Datasheet for the decision of 27 May 2020

Case Number: T 1059/18 - 3.5.03
Application Number: 12800854.7
Publication Number: 2717625
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Language of the proceedings: EN

Title of invention:
Method and device for cell changing in heterogeneous network

Applicant:
Huawei Technologies Co., Ltd.

Headword:
Cell changing in heterogeneous networks/HUAWEI

Relevant legal provisions:
EPC Art. 56

Keyword:
Inventive step - main request (yes)
Case Number: T 1059/18 - 3.5.03

**DECISION**

of Technical Board of Appeal 3.5.03
of 27 May 2020

**Appellant:**
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(Applicant)

**Representative:**
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**Decision under appeal:**
Decision of the Examining Division of the European Patent Office posted on 7 December 2017 refusing European patent application No. 12800854.7 pursuant to Article 97(2) EPC.

**Composition of the Board:**

Chair
K. Bengi-Akyürek

Members:
J. Eraso Helguera
R. Romandini
Summary of Facts and Submissions

I. The appeal was lodged by the applicant against the decision of the examining division refusing the present European patent application for lack of inventive step with respect to the claims of a main request.

II. In its decision, the examining division referred inter alia to the following prior-art documents:

D1: Nokia: "HCS measurement rules & high mobility", Tdoc RAN WG2 R2-041433, 3GPP TSG-RAN-WG2 Meeting #43, Prague, CZ, 16th-20th August 2004;

D4: WO 2011/013967 A2;

D6: Huawei: "Email report on "Home-(e)NB mobility, remaining issues", R2-086778, 3GPP TSG-RAN2 Meeting #64, Prague, CZ, 10th-14th November 2008;

D13: GB 2 358 550 A.

III. The appellant requested that the decision under appeal be set aside and that a patent be granted on the basis of the claims of the main request underlying the decision, or, in the alternative, on the basis of the claims of either of a first and a second auxiliary request, both filed with the statement of grounds of appeal.

IV. Claim 1 of the main request reads:

"A method for cell changing of a user equipment in a heterogeneous network, comprising:
determining (101), by the user equipment, a movement state of the user equipment;

determining (102), by the user equipment, a frequency priority order according to the determined movement state, wherein: when the movement state is a high movement state in which the number of cell changes in a specified time exceeds a first threshold, a priority of a frequency used by a cell with a wide coverage in the heterogeneous network is higher than a priority of a frequency used by a cell with a small coverage, and, when the movement state is a low movement state in which the number of cell changes in a specified time is lower than a second threshold, a priority of a frequency used by a cell with a wide coverage in the heterogeneous network is lower than a priority of a frequency used by a cell with a small coverage;

performing (103), by the user equipment, a frequency measurement according to the determined frequency priority order and the determined movement state; and

performing (104), by the user equipment, a cell change according to the determined frequency priority order and a result of the frequency measurement,

wherein the performing (103) the frequency measurement according to the determined frequency priority order and the determined movement state comprises:

when the movement state is the high movement state in which the number of cell changes in the specified time exceeds the first threshold,

if signal strength or signal quality of a current serving cell is greater than a first demarcation, measuring at least one high-priority frequency in the heterogeneous network at intervals of a first specified time; and
if the signal strength or the signal quality of the current serving cell is less than the first demarcation, measuring all frequencies in the heterogeneous network at intervals of the first specified time;

and

when the movement state is the low movement state in which the number of cell changes in the specified time is lower than the second threshold,

if signal strength or signal quality of a current serving cell is greater than a first demarcation, measuring at least one high-priority frequency in the heterogeneous network at intervals of a first specified time;

if no cell is found at the at least one high-priority frequency in a second specified time, measuring the at least one high-priority frequency at intervals of a third specified time, wherein the third specified time is greater than the first specified time;

after at least one cell is found at the at least one high-priority frequency, measuring the at least one high-priority frequency at intervals of the first specified time; and

if the signal strength or the signal quality of the current serving cell is less than the first demarcation, measuring all frequencies in the heterogeneous network at intervals of the first specified time, and

wherein performing (104) the cell change, comprises: selecting, by the user equipment, a scaling factor corresponding to the current movement state of the user equipment according to a movement state of a user equipment, and scaling a relevant hysteresis used for cell reselection or handover, , [sic] and then performing, by the user equipment, the cell change
according to the frequency priority order, the result of the frequency measurement and the scaled relevant hysteresis,

wherein the user equipment in the heterogeneous network uses two sets of scaling factors to scale the hysteresis, respectively, and the two sets of scaling factors correspond to the size of a target cell and the movement state of the user equipment, respectively, and

wherein a first scaling factor among the first set of scaling factors is determined according to the size of the target cell for cell changing, and a second scaling factor among the second set of scaling factors is determined according to the movement state."

Independent claim 4 of the main request reads:

"A user equipment, comprising:

a first determining unit (10), configured to determine a movement state of the user equipment;

a second determining unit (11), configured to determine a frequency priority order according to the movement state determined by the first determining unit (10), wherein: when the movement state is a high movement state in which the number of cell changes in a specified time exceeds a first threshold, a priority of a frequency used by a cell with a wide coverage in the heterogeneous network is higher than a priority of a frequency used by a cell with a small coverage, and, when the movement state is a low movement state in which the number of cell changes in a specified time is lower than a second threshold, a priority of a frequency used by a cell with a wide coverage in the heterogeneous network is lower than a priority of a frequency used by a cell with a small coverage;

a measuring unit (12), configured to perform a frequency measurement according to the frequency
priority order determined by the second determining unit (11) and the determined movement state determined by the first determining unit (10); and

a processing unit (13), configured to perform a cell change according to the frequency priority order determined by the second determining unit (11) and a result of the frequency measurement performed by the measuring unit (12),

wherein the measuring unit (12) is specifically configured to:

when the movement state is the high movement state in which the number of cell changes in the specified time exceeds the first threshold,

if signal strength or signal quality of a current serving cell is greater than a first demarcation, measure at least one high-priority frequency in the heterogeneous network at intervals of a first specified time; and

if the signal strength or the signal quality of the current serving cell is less than the first demarcation, measure all frequencies in the heterogeneous network at intervals of the first specified time;

and

when the movement state is the low movement state in which the number of cell changes in the specified time is lower than the second threshold,

if signal strength or signal quality of a current serving cell is greater than a first demarcation, measure at least one high-priority frequency in the heterogeneous network at intervals of a first specified time; and

if no cell is found at the at least one high-priority frequency in a second specified time, measure the at least one high-priority frequency at intervals
of a third specified time, wherein the third specified time is greater than the first specified time;

measure the at least one high-priority frequency at intervals of the first specified time after at least one cell is found at the at least one high-priority frequency; and

if the signal strength or the signal quality of the current serving cell is less than the first demarcation, measure all frequencies in the heterogeneous network at intervals of the first specified time, and

wherein the processing unit (13) includes:

a receiving module (135) configured to receive a hysteresis used for cell changing from a current serving cell, where the hysteresis is obtained by the serving cell according to a size of a target cell for cell changing;

a determining module (136) configured to determine a scaling factor according to the determined movement state;

a scaling module (137) configured to scale the received hysteresis according to the determined scaling factor; and

a processing module (138) configured to perform the cell change according to the frequency priority order, the result of the frequency measurement and the scaled hysteresis,

wherein the user equipment in the heterogeneous network uses two sets of scaling factors to scale the hysteresis, respectively, and the two sets of scaling factors correspond to the size of the target cell and the movement state of the user equipment, respectively and

wherein a first scaling factor among the first set of scaling factors is determined according to the size of the target cell for cell changing, and a second
scaling factor among the second set of scaling factors is determined according to the movement state."

Reasons for the Decision

1. MAIN REQUEST

1.1 Inventive step (Article 56 EPC)

1.1.1 The board concurs with the decision under appeal and with the appellant that the subject-matter of claim 1 of the main request differs from D1 at least in that (board's emphasis):

(a) performing the frequency measurement according to the determined frequency priority order and the determined movement state further comprises:

when the movement state is the low movement state in which the number of cell changes in the specified time is lower than the second threshold, if signal strength or signal quality of a current serving cell is greater than a first demarcation,

if no cell is found at the at least one high-priority frequency in a second specified time, measuring the at least one high-priority frequency at intervals of a third specified time, wherein the third specified time is greater than the first specified time; after at least one cell is found at the at least one high-priority frequency, measuring the at least one high-priority
frequency at intervals of the first specified time,

and in that:

(b) performing the cell change, further comprises:

selecting, by the user equipment, a scaling factor corresponding to the current movement state of the user equipment according to a movement state of a user equipment, and scaling a relevant hysteresis used for cell reselection or handover, and then performing, by the user equipment, the cell change according to the frequency priority order, the result of the frequency measurement and the scaled relevant hysteresis,

wherein the user equipment in the heterogeneous network uses two sets of scaling factors to scale the hysteresis, respectively, and the two sets of scaling factors correspond to the size of a target cell and the movement state of the user equipment, respectively, and

wherein a first scaling factor among the first set of scaling factors is determined according to the size of the target cell for cell changing, and a second scaling factor among the second set of scaling factors is determined according to the movement state.

1.1.2 According to paragraph [0046] of the present application as published, the technical effect achieved by feature (a) is that it reduces the number of measurements carried out when the user equipment is in
a low movement state and stays in gaps between small cells for a long time.

On the basis of the application, the objective technical problem associated with feature (a) may be defined as "how to prevent wasting much battery energy of the user equipment when performing frequency measurements."

1.1.3 According to paragraphs [0053] and [0054] of the application as published, the technical effect achieved by feature (b) is that it adapts the hysteresis to the size of the cell and the movement state of the user equipment, avoiding thereby early reselection or handover and thus ping-pong effects.

The objective technical problem associated with feature (b) may therefore be framed as "how to avoid early or late cell changes of the user equipment in the heterogeneous network of D1."

1.1.4 Hence, the board holds that the two distinguishing features are associated with distinct partial objective problems; therefore, they may be assessed independently. For the reasons set out below, the board finds that distinguishing feature (a) alone justifies the acknowledgement of inventive step.

1.1.5 The examining division considered in point 19.5.2 of the appealed decision that the person skilled in the art starting out from D1 would introduce feature (a) by combining the teachings of D1 and D13 in a straightforward manner.

1.1.6 The board disagrees. D13 seeks to optimise the mobile terminal's battery life by considering two aspects: the
differences in signal quality among neighbouring cells (see page 2, point 1) and the rate of change in propagation conditions of those signals (see page 3, point 2). In accordance with the first aspect, the first technique of D13 proposes classifying the neighbouring cells according to a quality parameter signal (i.e. signal quality and/or strength) and monitoring the signals in different groups at different rates. As to the second aspect, the second technique of D13 suggests adjusting the monitoring rate depending upon the change over time in the quality parameter of the proximate signals. Both techniques may be used separately or in combination.

D13 does not specifically relate to heterogeneous networks but to cellular networks in general and TETRA in particular. Assuming arguendo that the skilled person starting out from D1 considered applying the teachings of D13 in order to prevent wasting much battery energy of the user equipment upon frequency measurements within the meaning of feature (a) would still require the skilled person to:

(i) purposely choose at least the first technique of D13 from the two techniques available and apply it at least to the specific situation of D1 in which the movement state is the low movement state and the signal strength or signal quality of a current serving cell is greater than a demarcation,

(ii) at least in this situation, set a threshold so low that, as soon as at least one cell is found again at a high-priority frequency, it is moved to the "foreground group" according to D13.
With respect to step (i) and account taken that the teachings of D13 should be applied to the specific situation of D1 in which the movement state is the low movement state, the second technique would appear to be the straightforward choice since it is explicitly presented in D13 as suited to "static conditions" (see page 3, point 2). However, this technique does not require the definition of intervals of a first, second and third specified time, as required by feature (a), because the monitoring rate is obtained from a time derivative of the quality parameters of the proximate cells.

If the skilled person nevertheless applied the first technique of D13 to D1, as argued by the examining division, following in particular the teachings of D13, page 8, lines 19-23, the board notes that, if a measured cell belonging to the foreground group and being monitored at a relatively high rate was not found in the corresponding monitoring period (and considering a second specified time equal to the first specified time), the quality parameter would be below the threshold and the cell would be moved to the "background group" and measured at a relatively low rate. After a cell was found at a high-priority frequency, the cells with a measured quality parameter being above the threshold would be moved to the "foreground group", while the rest of the cells would remain in the "background group". The examining division considered in point 19.5.2, third paragraph, of the impugned decision that "claim 1 discloses the lowest threshold possible (signal detection threshold). Such a choice cannot be considered to be inventive as it is regarded to be a common and obvious choice for the person skilled in the art."
The board disagrees. As explained in paragraph [0050] of the application as published, "[i]f no cell is found in the second specified time, it indicates that the user equipment may stay in a gap between the small cells at this time, and probably no cell will be found even if the user equipment performs the frequency measurement continually at intervals of the first specified time ...". Hence, the specific threshold "cell at a high-priority frequency found/not found" of distinguishing feature (a), chosen in the present application to reduce the measurement rate when the movement state corresponds to the low movement state and the signal strength or signal quality of a current serving cell is greater than a demarcation, is not arbitrary but purposively set to detect and tackle the specific situation of a static terminal situated in a gap between small cells in a heterogeneous network. Neither of D1 and D13 hint at using this specific combination of features or even addressing this particular situation. Thus, the person skilled in the field of 3GPP-based mobile networks would not arrive at this combination without the use of hindsight.

1.1.7 Prior-art documents D4 and D6 were cited by the examining division in relation to distinguishing feature (b). Neither of those documents discloses or hints at the introduction of distinguishing feature (a) into the system of D1.

1.1.8 At least for this reason, the subject-matter of claim 1 of the main request involves an inventive step in view of D1 and its combination with D13, D4 or D6 and the skilled person's common general knowledge.
1.1.9 The same reasoning applies *mutatis mutandis* to the subject-matter of the further independent claim 4.

1.2 In view of the above, the board decides that a patent is to be granted on the basis of the claims of the present main request.

The main request being allowable, the auxiliary requests on file need not be considered further.

**Order**

**For these reasons it is decided that:**

1. The decision under appeal is set aside.

2. The case is remitted to the examining division with the order to grant a patent on the basis of claims 1 to 6 of the main request as filed on 4 October 2017 and with a description and drawings to be adapted accordingly.

The Registrar: 

B. Brückner

The Chair:

K. Bengi-Akyürek

Decision electronically authenticated