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*[Continued on next page]*

# (54) Title: METHOD AND SERVER FOR COLLECTING RADIO FINGERPRINT POSITIONING DATA

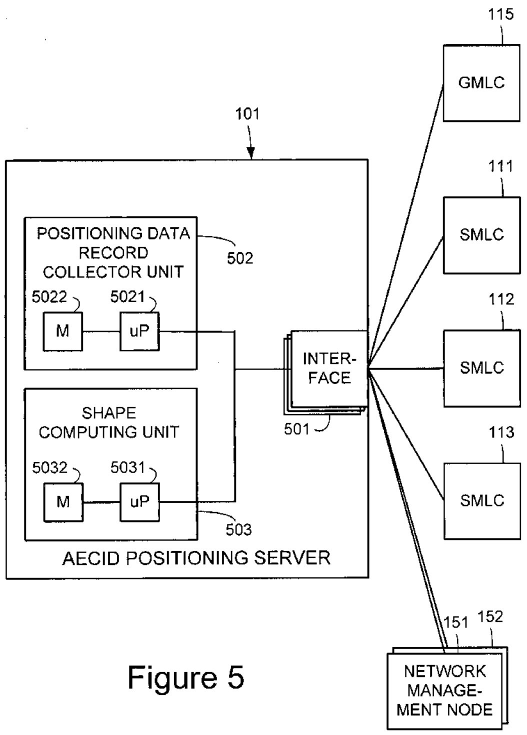


Figure 5

**(57) Abstract**: The present invention relates to a method and a positioning server (101) in a radio access network (100) for collecting radio fingerprint positioning data records from different nodes (111,121,151). The data records comprise geographical positions and radio network communication parameters and are stored and grouped in clusters in the positioning server (101). A geometrical shape representing a geographical area based on the network communication parameters in the collected positioning data records in the cluster is computed. When a notification about changed network configuration parameters for a radio cell is received, known positioning servers simply erase all positioning data records related to that radio cell. This results in the unavailability of still valid positioning data. The present invention overcomes this problem by selectively erase positioning data records in the positioning server (101) only when the configuration parameters have changed beyond a predefined value range.

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# METHOD AND SERVER FOR COLLECTING RADIO FINGERPRINT POSITIONING DATA

## TECHNICAL FIELD

The present invention relates to a method and a server for collecting radio fingerprint positioning data for a radio access network.

## BACKGROUND

When an emergency call is made to an emergency center it is important to determine the location of the terminal from where the call was made. Authorities in many countries have therefore put positioning requirements on the telecommunication network operators. Traditional fixed line telephones are simply localized by their telephone numbers as these are affiliated with the physical address of the subscriber. For mobile terminals however other techniques are necessary. A method that has become a de facto standard in many countries is assisted GPS (A-GPS). A-GPS is based on traditional GPS positioning using GPS enabled mobile terminals. Although traditional GPS alone is a very precise positioning method it has its drawbacks in areas with poor GPS signal conditions as in buildings and dense urban areas. To improve the sensitivity and to speed up the time to fix the satellites in these situations A-GPS uses additional GPS data provided by the radio access network (RAN).

Another approach to positioning is called fingerprinting positioning, or RF fingerprinting. Fingerprinting positioning algorithms operate by creating a database of radio fingerprint data for each point of a fine coordinate grid that covers the RAN. The fingerprint data may include:

- radio cell identities that are detected by the terminal, in each grid point

- quantized signal strength measurements, with respect to multiple base stations, performed by a mobile terminal, in each grid point

- radio connection information, such as the radio access bearer (RAB) etc.

Whenever a position request for a particular mobile terminal is received, fingerprint data for the mobile terminal is first obtained. This fingerprint data is matched with the fingerprint database to retrieve the corresponding grid point and thus identify the location of the mobile terminal. Of course, this approach requires that the fingerprint data for each grid point is unique and that the fingerprint data obtained from mobile terminal at a given point is relatively consistent.

The database of fingerprinted positions (the radio map) can be generated in several ways. One approach is to perform an extensive surveying operation that performs fingerprinting radio measurements repeatedly for all coordinate grid points of the RAN. The disadvantages of this approach include that the surveying required becomes substantial, even for small RANs. Further, some of the radio fingerprint data (e.g. signal strength and path loss) is sensitive to the orientation of the mobile terminal. For fine grids, the accuracies of the fingerprinted positions therefore become highly uncertain. Unfortunately, these potential problems are seldom reflected in the accuracy estimates reported along with the reported geographical result.

Another approach to RF fingerprinting is to replace the fine grid by high-precision position measurements of opportunity, and to provide fingerprinting radio measurements for said points. This avoids a number of the above drawbacks.

Ericsson’s Adaptive Enhanced Cell ID (AECID) is a fingerprinting method that collects for example A-GPS positioning data. The principle of the AECID method is for example described in the international patent application with the publication number WO2009/131506 and in the paper "AECID Fingerprinting Positioning Performance" by Liang Shi and Torbjörn Wigren published in the IEEE Globecom 2009 proceedings.

An AECID positioning server collects high precision position measurements of opportunity in positioning data records also called reference points, using for example A-GPS. The positioning data records are for example collected from serving or gateway mobile location centres, SMLC/GMLC and comprise determined geographical positions associated with radio network communication parameters that are recorded during the high precision positioning measurement.

For GSM, the associated radio network communication parameters comprise the CGI of a serving cell and of neighbour cells and the corresponding signal strengths. Corresponding communication parameters are recorded for other radio technologies.

All collected positioning data records can be saved in an intermediate storage for later processing.

The AECID fingerprinting method continues by grouping the high precision position measurements in clusters. The high precision position measurements of each cluster are tagged with the same set of serving cell and detected neighbour cells, as well as network measurements. For each cluster that has enough high precision position measurements, a geometrical shape representing a geographical area is computed.

A problem arises when the RAN is reconfigured and network configuration parameters (such as cell identities, radio systems types, antenna height etc) change. At these occasions a number of collected positioning data records become invalid or misleading. When such configuration parameter changes are made, existing positioning servers erase all the collected positioning data records related to the changed configuration parameters and a large number of positioning data records has to be collected anew in order to compute new valid geometrical shapes. This is turn also means that positioning data that still was valid becomes unavailable.

**SUMMARY**

With this background, it is the object of the present invention to obviate at least some of the disadvantages mentioned above.

The object is achieved by a method that comprises the steps of collecting by a positioning server (such as an AECID server) from a least one node (such as a SMLC, GMLC, base station or a network management node) a plurality of positioning data records where each positioning data record comprises a determined geographical position and a set of determined radio network communication parameters including the identity of at least one radio cell and where the radio network communication parameters are associated with the determined geographical position. The collected positioning data records having the same set of radio network communication parameters are stored and grouped in a cluster.

When the cluster comprises a certain number of collected positioning data records, a geometrical shape representing a geographical area is computed based on the geographical position data in the collected positioning data records in the cluster.

When the positioning server receives a notification from another node (such as a network management node) that at least one configuration parameter for an identified radio cell has changed, positioning data records comprising the identified radio cell are erased from the cluster, only if the value of at least one selected configuration parameter has changed beyond a predefined value range. Optionally, the geometrical shape is recomputed based on the geographical position data in the remaining positioning data records in the cluster.

The object of the invention is further achieved by a positioning server (e g an AECID server) for collecting the radio fingerprint positioning data according to the method described above. The AECID server comprises one or several communication interfaces adapted to communicate with nodes such as SMLCs, GMLCs base stations and network management nodes. The positioning server further comprises

- a positioning data record collector unit and

- a shape computing unit.

The positioning data record collector unit is adapted to collect the positioning data records described above. The shape computing unit is adapted to compute the geometrical shape representing the geographical area for the collected positioning data records in the cluster.

The shape computing unit is also adapted to erase from the cluster, only those positioning data records comprising an identified radio cell if at least one selected configuration parameter related to that identified radio cell has changed beyond a predefined value range.

An advantage with the invention is that minor network configuration changes will have no impact on already collected positioning measurements and performed shape computation. This in turn results in an increased availability of valid fingerprints for positioning.

The invention will now be described in more detail and with preferred embodiments and referring to accompanying drawings.

**BRIEF DESCRIPTION OF THE DRAWINGS**

Figure **1** is a block diagram illustrating an example of a fingerprinting positioning architecture.

Figure **2** is a flow chart or signaling diagram illustrating the method of collecting high precision position measurements of opportunity including the method of the present invention.

Figure **3** is a flow chart or signaling diagram illustrating a typical AECID positioning signaling flow.

Figure **4** is a flow chart illustrating the method of the present invention.

Figure **5** is a block diagram illustrating a positioning server according to the present invention.

**DETAILED DESCRIPTION**

An example of an online Adaptive Enhanced Cell ID (AECID) fingerprinting architecture is illustrated by Figure **1.** The architecture comprises an AECID positioning server **101** and a plurality of service mobile location centers, SMLC **111-113** connected to the positioning server **101.** Each SMLC **111-113** is connected to a plurality of base station controllers and/or base stations, BSC/BS **121-126** that are serving a plurality of mobile terminals **131-134.** Each BSC/BS **121-126** is configured from a network management node **151,152.** The network management node **151,152** is also connected to the AECID positioning server **101.** The AECID position server **101** could also be connected to a GMLC **115** as shown in Figure **5.** The GMLC **115** is normally located in the core network and not in the RAN **100.**

In the illustrated architecture there is a functional division between the positioning server **101** and the plurality of SMLCs **111-113**. The SMLCs **111-113** implement the signaling flow associated with the collection of A-GPS measurements from the base stations BSC/BS **121-126**. The SMLCs **111-113** create positioning data records (also called reference points) comprising a determined geographical position (using for example A-GPS) and a set of determined radio network parameters associated with the determined geographical position. The associated radio network communication parameters typically comprise the radio cell identity of a serving cell and of neighbour cells and the corresponding signal strengths and/or path loss parameters.

For example:

- GSM Control Plane: CGI (Cell Global Identity) of serving cell, TA (Timing Advance), CGI of neighbour cell and corresponding Signal strength;
- GSM User Plane: CGI of serving cell, TA, ARFCN (Absolute Radio Frequency Channel Number )/BSIC (Base Station Identity Code) of neighbour cell and corresponding Signal strength;
- WCDMA Control Plane: Global UC_ID of serving cell, RTT (Round Trip Time), Global UC_ID of neighbour cell and corresponding path loss;
- WCDMA User Plane: SAI (Service Area Identifier) of serving cell, Primary Scrambling Code of neighbour cell and corresponding path loss.

The SMLC is responsible for the GSM and WCDMA control plane communication parameters and the GMLC is responsible for the user plane communication parameters.

The collection of high precision position measurements of opportunity using A-GPS is illustrated by the signaling diagram in Figure **2**. A Perform Location Measurement Request message from the BSC/BS **121** is received by the SMLC **111** in step **201**. The SMLC **111** starts an A-GPS positioning flow in step **202** by sending a MS Position Command message to the BSC/BS **121** in step **203**. The position measurement data are received in a MS Position Response message in step **204**. If enough positioning data is received and the location request is succeeded in step **205**, the SMLC **111** sends a Perform Location Response to the BSC/BS **121** in step **206** and sends a positioning record with the determined geographical position and a set of determined radio network parameters associated with the determined geographical position in an Upload Record message to the AECID server **101** in step **207**. The AECID server **101** stores the positioning data record in step **208** and groups the received data records in clusters in step **209**. For each cluster that has enough collected high precision position measurements, a geometrical AECID shape is computed in step **210**, where the shape represents a geographical area. The shape can be a polygon or an ellipse depending on the type of radio system (GSM, WCDMA etc). The shape can be sent back to the SMLC **111** and stored in an AECID shape cache.

The computed shape is used for positioning of individual mobile terminals **131-134** in the radio access network, RAN **100**. An example of an information flow and the involved network elements is shown in the signaling diagram in Figure **3**. The SMLC **111** receives a Perform Location request message from the BSC/BS **121** in step **301**. This message may in turn be trigged by a request from an emergency center requiring locating a mobile terminal **131**. The SMLC **111** sends a TA request message back to the BSC/BS **121** in step **302** and receives in step **303** a TA response message with network parameters such as the cell identities of serving and neighbor cells and corresponding signal strength. The SMLC **111** performs a lookup in the AECID shape cache in step **304**. The identified shape including the cell identities and the corresponding signal strength is returned to the BSC/BS in a perform location response message in step **305**. More details on the information elements in each message discussed above are found in the 3GPP specifications TS 48.071 and TS 49.031.

The steps **207** to **213** in Figure 2 are more detailed in Figure **4**. As described above, the AECID server **101** receives in step **207** a positioning record with a determined geographical position and a set of determined radio network parameters associated with the determined geographical position. The AECID server **101** stores the positioning data record in step **208**. Positioning data records having the same set of radio network parameters are grouped in a cluster in step **209**. In step **209b** a check is made if sufficient positioning data records have been collected. If this is the case, the geometrical shape is computed in step **210**.

The process of collecting new positioning data records and computing geometrical shapes in the AECID server **101** can be an ongoing and repeated activity during the operation of the RAN.

In the event that the RAN **100** is re-configured at a network management node **151**, a number of configuration parameters related to a radio cell may change. A notification of these changes is sent from the management node **151** to the AECID server **101** in step **211**. The notification could for example comprise the export of a changed cell list, CCL which includes data about those radio cells whose configuration parameters have changed.

Instead of erasing all the collected positioning data records related to the changed configuration parameters as in existing RANs, the present invention selectively, after the decision step **211b**, erase in step **212** from the cluster, only those positioning data records comprising the identified radio cell for which the value of a selected configuration parameter has changed beyond a predefined value range.

To achieve this, each one of the network configuration parameters for the RAN **100** is given a different 'sensibility' weight and/or ranges within they can change without impacting the positioning data records. For example, some low level sensibility configuration parameters may change without disturbing the collected positioning data at all such as naming information in network cell data like BSC name and cell name. Some selected medium level sensibility parameters may vary within a certain value range without disturbing the collected positioning data. Examples on that are radio system parameters such as minimum received signal level at the mobile terminal, antenna gain, antenna tilt, base station, BS power, cell direction, sector angle and TA limit. Other examples are geographic information parameters related to the location of the cell or radio equipment such as BSC/BS site latitude/longitude, cell latitude/longitude, altitude range within the cell coverage, maximum cell radius and antenna height.

Some selected high level sensibility parameters may always affect the collected positioning data if they are changed, for example identity parameters for the radio cell or for the mobile network such as MCC (Mobile Country Code) MNC (Mobile Network Code) LAC (Location Area Code) and CI (Cell Identity). Other parameters are some other major network parameters like antenna type (OMNI, Sector) radio system type (GSM800, GSM900, GSM1800 etc) and cell type (PICO,MICRO, MACRO) etc.

In short, if a selected configuration parameter related to an identified radio cell has changed beyond a predefined value range, only the positioning data records comprising the identified radio cell are erased from the cluster as in step **212** in Figure **4**.

The total set of configuration parameters for each radio cell can also be expressed as

$$S = \{P^h, P^m, P^l\}$$

where $S$ is a set including all the configuration parameters for certain cell.

$P^h$ is a set for high level sensibility configuration parameters:

$$P^h = \{P_1^h, P_2^h, ..., P_i^h\}$$

$P^m$ is a set for middle level sensibility configuration parameters:

$$P^m = \{P_1^m, P_2^m, ..., P_j^m\}$$

$P^l$ is a set for low level sensibility configuration parameters:

$$P^l = \{P_1^l, P_2^l, ..., P_k^l\}$$

and $i + j + k = N$, where $N$ is the total number of configuration parameters for the radio cell.

In the set $P^m$, there are two subset $P^a$ and $P^r$, and $P^m = \{P^a, P^r\}$, $P^a$ includes the configuration parameters which use absolute value as threshold while $P^r$ includes the configuration parameters which use ratio as threshold.

$p$ is the parameter,

$d(p)$ is the difference between new value and old value for configuration parameter $p$,

$r(p)$ is the ratio of new value and old value for configuration parameter $p$.

$v(p)$ is the threshold for configuration parameter $p$.

The pseudo code for an embodiment of an implemented logic control can be as follows:

```
if p∈P^l, then
{
     Ignore the change.
}
else if p∈P^h, then
{
     delete the corresponding
     positioning data records that
     belongs to this radio cell.
}
else if p∈P^m, then
{
     if p∈P^a and d(p)<v(p), then
     {
          Ignore the change.
     }
     else
     {
          delete the corresponding
          positioning data records that
          belongs to this radio cell.
     }
     end
     If p∈P^r and r(p)<v(p),  then
     {
          Ignore the change.
     }
     else
     {
          delete the corresponding
          positioning data records that
          belongs to this radio cell.
     }
     end
}
end
```

In the example above, $S$ comprises three sets $S=\{P^h,P^m,P^l\}$ . $S$ could very well comprise more than three sets, but three sets can be seen as a preferred embodiment.

Returning to Figure **4**, the geometrical shape is optionally recomputed in step **213** based on the geographical position data in the remaining positioning data records in the cluster. The recomputation can for example be performed each time a positioning data record is erased or when the number of positioning data records in the cluster falls below a predetermined threshold or at regular intervals.

The AECID positioning server **101** for collecting radio fingerprint positioning data according to the method described above is illustrated in Figure **5** and comprises one or several communication interfaces **501** adapted to communicate with SMLC/GMLCs **111-113,115**, base stations **121-126** (not shown) and with network management nodes **151,152**. The AECID server **101** further comprises

- a positioning data record collector unit **502** and
- a shape computing unit **503**.

The positioning data record collector unit **502** is adapted to collect the positioning data records described above from the different nodes. The shape computing unit **503** is adapted to compute the geometrical shape representing the geographical area for the collected positioning data records in the cluster.

The shape computing unit **503** is also adapted to erase from the cluster, only those positioning data records comprising an identified radio cell if at least one selected configuration parameter related to that identified radio cell has changed beyond a predefined value range.

The positioning data record collector unit **502** and shape computing unit **503** could in one embodiment each comprise a micro processor uP **5021,5031** and a memory area M **5022,5032** adapted to execute the collections and computations described above.

Although the architecture in Figure **1** illustrates an online collection scenario where a functional division between the positioning server **101** and the SMLCs **111-113** is used, this division is not a necessity in the context of the present invention. In principle, the present invention is also operable if the functionality in the AECID positioning server **101** and the SMLCs **111-113** together is integrated in a single positioning server. The AECID positioning server **101** could also collect the positioning data records from other nodes such as network management nodes 151,152. In this case the position data records originate from offline collections using different positioning tools.

**CLAIMS**

1. A method in a positioning server (**101**) for collecting radio fingerprint positioning data for a radio access network, RAN (**100**) comprising the steps of:

- collecting (**207**) from a least one first node (**111,121,151**) a plurality of positioning data records where each positioning data record comprises a determined geographical position and a set of determined radio network communication parameters including the identity of at least one radio cell and where the radio network communication parameters are associated with the determined geographical position;

- storing (**208**) the collected positioning data records;

- grouping (**209**) positioning data records having the same set of radio network parameters in a cluster;

- when the cluster comprises a certain number of collected positioning data records, computing (**210**) a geometrical shape representing a geographical area based on the geographical position data in the collected positioning data records in the cluster;

- receiving (**211**) from a second node (**151,152**) a notification that at least one configuration parameter for an identified radio cell has changed;

- erasing (**212**) from the cluster, positioning data records comprising the identified radio cell if the value of at least one selected configuration parameter has changed beyond a predefined value range.

2. A method as in claim 1 where the first node (**111,121,151**) is any of the following nodes:

- a serving mobile location centre, SMLC (**111-113**);

- a gateway mobile location centre, GMLC (**111-113**);

- a network management node (**151,152**);

- a base station, BSC/BS (**121-126**);

and where the second node (**151,152**) is a network management node (**151,152**).

3. A method as in claim 2 where the set of determined radio network communication parameters comprises any or a combination of:

- identity parameters for the serving radio cell,

- identity parameters for the neighbor radio cells,

- signal strength and/or path loss parameters for each radio cell.

4. A method as in claim 3 where the configuration parameters comprise any or a combination of:

- identity parameters for the radio cell,

- identity parameters for the mobile network,

- radio system parameters such as type of radio system, cell or antenna,

- geographic location of the cell or radio equipment.

5. A method as in any of the preceding claims where the geographical positions are determined by using assisted GPS, A-GPS.

6. A method as in claim 1 including a further step (**213**) of recomputing the geometrical shape each time a positioning data record is erased.

7. A method as in claim 1 including a further step (**213**) of recomputing the geometrical shape when the number of positioning data records in the cluster falls below a predetermined threshold.

8. A method as in claim 1 including a further step (**213**) of recomputing the geometrical shape at regular intervals.

9. A method as in any of the preceding claims where the geometrical shape is a polygon.

10. A positioning server (**101**) for collecting radio fingerprint positioning data for a radio access network, RAN (**100**) comprising:

- at least one communication interface (**501**) adapted to communicate with a plurality of nodes (**111,121,151**);

- a positioning data record collector unit (**502**);

- a shape computing unit (**503**);

where the positioning data record collector unit (**502**) is adapted to collect from at least one first node (**111,121,151**) and to store in a cluster, positioning data records each data record comprising a determined geographical position and a set of determined radio network communication parameters associated with the determined geographical position and where the shape computing unit (**503**) is adapted to compute a geometrical shape representing a geographical area for the collected positioning data records in the cluster and where the shape computing unit (**503**) is **characterized in that** it is further adapted to erase from the cluster, selected positioning data records for a specific radio cell if at least one selected configuration parameter for that radio cell received in a notification from a second node (**151**) has changed beyond a predefined value range.

11. A positioning server (**101**) as in claim 10 where the at least one first node (**111,121,151**) is any or a combination of the following nodes:

- a serving mobile location centre, SMLC (**111-113**);

- a gateway mobile location centre, GMLC (**111-113**);

- a network management node (**151,152**);

- a base station, BSC/BS (**121-126**);

and where the second node (**151**) is a network management node (**151,152**).

12. A positioning server (**101**) as in claim 11 where the set of determined radio network communication parameters comprises any or a combination of:

- identity parameters for the serving radio cell,

- identity parameters for the neighbor radio cells,

- signal strength and/or path loss parameters for each radio cell.

13. A positioning server (**101**) as in claim 12 where the configuration parameters comprise any or a combination of:

- identity parameters for the radio cell,

- identity parameters for the mobile network,

- radio system parameters such as type of radio system, cell or antenna,

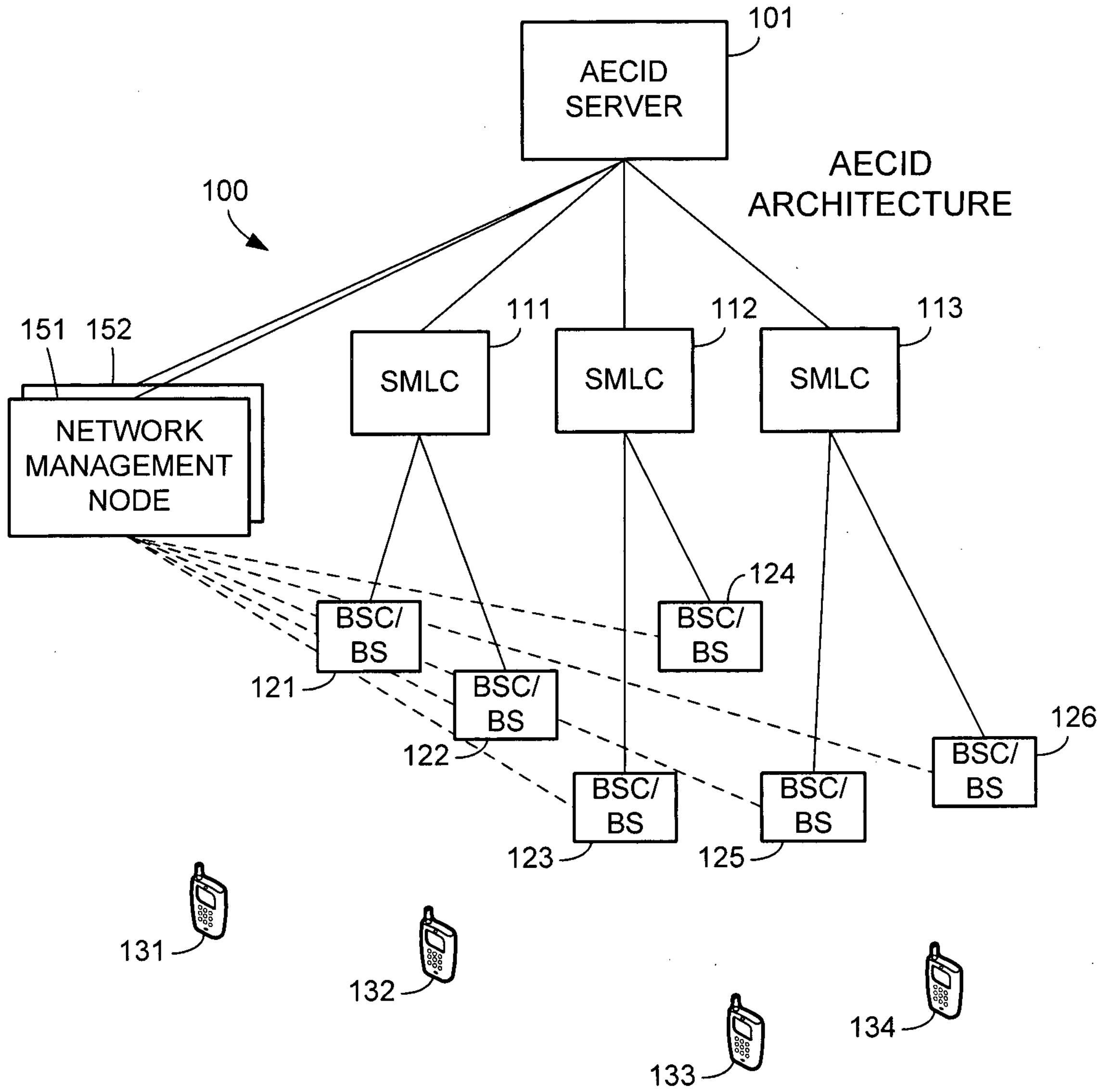
- geographic location of the cell or radio equipment.

14. A positioning server (**101**) as in claim 10 where the shape computing unit (**503**) is further adapted to recompute the

geometrical shape each time a positioning data record is erased.

15. A positioning server (**101**) as in claim 10 where the shape computing unit (**503**) is further adapted to recompute the geometrical shape when the number of positioning data records in the cluster falls below a predetermined threshold.

16. A positioning server (**101**) as in claim 10 where the shape computing unit (**503**) is further adapted to recompute the geometrical shape at regular intervals.



101
AECID SERVER
AECID ARCHITECTURE
100
151 152
NETWORK MANAGEMENT NODE
111
SMLC
112
SMLC
113
SMLC
124
BSC/ BS
BSC/ BS
121
BSC/ BS
122
126
BSC/ BS
BSC/ BS
123
BSC/ BS
125
131
132
133
134


Figure 1

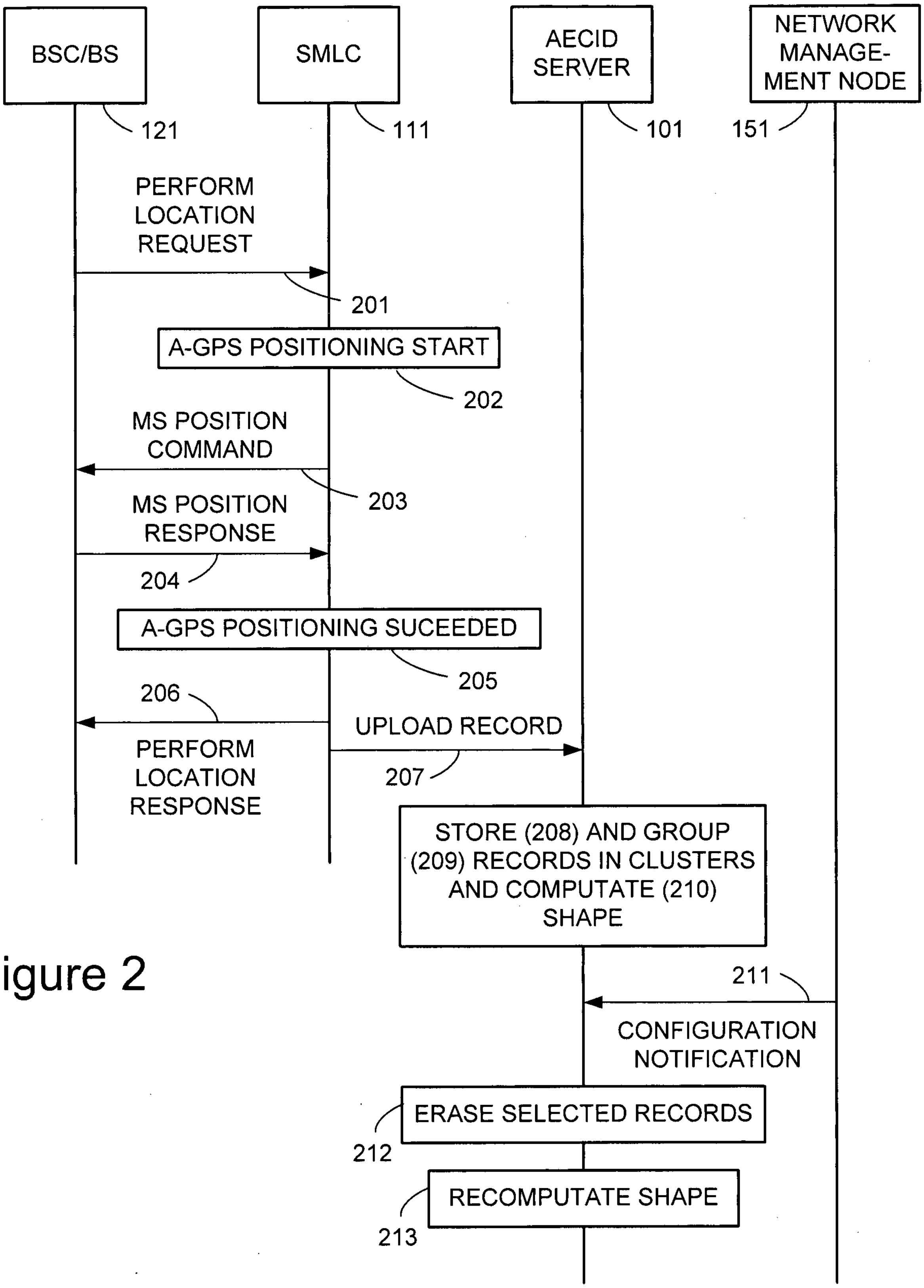

BSC/BS
SMLC
AECID SERVER
NETWORK MANAGE-MENT NODE
121
111
101
151
PERFORM LOCATION REQUEST
201
A-GPS POSITIONING START
202
MS POSITION COMMAND
203
MS POSITION RESPONSE
204
A-GPS POSITIONING SUCEEDED
205
206
UPLOAD RECORD
PERFORM LOCATION RESPONSE
207
STORE (208) AND GROUP (209) RECORDS IN CLUSTERS AND COMPUTATE (210) SHAPE
211
CONFIGURATION NOTIFICATION
ERASE SELECTED RECORDS
212
RECOMPUTATE SHAPE
213

Figure 2

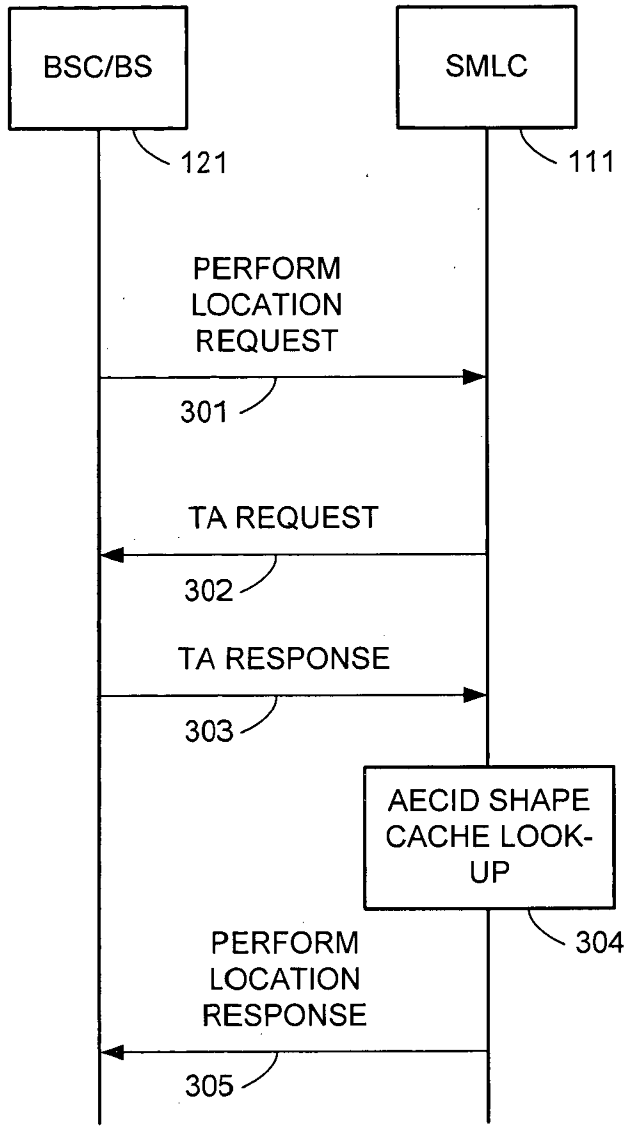

BSC/BS
SMLC
121
111
PERFORM LOCATION REQUEST
301
TA REQUEST
302
TA RESPONSE
303
AECID SHAPE CACHE LOOK-UP
304
PERFORM LOCATION RESPONSE
305

Figure 3

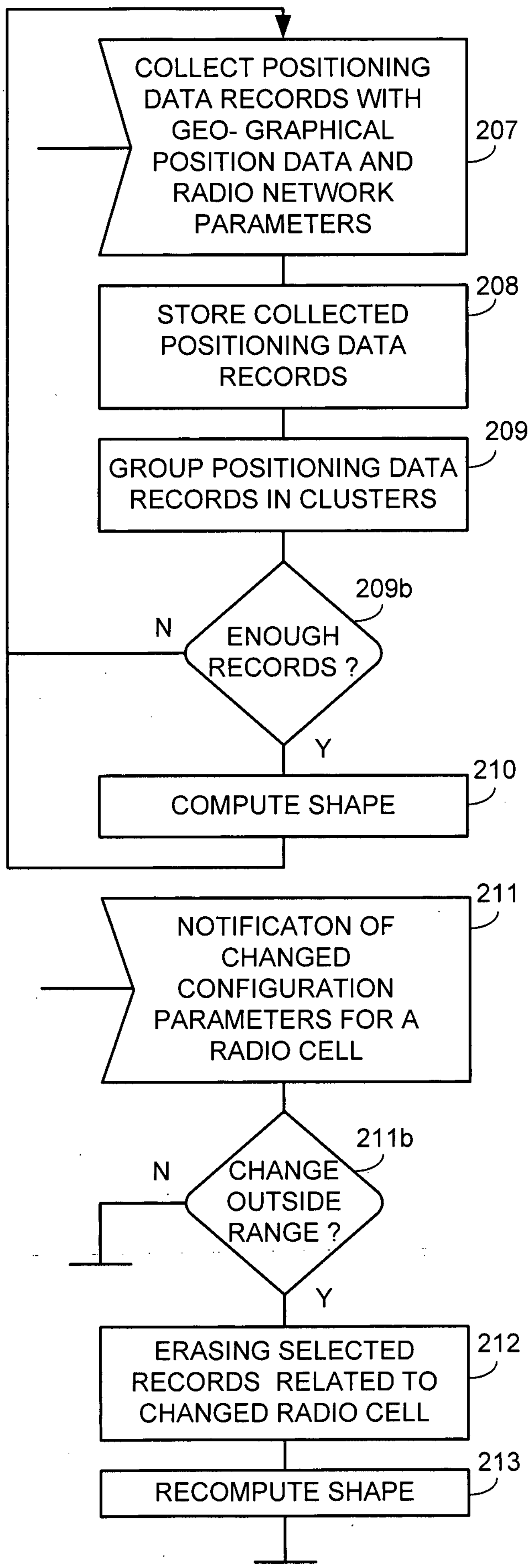

COLLECT POSITIONING DATA RECORDS WITH GEO- GRAPHICAL POSITION DATA AND RADIO NETWORK PARAMETERS
207
STORE COLLECTED POSITIONING DATA RECORDS
208
GROUP POSITIONING DATA RECORDS IN CLUSTERS
209
ENOUGH RECORDS ?
209b
N
Y
COMPUTE SHAPE
210
NOTIFICATON OF CHANGED CONFIGURATION PARAMETERS FOR A RADIO CELL
211
CHANGE OUTSIDE RANGE ?
211b
N
Y
ERASING SELECTED RECORDS RELATED TO CHANGED RADIO CELL
212
RECOMPUTE SHAPE
213

Figure 4

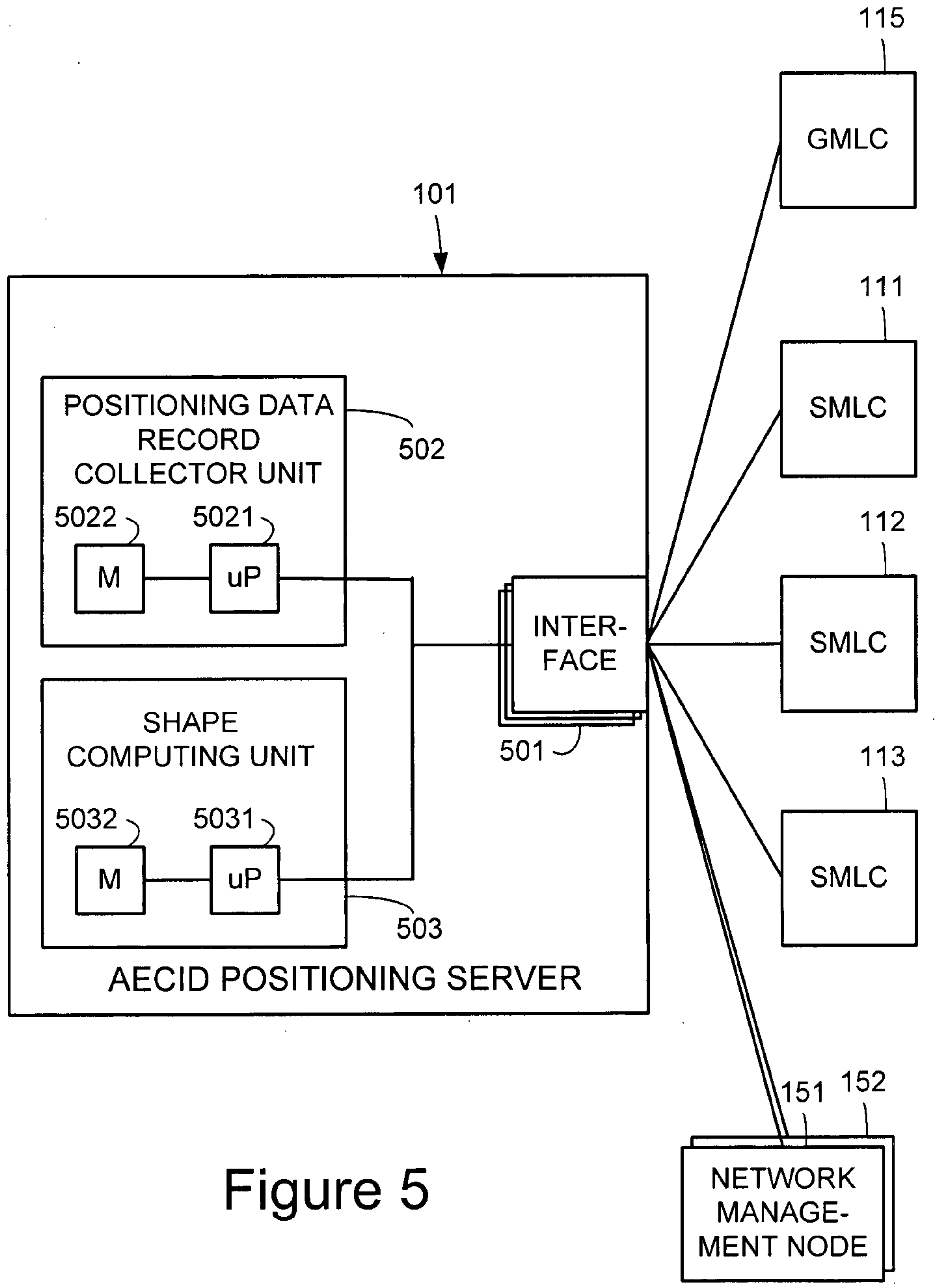

115
GMLC
101
111
SMLC
POSITIONING DATA RECORD COLLECTOR UNIT
502
5022
5021
M
uP
112
SMLC
INTER-FACE
501
SHAPE COMPUTING UNIT
113
SMLC
5032
5031
M
uP
503
AECID POSITIONING SERVER
151
152
NETWORK MANAGE-MENT NODE

Figure 5

# INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2011/000781

**A. CLASSIFICATION OF SUBJECT MATTER**

H04W 64/00 (2009.01) i

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: H04W, H04Q, H04M, H04J

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 practicable, search terms used)

EPODOC, CPRS, CPRSABS,CNABS, VEN: FINGERPRINT+, POSITION+, LOCATION+, BASE W STATION, CELL, BS, BTS, NODE, ENB, ERAS+, DELET+, CANCEL+, DISPEL+, REMOV+, PARAMETER?, DATA, CLUSTER, GROUP, BATCH, GEOGRAPHICAL, GEMETRICAL, SHAPE, LANDFORM, CHANG+, ALTER+, RENOVAT+, UPDAT+, RADIO

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| A | WO2009134174A1 (TELEFONAKTIEBOLAGET L M ERICSSON) 05 Nov. 2009(05.11.2009) See the whole document | 1-16 |
| A | WO2007086784A1 (TELEFONAKTIEBOLAGET L M ERICSSON) 02 Aug. 2007(02.08.2007) See the whole document | 1-16 |
| A | CN101048962A (ZTE CORP.) 03 Oct. 2007(03.10.2007) See the whole document | 1-16 |

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

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim (S) or which is cited to establish the publication date of another citation or other special reason (as specified)

"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 | Date of mailing of the international search report |
|---|---|
| 29 Jan. 2012(29.01.2012) | **09 Feb. 2012 (09.02.2012)** |

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# INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2011/000781

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
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| A | CN101547506A (UNIV HUAZHONG SCIENCE TECH) 30 Sep. 2009(30.09.2009) See the whole document | 1-16 |

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Information on patent family members

International application No.
PCT/CN2011/000781

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