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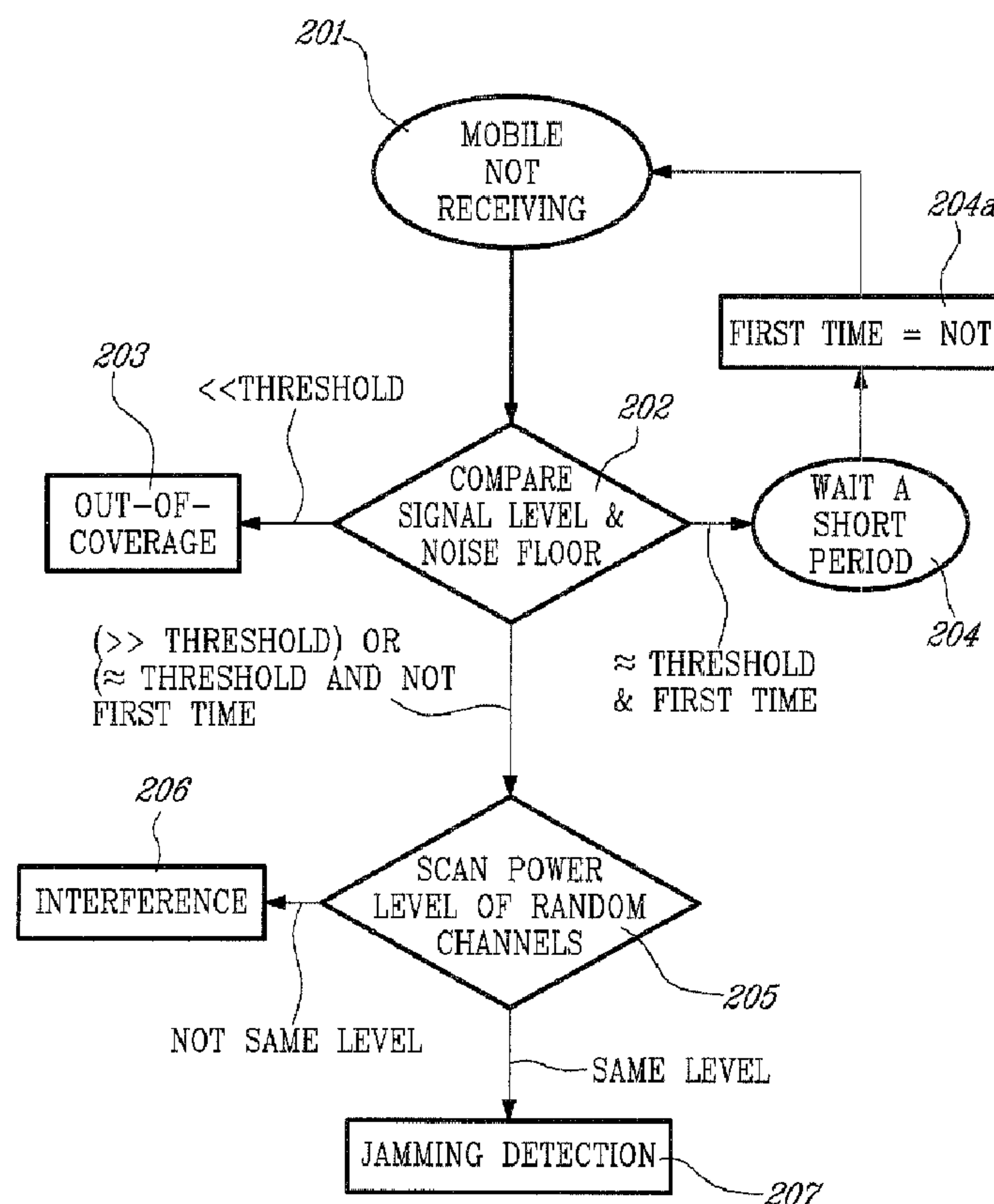
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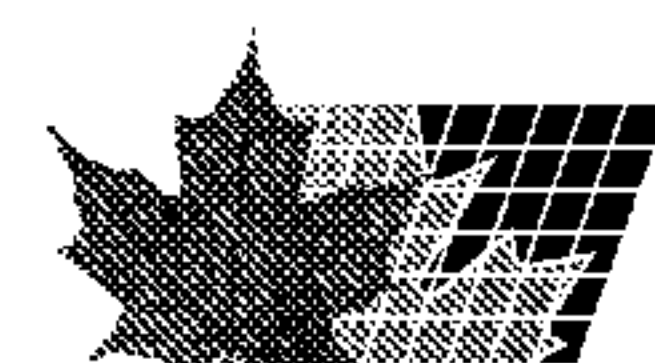
(54) Titre : DETECTEUR DE BROUILLEUR COMMERCIAL

(54) Title: DETECTOR OF COMMERCIAL JAMMER



(57) Abrégé/Abstract:

The present invention relates to a method and device for detecting a communication-interfering jammer in the proximity of a communication equipment normally receiving an intelligible signal. As a first operation, an absence of reception of the intelligible signal by the communication equipment is detected. A discrimination of the detection of a communication-interfering jammer in



(57) **Abrégé(suite)/Abstract(continued):**

the proximity of the communication equipment from at least one other cause for the absence of reception of the intelligible signal by the communication equipment is then conducted. A communication-interfering jammer is finally detected in the proximity of the communication equipment when the discrimination indicates that there exists no other cause for the absence of reception of the intelligible signal by the communication equipment.

ABSTRACT OF THE DISCLOSURE

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The present invention relates to a method and device for detecting a communication-interfering jammer in the proximity of a communication equipment normally receiving an intelligible signal. As a first operation, an absence of reception of the intelligible signal by the communication equipment is detected. A discrimination of the detection of a communication-interfering jammer in the proximity of the communication equipment from at least one other cause for the absence of reception of the intelligible signal by the communication equipment is then conducted. A communication-interfering jammer is finally detected in the proximity of the communication equipment when the discrimination indicates that there exists no other cause for the absence of reception of the intelligible signal by the communication equipment.

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DETECTOR OF COMMERCIAL JAMMER

FIELD OF THE INVENTION

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The present invention relates to a device for detecting a communication-interfering jammer, in particular but not exclusively a commercial jammer.

BACKGROUND OF THE INVENTION

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In order to interfere with communications, a commercial jammer typically transmits a pseudo-random noise over a whole downlink frequency bandwidth of a communications system or network. Normally, the pseudo-random noise has a substantially constant amplitude over the whole downlink frequency bandwidth.

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When this substantially constant amplitude of the pseudo-random noise is sufficiently high, any communication mobile or terminal in close proximity to the jammer will be prevented to receive any intelligible signal from the communication system or network.

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SUMMARY OF THE INVENTION

According to the present invention, there is provided a method for detecting a communication-interfering jammer in the proximity of a communication equipment normally receiving an intelligible signal, comprising:

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detecting an absence of reception of the intelligible signal by the communication equipment; discriminating the detection of a communication-interfering jammer in the proximity of the communication equipment from at least one other cause for the absence of reception of the intelligible signal by the communication equipment; and detecting a communication-interfering jammer in the proximity of

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the communication equipment when the discrimination indicates that there exists no other cause for the absence of reception of the intelligible signal by the communication equipment.

The present invention also relates to a device for detecting a communication-interfering jammer in the proximity of a communication equipment normally receiving an intelligible signal, comprising: means for
5 detecting an absence of reception of the intelligible signal by the communication equipment; means for discriminating the detection of a communication-interfering jammer in the proximity of the communication equipment from at least one other cause for the absence of reception of the intelligible signal by the communication equipment; and means for detecting a communication-interfering
10 jammer in the proximity of the communication equipment when the discriminating means indicates that there exists no other cause for the absence of reception of the intelligible signal by the communication equipment.

Further according to the present invention, there is provided a device for
15 detecting a communication-interfering jammer in the proximity of a communication equipment normally receiving an intelligible signal, comprising:

a detector of an absence of reception of the intelligible signal by the communication equipment;

a discriminator of the detection of a communication-interfering jammer in
20 the proximity of the communication equipment from at least one other cause for the absence of reception of the intelligible signal by the communication equipment; and

a detector of a communication-interfering jammer in the proximity of the communication equipment when the discrimination means indicates that there
25 exists no other cause for the absence of reception of the intelligible signal by the communication equipment.

The foregoing and other objects, advantages and features of the present invention will become more apparent upon reading of the following non-
30 restrictive description of an illustrative embodiment thereof, given by way of example only with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

In the appended drawings:

5 Figure 1 is a schematic block diagram of the non-restrictive, illustrative embodiment of the device according to the present invention, for detecting a communication-interfering jammer in the proximity of a communication equipment; and

10 Figure 2 is a schematic flow chart showing the operation of the non-restrictive, illustrative embodiment of the method according to the present invention, for detecting a communication-interfering jammer in the proximity of a communication equipment.

15 DETAILED DESCRIPTION OF THE ILLUSTRATIVE EMBODIMENT

 The non-restrictive, illustrative embodiment of the jammer-detecting device in accordance with the present invention constitutes a standalone functionality designed for detecting the presence of a commercial jammer in a
20 frequency bandwidth of interest.

 Although the non-restrictive, illustrative embodiment of the method and device of the present invention will be described in relation to a cellular communication system or network, it should be kept in mind that the present
25 invention applies as well to other types of communication systems or networks.

 When a mobile or terminal receives no intelligible signal from a cellular communication system or network, an algorithm is required to discriminate jammer detection from two other cases (hereinafter the first and second cases).
30 Of course, the non-restrictive, illustrative embodiment of the jammer-detecting method and device incorporates such an algorithm.

The first case is an out-of-coverage case. This out-of coverage case happens when a mobile or terminal is out-of-coverage, for example when the mobile or terminal is outside cellular coverage in fringe areas or inside a building with high penetration loss.

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The second case is met when the mobile or terminal is located in an area with strong cellular interference on the common control channel(s). More specifically, this situation is met in locations where strong common control channel(s) is (are) received, these strong common control channel(s) originating from multiple cellular base stations operating at the same frequency (for FDMA (Frequency Division Multiple Access) systems) or with the same code (for CDMA (Code Division Multiple Access) systems).

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The structure and operation of the non-restrictive, illustrative embodiment of the jammer-detecting method and device according to the present invention will now be described with reference to Figures 1 and 2 of the appended drawings. It should be mentioned here that the references 101-107 (including 104a) refer to Figure 1 while the references 201-207 (including 204a) refer to Figure 2.

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Discrimination of the out-of-coverage case

Operation 201

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The non-restrictive, illustrative embodiment of the jammer-detecting device comprises a mobile or terminal reception detector 101 for detecting that the mobile or terminal no longer receives an intelligible signal from the cellular communication system or network.

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When a mobile or terminal no longer receives an intelligible signal from the cellular system or network, the out-of-coverage discrimination is first executed. Detection that the mobile or terminal no longer receives an intelligible

signal can be carried out through conventional methods well known to those of ordinary skill in the art. An example is the detection of a signal-to-noise ratio lower than a given threshold.

5 Operation 202

The out-of-coverage discrimination first comprises a comparison of the average power level on at least one common control channel with a predicted noise floor. This comparison is conducted by the signal and noise comparator
10 102.

As well known to those of ordinary skill in the art, the predicted noise floor is a function of the mobile or terminal noise figure and the frequency bandwidth of concern.

15 Operation 203

If the difference between the average power level of the common control channel and the predicted noise floor as determined by the signal and noise
20 comparator 102 is lower (for example by 10% lower) than the signal-to-noise ratio required for proper operation of the mobile or terminal plus a certain margin to take into consideration normal co-channel interference, the cellular system or network is then considered as out-of-coverage. This condition is detected by the out-of-coverage detector 103.

25 The signal-to-noise ratio required for proper operation of the mobile or terminal plus the above-mentioned margin will be referred to as the "threshold" in the following description.

30 If the difference between the average power level of the common control channel and the predicted noise floor as determined by the signal and noise comparator 102 is higher (for example by 10% higher) than the threshold, the

cellular system or network is either jammed or in interference on the common control channel. The procedure then goes to operation 205 in order to perform the discrimination of the common channel interference case.

5 Operation 204

 The first time (104a and 204a) the average power level on the common control channel is compared to the predicted noise floor, the difference between this average power level of the common control channel and the predicted noise
10 floor is approximately equal to the threshold (for example equal to the threshold $\pm 10\%$), the jammer-detecting device waits for a short period of time generated by the timer 204, for example a few seconds.

 After this waiting period, as the difference between the average power
15 level of the common control channel and the predicted noise floor is approximately equal to the threshold, the reception may correctly resume. If not, discrimination of the out-of-coverage case is performed a second time with the following result:

- 20 - If the difference between the average power level of the common control channel and the predicted noise floor is lower (for example by 10% lower) than the threshold, the out-of-coverage detector 103 detects an out-of-coverage condition of the cellular system or network (Operation 203);
- 25 - If the difference between the average power level of the common control channel and the predicted noise floor is higher (for example by 10% higher) than the threshold, the cellular system or network is either jammed or in interference on the common control channel, and the procedure then goes to Operation 205; and
- 30 - If the difference between the average power level of the common control channel and the predicted noise floor is approximately equal (for example

equal to the threshold $\pm 10\%$) to the threshold as a result of the second (104a and 204a) out-of-coverage discrimination (104a and 204a), the cellular system or network is either jammed or in interference on the common control channels, and the procedure then goes to Operation 205.

Discrimination of the common channel interference case

At this stage, the jammer-detecting method and device considers the cellular system or network as being jammed or in cellular interference on the common control channel.

Operation 205

Discrimination of the common channel interference case is conducted by first comparing to each other the respective RF (Radio Frequency) power levels of a random set of channels within the relevant frequency bandwidth. The non-restrictive, illustrative embodiment of the jammer-detecting device comprises a random channels power level scanner 105 for performing this comparison.

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In FDMA systems or networks, this comparison is made by scanning different frequencies corresponding to a set of channels. In CDMA systems or networks, the comparison is made by scanning different codes corresponding to different common channels.

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Operation 206

If the average RF power levels of the various channels are different, an interference detector 106 of the non-restrictive, illustrative embodiment of the jammer-detecting device detects that the mobile or terminal is victim of cellular interference on the common control channel(s).

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Detection of the presence of a jammer, in particular but not exclusively a commercial jammer

Operation 207

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If the average RF power levels of the various channels are similar, the non-restrictive, illustrative embodiment of the jammer-detecting device comprises a jammer detector 107 indicating that the mobile or terminal is being jammed, that is under the influence of a jammer.

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Those of ordinary skill in the art will appreciate that, prior to detecting the presence of a jammer, the non-restrictive illustrative embodiment of the jammer-detecting device according to the present invention first determines whether the absence of reception of an intelligible signal by the cellular mobile or terminal is caused by either out-of-coverage or interference.

15

Although the present invention has been described in the foregoing specification by means of a non-restrictive illustrative embodiment thereof, this illustrative embodiment can be modified as will, within the scope of the appended claims without departing from the spirit and nature of the subject invention.

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WHAT IS CLAIMED IS:

1. A device for detecting a communication-interfering jammer in the proximity of a communication equipment normally receiving an intelligible signal,
5 comprising:

means for detecting an absence of reception of the intelligible signal by the communication equipment;

means for discriminating the detection of a communication-interfering jammer in the proximity of the communication equipment from at least one other
10 cause for the absence of reception of the intelligible signal by the communication equipment; and

means for detecting a communication-interfering jammer in the proximity of the communication equipment when the discriminating means indicates that there exists no other cause for the absence of reception of the intelligible signal
15 by the communication equipment.

2. A method for detecting a communication-interfering jammer in the proximity of a communication equipment normally receiving an intelligible signal, comprising:

20 detecting an absence of reception of the intelligible signal by the communication equipment;

discriminating the detection of a communication-interfering jammer in the proximity of the communication equipment from at least one other cause for the absence of reception of the intelligible signal by the communication equipment;
25 and

detecting a communication-interfering jammer in the proximity of the communication equipment when the discrimination indicates that there exists no other cause for the absence of reception of the intelligible signal by the communication equipment.

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3. A method for detecting a communication-interfering jammer as defined in claim 2, wherein discriminating the detection of a communication-interfering jammer comprises:

5 discriminating the detection of a communication-interfering jammer in the proximity of the communication equipment from an out-of-coverage situation.

4. A method for detecting a communication-interfering jammer as defined in claim 2, wherein discriminating the detection of a communication-interfering jammer comprises:

10 discriminating the detection of a communication-interfering jammer in the proximity of the communication equipment from a situation of interference.

5. A method for detecting a communication-interfering jammer as defined in claim 2, wherein the communication equipment comprises at least one
15 common control channel and wherein discriminating the detection of a communication-interfering jammer comprises:

discriminating the detection of a communication-interfering jammer in the proximity of the communication equipment from a situation of interference on
said at least one common control channel.

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6. A method for detecting a communication-interfering jammer as defined in claim 3, wherein the communication equipment comprises at least one common control channel, and wherein discriminating the detection of a communication-interfering jammer in the proximity of the communication
25 equipment from an out-of-coverage situation comprises:

comparing an average power level on the common control channel of the communication equipment with a predicted noise floor.

7. A method for detecting a communication-interfering jammer as defined
30 in claim 6, wherein discriminating the detection of a communication-interfering jammer in the proximity of the communication equipment from an out-of-coverage situation comprises:

detecting an out-of-coverage situation when the comparison between the average power level and the predicted noise floor indicates that a difference between said average power level and said predicted noise floor is lower than a given threshold.

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8. A method for detecting a communication-interfering jammer as defined in claim 6, wherein, when the comparison between the average power level and the predicted noise floor indicates that a difference between said average power level and said predicted noise floor is higher than a given threshold, discriminating the detection of a communication-interfering jammer in the proximity of the communication equipment from an out-of-coverage situation comprises:

detecting either a communication-interfering jammer in the proximity of the communication equipment or a situation of interference on the common control channel.

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9. A method for detecting a communication-interfering jammer as defined in claim 6, wherein, when the comparison of the average power level with the predicted noise floor indicates that the difference between said average power level and said predicted noise floor is approximately equal to a given threshold, discriminating the detection of a communication-interfering jammer in the proximity of the communication equipment from an out-of-coverage situation comprises:

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waiting for a short period of time;

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after said short period of time has elapsed, detecting whether there is still an absence of reception of the intelligible signal by the communication equipment; and

30

in the absence of reception of the intelligible signal by the communication equipment, repeating said comparison of the average power level on the common control channel of the communication equipment with the predicted noise floor.

10. A method for detecting a communication-interfering jammer as defined in claim 3, wherein the communication equipment comprises a set of channels, and wherein discriminating the detection of a communication-interfering jammer in the proximity of the communication equipment from a situation of interference comprises:

comparing to each other power levels of at least a portion of the channels of said set.

11. A method for detecting a communication-interfering jammer as defined in claim 10, wherein discriminating the detection of a communication-interfering jammer in the proximity of the communication equipment from a situation of interference further comprises:

detecting a situation of interference when the comparison of the power levels indicate that the power levels of said at least a portion of the channels are different from each other.

12. A method for detecting a communication-interfering jammer as defined in claim 10, wherein detecting a communication-interfering jammer in the proximity of the communication equipment comprises:

detecting a communication-interfering jammer in the proximity of the communication equipment when the comparison of the power levels indicate that the power levels of said at least a portion of the channels are similar to each other.

13. A device for detecting a communication-interfering jammer in the proximity of a communication equipment normally receiving an intelligible signal, comprising:

a detector of an absence of reception of the intelligible signal by the communication equipment;

a discriminator of the detection of a communication-interfering jammer in the proximity of the communication equipment from at least one other cause for

the absence of reception of the intelligible signal by the communication equipment; and

5 a detector of a communication-interfering jammer in the proximity of the communication equipment when the discrimination means indicates that there exists no other cause for the absence of reception of the intelligible signal by the communication equipment.

14. A device for detecting a communication-interfering jammer as defined in claim 13, wherein the discriminator comprises:

10 a detector of an out-of-coverage situation, the out-of-coverage situation constituting said at least one other cause for the absence of reception of the intelligible signal by the communication equipment.

15 15. A device for detecting a communication-interfering jammer as defined in claim 13, wherein the discriminator comprises:

a detector of a situation of interference, said situation of interference constituting said at least one other cause for the absence of reception of the intelligible signal by the communication equipment.

20 16. A device for detecting a communication-interfering jammer as defined in claim 13, wherein the communication equipment comprises at least one common control channel and wherein the discriminator comprises:

25 a detector of a situation of interference on the common control channel, said situation of interference on the common control channel constituting said at least one other cause for the absence of reception of the intelligible signal by the communication equipment.

30 17. A device for detecting a communication-interfering jammer as defined in claim 14, wherein the communication equipment comprises at least one common control channel, and wherein the discriminator further comprises:

a comparator of an average power level on the common control channel of the communication equipment with a predicted noise floor.

18. A device for detecting a communication-interfering jammer as defined in claim 17, wherein the detector an out-of-coverage situation comprises:

5 means for detecting an out-of coverage situation when the comparison between the average power level and the predicted noise floor indicates that a difference between said average power level and said predicted noise floor is lower than a given threshold.

10 19. A device for detecting a communication-interfering jammer as defined in claim 17, wherein the discriminator comprises means for detecting, when the comparison between the average power level and the predicted noise floor indicates that a difference between said average power level and said predicted noise floor is higher than a given threshold, either a communication-interfering jammer in the proximity of the communication equipment or a situation of
15 interference on the common control channel.

20 20. A device for detecting a communication-interfering jammer as defined in claim 17, wherein the discriminator comprises, when the comparison between the average power level and the predicted noise floor indicates that the difference between said average power level and said predicted noise floor is approximately equal to a given threshold:

a timer for generating a short period of time;

25 the detector of an absence of reception comprises means for detecting, after said short period of time has elapsed, whether there is still an absence of reception of the intelligible signal by the communication equipment; and

the comparator comprises means for repeating, in the absence of reception of the intelligible signal by the communication equipment, the comparison of the average power level on the common control channel of the communication equipment with the predicted noise floor.

21. A device for detecting a communication-interfering jammer as defined in claim 15, wherein the communication equipment comprises a set of channels, and wherein the discriminator comprises:

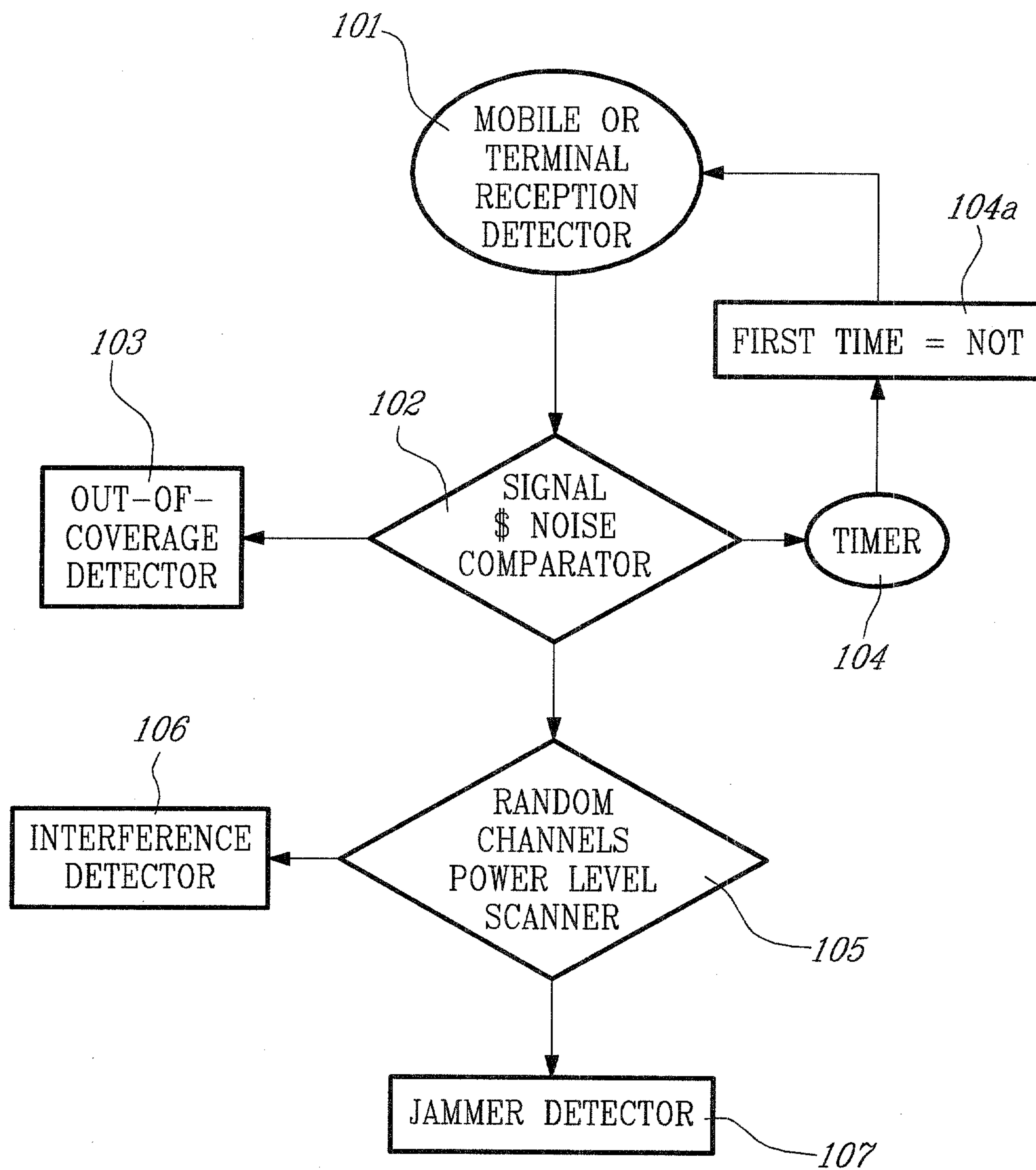
5 a comparator of power levels of at least a portion of the channels of said set to each other.

22. A device for detecting a communication-interfering jammer as defined in claim 21, wherein the discriminator comprises:

10 a detector of a situation of interference when the comparison of the power levels indicate that the power levels of said at least a portion of the channels are different from each other.

23. A device for detecting a communication-interfering jammer as defined in claim 21, wherein the detector of a communication-interfering jammer in the proximity of the communication equipment comprises:

15 means for detecting a communication-interfering jammer in the proximity of the communication equipment when the comparison of the power levels indicate that the power levels of said at least a portion of the channels are similar to each other.

FIG. 1

