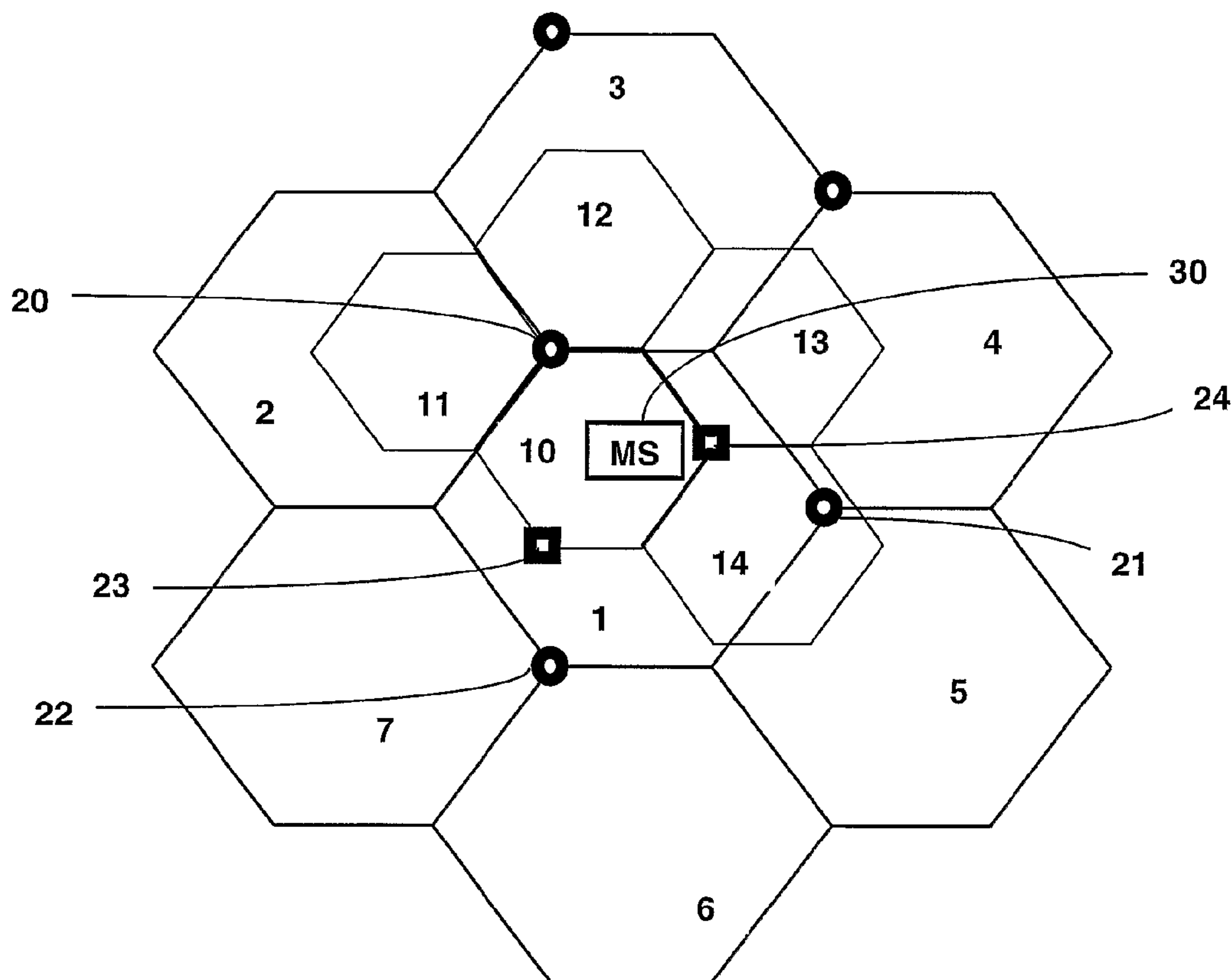




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(54) Titre : PROCEDE POUR EFFECTUER UN TRANSFERT AVEUGLE LORS D'UN TRANSFERT ENTRE SYSTEMES
ET ENTRE FREQUENCES D'UN SYSTEME DE COMMUNICATION MOBILE
(54) Title: PROCESS FOR IMPLEMENTATION OF A BLIND HANDOVER IN AN INTERSYSTEM AND
INTERFREQUENCY HANDOVER WITH MOBILE COMMUNICATIONS SYSTEMS



(57) Abrégé/Abstract:

The invention relates to a method for carrying out a blind handover in an intersystem and interfrequency handover in mobile communication systems, whereby a mobile station is supplied by several base stations prior to the handover i.e. it can receive



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

several other base stations in addition to the supplying base station. According to the invention, measurement of the propagation time of the signals received from the base station is carried out by the mobile station on the air interface. The measured propagation times are transmitted to one of the base stations. The location of the mobile station is determined using the transmitted propagation time measuring data by the mobile communication network. With the aid of a data base, at least one suitable base station for an intersystem or interfrequency handover is then selected using the determined location and the data necessary for a handover is transmitted to the mobile station from the selected base station. The mobile station can carry out the handover to the selected base station using said information.

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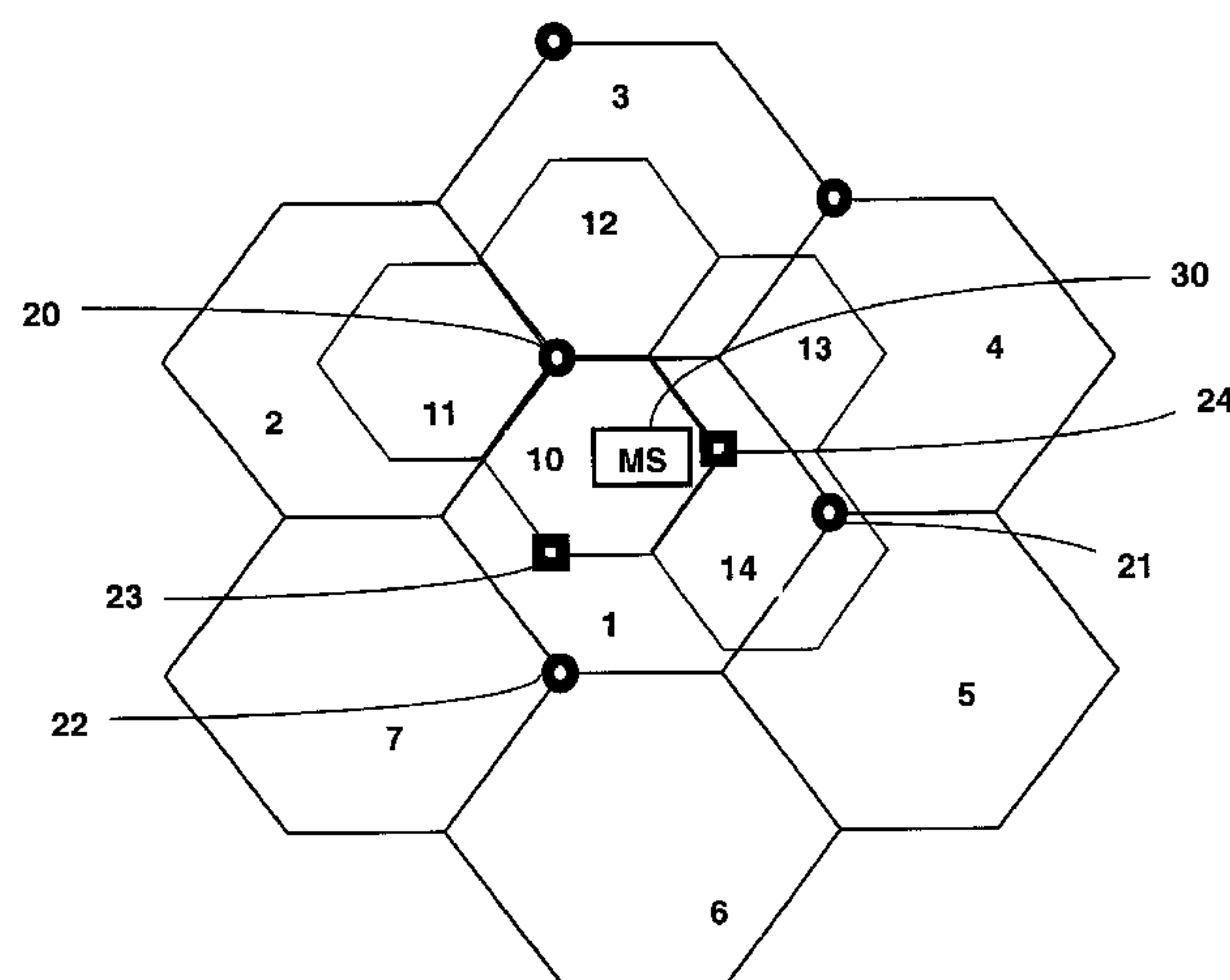
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[Fortsetzung auf der nächsten Seite]

(54) Title: METHOD FOR CARRYING OUT A BLIND HANDOVER IN AN INTERFREQUENCY HANDOVER IN MOBILE COMMUNICATION SYSTEMS

(54) Bezeichnung: VERFAHREN ZUR DURCHFÜHRUNG EINES BLIND HANDOVER BEI INTERSYSTEM- UND INTERFREQUENZ HANDOVER BEI MOBILKOMMUNIKATIONSSYSTEMEN



(57) Abstract: The invention relates to a method for carrying out a blind handover in an intersystem and interfrequency handover in mobile communication systems, whereby a mobile station is supplied by several base stations prior to the handover i.e. it can receive several other base stations in addition to the supplying base station. According to the invention, measurement of the propagation time of the signals received from the base station is carried out by the mobile station on the air interface. The measured propagation times are transmitted to one of the base stations. The location of the mobile station is determined using the transmitted propagation time measuring data by the mobile communication network. With the aid of a data base, at least one suitable base station for an intersystem or interfrequency handover is then selected using the determined location and the data necessary for a handover is transmitted to the mobile station from the selected base station. The mobile station can carry out the handover to the selected base station using said information.

[Fortsetzung auf der nächsten Seite]

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- mit internationalem Recherchenbericht
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Zur Erklärung der Zweibuchstaben-Codes und der anderen Abkürzungen wird auf die Erklärungen ("Guidance Notes on Codes and Abbreviations") am Anfang jeder regulären Ausgabe der PCT-Gazette verwiesen.

(57) Zusammenfassung: Die Erfindung betrifft ein Verfahren zur Durchführung eines sogenannten „Blind Handover“ bei einem Intersystem- und Interfrequenz Handover in Mobilkommunikationssystemen und geht davon aus, dass eine Mobilstation vor dem Handover von mehreren Basisstation versorgt wird, d.h. neben der versorgenden Basisstation auch Signale von mehreren anderen Basisstation empfangen kann. Erfindungsgemäss wird von der Mobilstation eine Laufzeitmessung der von den Basisstationen auf der Luftschnittstelle empfangenen Signale durchgeführt. Die gemessenen Laufzeiten werden an eine der Basisstationen übermittelt. Daraufhin wird seitens des Mobilkommunikationsnetzes anhand der übermittelten Laufzeitmessdaten der Aufenthaltsort der Mobilstation ermittelt. Mit Hilfe einer Datenbasis wird dann anhand des ermittelten Aufenthaltsorts mindestens eine geeignete Basisstation für einen Intersystem- oder Interfrequenz Handover ausgewählt, und die für einen Handover benötigten Daten der ausgewählten Basisstation an die Mobilstation übermittelt. Anhand dieser Informationen kann die Mobilstation den Handover zur ausgewählten Basisstation durchführen.

05/27/2004

Process for Implementation of a Blind Handover in an Intersystem- and Interfrequency Handover with Mobile Communication Systems

The invention relates to a process for implementation of a so-called "Blind Handover" in an intersystem and interfrequency Handover in mobile communication systems, in particular with inhomogeneous network structures of shared mobile communication systems.

With a so-called Blind Handover (HO) with inhomogeneity of the different network structures, i.e., different frequency layers or provider regions of the participating networks, no guarantee can be given for the successful implementation of the HO.

The specifications valid at this time, for example, disclosed in 3GPP TS 23.009 V5.1.0 (2002-06) "3rd Generation Partnership Project", Technical Specification Group Core Network, Handover Procedures (Release 5), provides that, for example, with a handover between one UMTS layer and one GSM layer per UMTS cell one HO candidate can be configured for a blind handover. In this case it is assumed that the provider region of the destination cell is compatible with the originating cell, i.e., the provider regions of the respective cells of the UMTS and the GSM networks are congruent at the place of the handover. Otherwise the arising situation is ambiguous. The result would then be an HO error and therewith the risk of losing the connection (call drop).

In order to avoid these problems with a blind handover, so-called dual-mobile end devices can be used, i.e., mobile telephones with two separate transmit/receive arrangements that can work at two different frequencies or in two mobile radio networks.

[Modified page]

In WO 00 28774 A a process is proposed for implementation of an intersystem and interfrequency handover within CDMA networks, wherein a mobile station is provided with radio signals by several base stations, and, with the aid of a database, on the basis of the stopping location of the mobile station at least one suitable base station is selected for the intersystem and interfrequency handover. The data of the selected station required for a handover is communicated to the mobile station, so that the mobile station can execute the handover to the selected base station. The mobile station determines its stopping location by means of a satellite-supported GPS positioning system and/or through transmission time measurement of the radio signal and transfers the determined position data to the mobile radio system. The disadvantage of this is that the mobile stations, for executing this handover process, preferably must be fitted with a GPS positioning system, which causes additional costs and increases the structural size of the device.

Not an object of the process described here are the signalizations exchanged between participating devices and the participating network nodes, as for example base stations, RNC (radio network controllers) and exchange sites (UMSC) of the participating mobile communications networks. Therefore this will not be detailed further.

The object of the invention is to state a process through which a blind handover can be implemented without great risk between two different layers of mobile communication systems, even if these have no common network structure. The process is intended to be based purely on a transmission time measurement of the radio signals for determination of the stopping location of the mobile station, so that on the part of the mobile stations no additional hardware is needed.

This object is achieved according to the invention through the features of patent claim 1.

[Modified page]

2a

The invention starts with the fact that before the handover a mobile station is cared for by several base stations, i.e., besides the provider base station signals of several other base stations can also be received.

According to the invention, a transmission time measurement is implemented by the mobile station of the signals received from the base station on the air interface. According to the level ratio of the signals the end device must be forcibly requested to carry out this transmission time measurement. The measured transmission times are transmitted to one of the base stations. Thereupon, based on the transmitted measured transmission time data, the location of the mobile station is determined by the mobile communications network. With the help of a data base, on the basis of the determined stopping location at least one suitable base station is selected for an intersystem or interfrequency handover, and the data required for a handover for the selected base station is transmitted to the mobile station. On the basis of this information the mobile station can implement the handover to the selected base station.

With this process, by means of a further developed blind handover, henceforth designated blind handover advanced, the possibility exists of implementing such handovers in a more unerring manner.

- The end device need not be fitted with GPS or a dual end device (with two transmit/receive units) and can therefore be produced cost-effectively.

Advantageous embodiments and developments of the invention result from the features of the dependent claims.

For determination of the location information the participating device must measure the level relationship of its own cell and that of at least one or two additional cells. Besides the signal levels, the signal transmission times of the cells are also measured. If this is not actually required through the current level relationship, the end device must be forcibly called upon to execute this measurement. This can happen, for example, through specifically informing the end device of the other provider threshold values which force a measurement, or through adjusting at the start the parameters of the network so that these measurements are obligatorily executed.

The information thus generated of the signal transmission times is transferred to the network. In order to be able to utilize this information for a blind HO, the layer in which the potential destination cell is located must be analyzed beforehand as to the best provider station, thus the best server. This can happen in different ways and manners. For one, the provider region of the best server can be determined with appropriate processes and, for another, this can occur from the available measurement data. The best server thus obtained can then be assigned at each point over the polygon.

The coordinates of these end devices are then compared to the best server databank and thus the appropriate destination cell is selected. This destination cell is then transferred by HO command to the end device and thus the blind handover is intentionally accomplished.

An implementation example of the invention is detailed on the basis of the drawn figure.

Figure 1 shows, as an example, a section of the cell structure of two overlying mobile communications networks, for example, a UMTS network and a GSM network.

The UMT network comprises a multiplicity of radio cells 10-14, which are provided with radio signals by a multiplicity of fixedly installed base stations 20, 23, 24. Likewise, the GSM network comprises a multiplicity of radio cells 1-7, which are provided with radio signals by a multiplicity of fixedly installed base stations 20-22.

The UMTS and the GSM networks have in common, for example, the site for the base station 20.

A mobile station 30 is located inside the UMTS cell 10 and is provided with radio signals, for example, by the base station 24. The mobile station 30 would like to execute a blind handover into a suitable radio cell of the GSM network.

According to the invention, for this the stopping location of the mobile station 30 must first be determined.

Through a suitable application, the end device is requested to measure the provider level and the quality of the base station 24 and the neighbouring UMTS base stations 20, 23. In this, the end device 30 must identify unambiguously the appropriate base stations 20, 23, 24 and the associated transmission times of the signals on the air interface must be determined. This information about the neighbouring cells and its own cell is sent as an information packet to one base station, for example, 24.

From only two measured neighbouring cells and its own cell, the location of the end device 30 can thus be calculated. This process is not dependent on whether the stopping place of the end device is inside or outside a building.

In order to determine the stopping place of a participant end device without knowledge of the direction information, three base stations 20, 23, 24 are thus necessary, whose locations are accurately known. Based on the transmission time measurement of the signals between the final device and each of the base stations, circular rings can be calculated which define the distance of the stopping location end device to the base station in each case. The common point of intersection of the three circular rings is the stopping location of the end device. The sites of the base station are here the reference points, the site coordinates being available from the site data bank of the network operator.

In theory three circles intersect at one point. This is impossible under real conditions, since the principal of transmission time measurement is dependent on the propagation conditions and the processing speed of the signals in the microchip of the end device (chip frequency). The segment length per measurement interval cannot be arbitrarily small.

That means in practice that the stopping location of the end device is described by a sectional area. Hence the accuracy of the determination of the stopping location increases with the number of measured base stations.

With a chip frequency of, for example, 3.84 MHz the smallest measurement interval a per chip calculates to be

$$a = \text{speed of light } C / \text{chip frequency } f_{\text{bit}} = 300\text{E}6 / 3.84\text{E}6 = 78 \text{ m}$$

With modern end devices much better measurement accuracies can be achieved in practice.

Accuracy also depends on the receiver of the end device. The receiver must be able to resolve time intervals within the chip frequency in order to deliver results within a 10 m range. The common sectional area of the circle yields the probable stopping region of the end device.

Since the end device possesses no information on the frame synchronicity of the participating base stations, the determined stopping location of the end device contains additional measurement errors.

In order to circumvent these, principally two possibilities are offered:

- The base stations are synchronized with a central clock or via GPS time.
- Through measurements on the part of the base stations the amount of asynchronicity with respect to other base stations is established and a matrix formed.

Base on the ascertained stopping location of the mobile station 30, with the help of an available data base in the mobile communications network, a determination is made of the most suitable radio cell or base station of the GSM network for a handover. For example, in Fig. 1 this is the GSM base station 20, which provides for the GSM radio cell 1, among others.

So that the mobile station 30 also completes an HO to the appropriate GSM destination cell 1, it must be informed, after the evaluation of the location information (measured value) of the end device, of the target cell or the appropriate base station 20. This can be accomplished directly in the form of an HO order to the mobile station.

From this there results the fact that the functionality of the appropriate network nodes, for example, RNC, must be expanded accordingly, such that the evaluation of the measurement data results in location information, from which the best provider base station obtained from a best server databank is sent to the destination cell and is made available to the end device participating in the handover and to the base station.

[Modified page]

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08/02/2004

Patent Claims

1. Process for implementation of a blind handover in an intersystem and interfrequency handover in mobile communication systems, wherein a mobile station (30) is provided with radio signals by several base stations (23, 24) and, with the aid of a database, on the basis of the stopping location of the mobile station (30) at least one suitable base station (20) is selected for an intersystem or interfrequency handover, wherein the data of the selected base station (20) required for a handover is communicated to the mobile station and the mobile station (30) implements the handover to the selected base station (20), wherein the mobile station (30) carries out a transmission time measurement of the signals received from the base stations (23, 24) over the air interface as well as a measurement of the signal strengths and/or the signal qualities of the base stations (23, 24), so that the measured transmission times, signal strengths and/or signal qualities are communicated to one of the base stations (23, 24) and that, on the part of the mobile communications network, on the basis of the transmission time measurement the stopping location of the mobile station (30) is determined, characterized in that the end device is forcibly requested to carry out a transmission time measurement, through other provider level threshold values being intentionally communicated to the end device, which values force a measurement, or through the parameters of the network being adjusted beforehand in such a manner that these measurements are obligatorily carried out, and that the mobile station (30) changes at the handover from a base station (24) of a first UMTS mobile communications system to a base station (20) of a second GSM mobile communications system.

2. Process according to claim 1, characterized in that the mobile station (30) during the handover changes the used radio frequencies.

[Modified page]

3. Process according to one of the claims 1 or 2, characterized in that the provider region of the base station (24) serving the mobile station before the handover differs from the provider region of the base station (20) serving the mobile station after the handover.

4. Process according to one of the claims 1 to 3, characterized in that the provider region of the base station (24) serving the mobile station before the handover overlaps the provider region of the base station (20) serving the mobile station after the handover.

5. Process according to one of the claims 1 to 4, characterized in that the exact stopping location of the mobile station (30) is determined by means of a GPS receiver.

6. Process according to one of the claims 1 to 5, characterized in that a frame synchronisation between the participating base stations (23, 24) is carried out by means of a central clock.

7. Process according to one of the claims 1 to 6, characterized in that deviations of the frame synchronisation between the participating base stations (23, 24) are determined, stored in a matrix and used for the calculation of the stopping location of the mobile station (30).

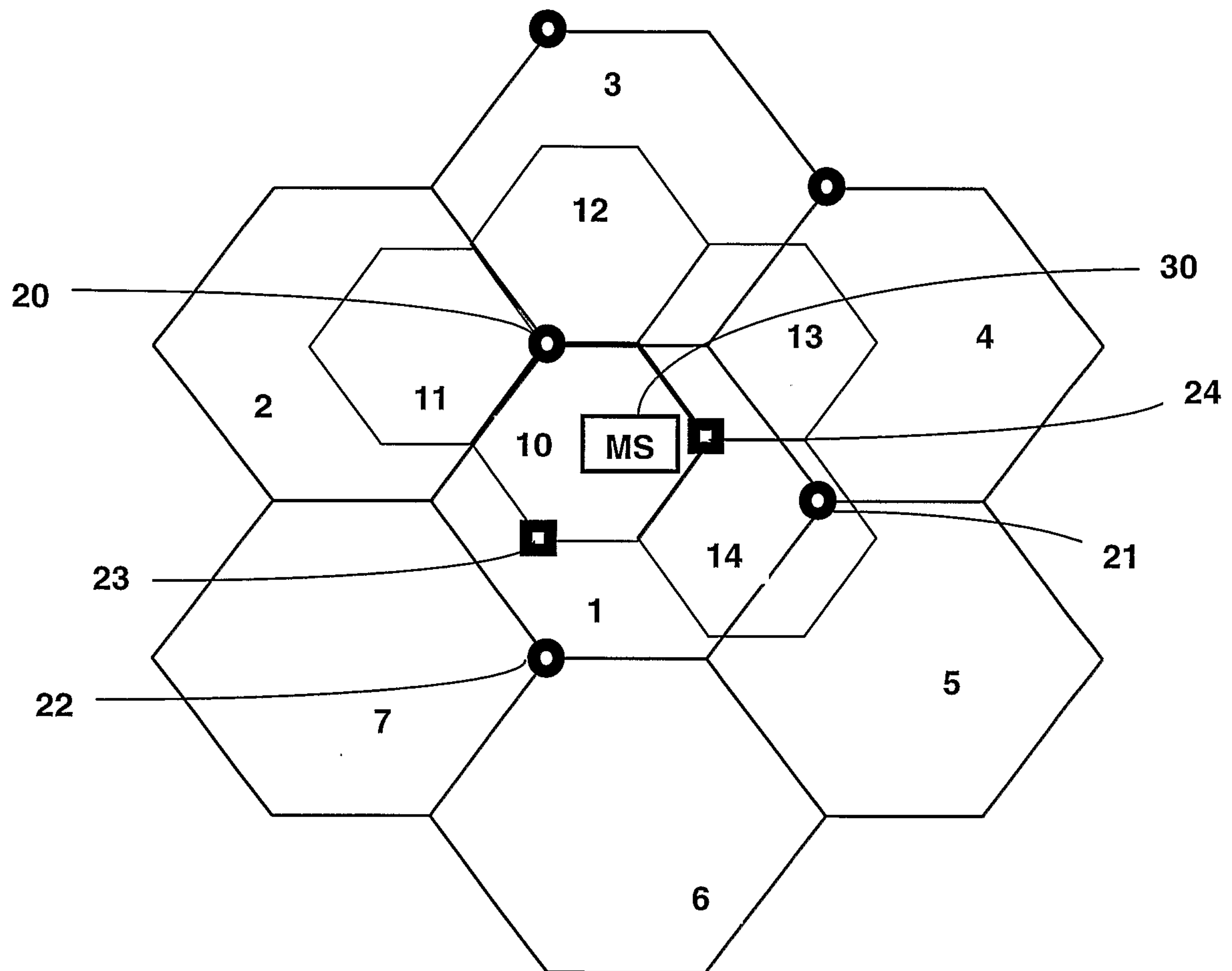


Fig. 1

