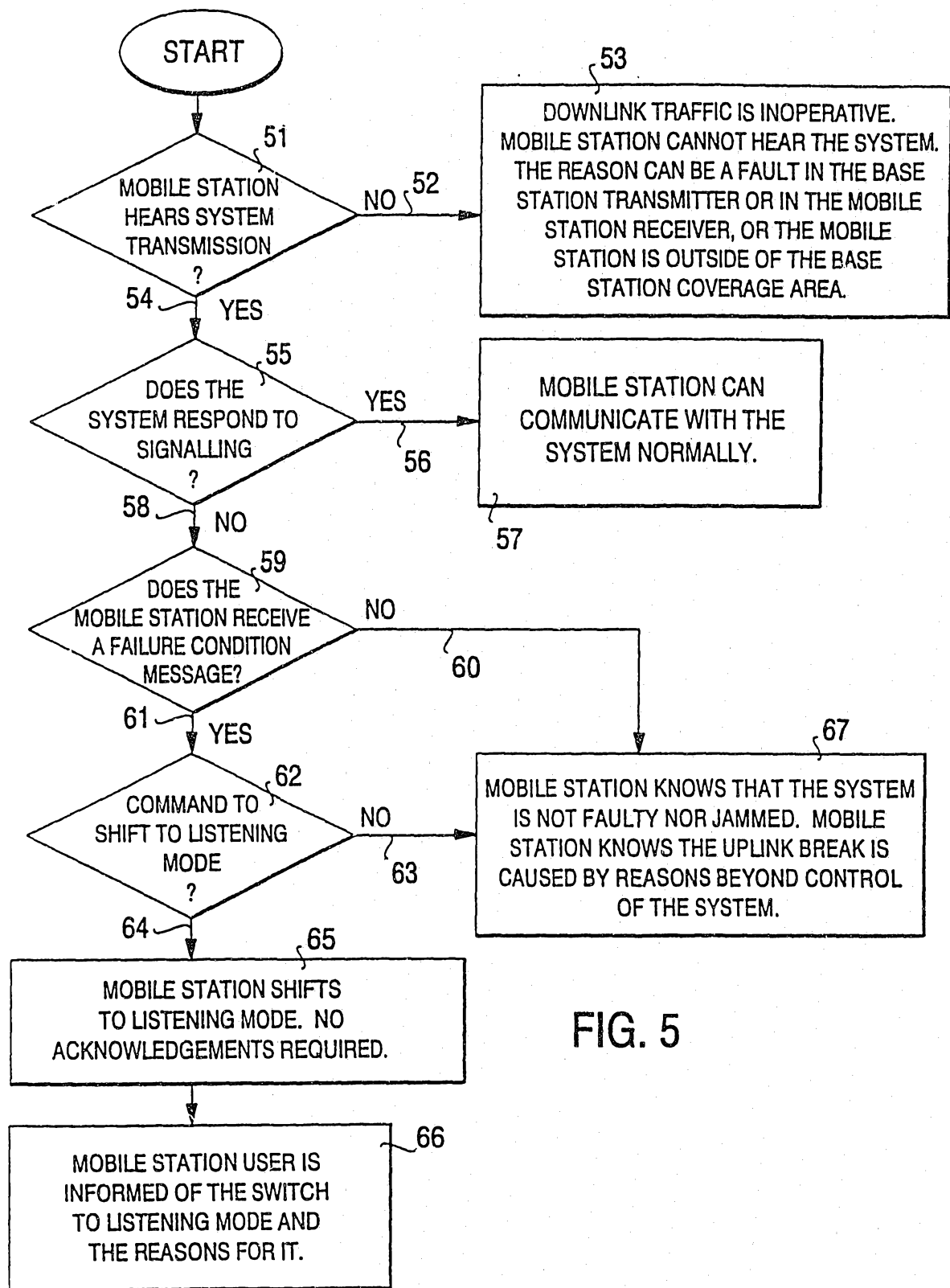


FIG. 5

INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 95/00318

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: H04Q 7/34, H04Q 7/38

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)

IPC6: H04Q, H04B

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

SE,DK,FI,NO classes as above

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

WPI, CLAIMS, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0310379 A2 (KABUSHIKI KAISHA TOSHIBA), 5 April 1989 (05.04.89), claims 1-12, abstract --	1-17
A	SE 469736 B (TELEFON AB L M ERICSSON), 30 August 1993 (30.08.93), abstract -- -----	1-17

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:

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- *E* earlier document but published on or after the international filing date
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- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

T later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

X document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

Y document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

& document member of the same patent family

Date of the actual completion of the international search

26 October 1995

Date of mailing of the international search report

30-10-1995

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INTERNATIONAL SEARCH REPORT

Information on patent family members'

02/10/95

Ir. national application No.

PCT/FI 95/00318

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SE-B- 469736	30/08/93	AU-B- 658489 AU-A- 3578793 EP-A- 0578810 JP-T- 6506816 SE-A- 9200336 WO-A- 9316562	13/04/95 03/09/93 19/01/94 28/07/94 06/08/93 19/08/93