Title: A METHOD FOR ASSISTING A WIRELESS DEVICE TO PERFORM UPLINK TRANSMISSIONS

Abstract: A first Radio Network Node (RNN) 110, and a method therein, for assisting a wireless device 130 to perform an uplink transmission to a second RNN 120. The first RNN, the second RNN and the wireless device are operated in a wireless communications network 100. The first RNN is configured to serve the wireless device when located in a first cell 112 and the second RNN is configured to serve the wireless device when located in a second cell, wherein the second cell has a size that is below a threshold and arranged to at least partly overlap the first cell. Further, the first RNN is adapted to trigger the wireless device to perform the uplink transmission using a configured Timing Advance (TA) value and a guard time without performing a preceding random access procedure in the second cell towards the second RNN.
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A METHOD FOR ASSISTING A WIRELESS DEVICE TO PERFORM UPLINK TRANSMISSIONS

TECHNICAL FIELD

Embodiments herein relate generally to a first Radio Network Node (RNN), a second RNN, a wireless device, and methods therein. In particular they relate to assisting the wireless device to perform an uplink transmission to the second RNN.

BACKGROUND

Communication devices such as terminals are also known as e.g. User Equipments (UE), mobile terminals, mobile devices, wireless devices, wireless terminals and/or mobile stations. Terminals are enabled to communicate wirelessly in a cellular communications network or wireless communication system, sometimes also referred to as a cellular radio system or cellular networks. The communication may be performed e.g. between two terminals, between a terminal and a regular telephone and/or between a terminal and a server via a Radio Access Network (RAN) and possibly one or more core networks, comprised within the cellular communications network.

Terminals may further be referred to as mobile telephones, smartphones, cellular telephones, laptops, surf plates or tablets with wireless capability, just to mention some further examples. The terminals in the present context may be, for example, portable, pocket-storable, hand-held, computer-comprised, or vehicle-mounted mobile devices, enabled to communicate voice and/or data, via the RAN, with another entity, such as another terminal or a server.

The cellular communications network covers a geographical area which is divided into cell areas, wherein each cell area being served by an access node such as a base station, e.g. a Radio Base Station (RBS), which sometimes may be referred to as e.g. "eNB", "eNodeB", "NodeB", "B node", or BTS (Base Transceiver Station), depending on the technology and terminology used. The base stations may be of different classes such as e.g. macro eNodeB, home eNodeB or pico base station, based on transmission power and thereby also cell size. A cell is the geographical area where radio coverage is provided by the base station at a base station site. However, the site of the base station and the site of its connected antenna/antennae, which represent(s) the network's point of transmission and reception of radio signals in the cell may be different. One base station, situated on the base station site, may serve one or several cells. Further, each base
station may support one or several communication technologies. The base stations communicate over the air interface operating on radio frequencies with the terminals within range of the base stations. In the context of this disclosure, the expression Downlink (DL) is used for the transmission path from the base station to the mobile station. The expression Uplink (UL) is used for the transmission path in the opposite direction i.e. from the mobile station to the base station.

In 3rd Generation Partnership Project (3GPP) Long Term Evolution (LTE), base stations, which may be referred to as eNodeBs or even eNBs, may be directly connected to one or more core networks.

3GPP LTE radio access standard has been written in order to support high bitrates and low latency both for uplink and downlink traffic. All data transmission is in LTE controlled by the radio base station.

With the proliferation of user friendly smartphones and tablets, the usage of high data rate services such as video streaming over the wireless communications network is becoming commonplace, greatly increasing the amount of traffic in the wireless communications networks. Thus, there is a great urgency in the wireless communications network community to ensure that the capacity of the wireless communications network keeps up with this ever-increasing user demand. The latest wireless communications systems such as Long Term Evolution (LTE), especially when coupled with interference mitigation techniques, have spectral efficiencies very close to the theoretical Shannon limit. The continuous upgrading of current wireless communications networks to support the latest technologies and densifying the number of cells and base stations per unit area are two of the most widely used approaches to meet the increasing traffic demands.

Another approach that is gaining high attention is to use heterogeneous wireless communications networks, sometimes referred to as heterogeneous networks, wherein the traditional pre-planned macro base stations and macro cells, known as the macro layer, are complemented with several low-powered base stations, serving comparatively small cells, that may be deployed in a relatively unplanned manner. The small cells are typically much smaller than the macro cells. A small cell may be served by a base station having a coverage which typically is in the order of 10's of meters, but could in theory be larger e.g. a couple of kilometers. A macro cell may be served by a base station having a coverage in the range of a distance in the order of a kilometer up to a few tens of kilometers. The 3rd Generation Partnership Project (3GPP) has incorporated the concept of heterogeneous networks as one of the core items of study in the latest enhancements
of LTE, such as LTE release 12, e.g. in the shape of "Small Cell Enhancements" (SCE).
Several types of low-powered base stations, such as pico base stations, femto base
stations, relays, and Remote Radio Heads (RRHs), for realizing heterogeneous networks
have been defined. The femto base stations are also known as home base stations or
Home eNBs (HeNBs).

One topic that is being studied for LTE release 12 is the possibility of serving a User
Equipment (UE) from more than one eNB simultaneously. This is also known as dual
connectivity. For example, the UE may be served from a Master eNB (MeNB), serving a
macro cell, and from a Small cell eNB, a.k.a. Secondary eNB, (SeNB), serving a small
cell. The control plane procedures of LTE have to be updated in order to support this.

SUMMARY

An object of embodiments herein is to provide a way of improving the performance
in a wireless communications network.

According to a first aspect of embodiments herein, the object is achieved by a
method in a first Radio Network Node (RNN) for assisting a wireless device to perform an
uplink transmission to a second RNN. The first RNN, the second RNN and the wireless
device are operated in a wireless communications network.

Further, the first RNN is configured to serve the wireless device when located in a
first cell and the second RNN is configured to serve the wireless device when located in a
second cell, wherein the second cell has a size that is below a threshold and arranged to
at least partly overlap the first cell.

Furthermore, the first RNN triggers the wireless device to perform the uplink
transmission using a configured Timing Advance (TA) value and a guard time without
performing a preceding random access procedure in the second cell towards the second
RNN.

According to a second aspect of embodiments herein, the object is achieved by a
first RNN for assisting a wireless device to perform an uplink transmission to a second
RNN. The first RNN, the second RNN and the wireless device are operated in a wireless
communications network.

Further, the first RNN is configured to serve the wireless device when located in a
first cell and the second RNN is configured to serve the wireless device when located in a
second cell, wherein the second cell has a size that is below a threshold and arranged to
at least partly overlap the first cell.

Furthermore, the first RNN comprises means adapted to trigger the wireless device
to perform the uplink transmission using a configured Timing Advance (TA) value and a
guard time without performing a preceding random access procedure in the second cell
towards the second RNN.

According to a third aspect of embodiments herein, the object is achieved by a
method in a second RNN for assisting a wireless device to perform an uplink transmission
to the second RNN. The second RNN and the wireless device are operated in a wireless
communications network.

Further, the second RNN is configured to serve the wireless device when located
in a second cell, wherein the second cell has a size that is below a threshold and
arranged to at least partly overlap the first cell.

Furthermore, the second RNN triggers the wireless device to perform the uplink
transmission using a configured Timing Advance (TA) value and a guard time without
performing a preceding random access procedure in the second cell towards the second
RNN.

According to a fourth aspect of embodiments herein, the object is achieved by a
second RNN for assisting a wireless device to perform an uplink transmission to the
second RNN. The second RNN and the wireless device are operated in a wireless
communications network.

Further, the second RNN is configured to serve the wireless device when located
in a second cell, wherein the second cell has a size that is below a threshold and
arranged to at least partly overlap the first cell.

Furthermore, the second RNN comprises means adapted to trigger the wireless
device to perform the uplink transmission using a configured Timing Advance (TA) value
and a guard time without performing a preceding random access procedure in the second
cell towards the second RNN.

According to a fifth aspect of embodiments herein, the object is achieved by a
method in a wireless device to perform an uplink transmission to a second RNN. The
second RNN and the wireless device are operated in a wireless communications network.
Further, the second RNN is configured to serve the wireless device when located in a second cell, wherein the second cell has a size that is below a threshold and arranged to at least partly overlap a first cell served by a first RNN comprised in the wireless communications network.

Furthermore, the wireless device receives a trigger configured to trigger the wireless device to perform the uplink transmission using a configured Timing Advance (TA) value and a guard time.

Yet further, the wireless device performs, by means of the configured TA value and the guard time, the uplink transmission to the second RNN without performing a preceding random access procedure in the second cell towards the second RNN.

According to a sixth aspect of embodiments herein, the object is achieved by a wireless device to perform an uplink transmission to a second RNN. The second RNN and the wireless device are operated in a wireless communications network.

Further, the second RNN is configured to serve the wireless device when located in a second cell, wherein the second cell has a size that is below a threshold and arranged to at least partly overlap a first cell served by a first RNN comprised in the wireless communications network.

Furthermore, the wireless device comprises means adapted to receive a trigger configured to trigger the wireless device to perform the uplink transmission using a configured Timing Advance (TA) value and a guard time.

Yet further, the wireless device comprises means adapted to perform, by means of the configured TA value and the guard time, the uplink transmission to the second RNN without performing a preceding random access procedure in the second cell towards the second RNN.

According to a seventh aspect of embodiments herein, the object is achieved by a computer program, comprising instructions which, when executed on at least one processor, causes the at least one processor to carry out embodiments of the method described herein.

According to an eight aspect of embodiments herein, the object is achieved by a carrier containing the computer program, wherein the carrier is one of an electronic signal, optical signal, radio signal or computer readable storage medium.
Since the wireless device performs the uplink transmission, e.g. an initial uplink transmission, using a configured Timing Advance (TA) value and a guard time without performing a preceding random access procedure in the second cell towards the second RNN, the access delay and overhead are reduced as compared to the access delay and overhead in the prior art systems. Further, a faster handover to the second cell or a faster addition of cells to the set of serving cells for the wireless device from the second RNN is achieved as compared to the handover or addition of cells as provided by the prior art systems. This results in an improved performance in the wireless communications network.

BRIEF DESCRIPTION OF DRAWINGS

Examples of embodiments herein are described in more detail with reference to attached drawings in which:
Figure 1 schematically illustrates an embodiment of a wireless communications network;
Figure 2 is a flowchart depicting embodiments of a method in a wireless communications network;
Figure 3 is a flowchart depicting embodiments of a method in a first RNN;
Figure 4 is a schematic block diagram illustrating embodiments of a first RNN;
Figure 5 is a flowchart depicting embodiments of a method in a second RNN;
Figure 6 is a schematic block diagram illustrating embodiments of a second RNN;
Figure 7 is a flowchart depicting embodiments of a method in a wireless device; and
Figure 8 is a schematic block diagram illustrating embodiments of a wireless device.

DETAILED DESCRIPTION

As part of developing embodiments herein, some problems will first be identified and discussed.

A situation addressed by some embodiments herein is when a wireless device operating in a heterogeneous network environment is to access a small cell with the aid of its current cell(s). For example, this may be the case in Carrier Aggregation when the wireless device performs secondary cell addition where the secondary cell is a small cell. During the secondary cell addition the wireless device may perform a Random Access
(RA) procedure in the small cell in order to acquire uplink synchronization, i.e. to receive a Timing Advance (TA) value, \( T_A \), from the eNB. Another situation addressed by some embodiments herein is when a wireless device operating in a heterogeneous network environment is to access a small cell with the aid of its current Master eNB (MeNB) in cooperation with a Secondary eNB (SeNB). For example, this may be the case when the wireless device performs a full or partial handover to the SeNB and the small cell or adding a small cell to its set of serving cells. The MeNB is usually controlling a larger cell that the wireless device is connected in. After some control signaling involving the SeNB, the MeNB and the wireless device, the wireless device performs a Random Access (RA) procedure in the small cell in order to acquire uplink synchronization, i.e. to receive a Timing Advance (TA) value, \( T_A \), from the SeNB. To perform a RA, as in the above two situations, adds overhead and delay to the procedure. To limit this effect it is possible to provide the wireless device with a dedicated random access preamble in order to enable a shortened, contention-less RA procedure and to avoid the risk of preamble collision.

This is disclosed in WO2013/020209 A1. However, a problem with this approach is that it may cause a shortage of dedicated random access preambles, thus reducing the efficiency of the method and causing additional problems.

For instance, if the pool of dedicated random access preambles is already depleted, a wireless device may have to wait for a dedicated random access preamble to become available or resort to perform a regular RA procedure. In addition, although the use of a dedicated random access preamble shortens the regular RA procedure, the RA procedure using random access preambles still adds overhead and delay.

These shortcomings are addressed by embodiments herein.

Embodiments herein relate to the area of wireless communications networks and to the cooperation between different cell layers.

In some embodiments described herein, the wireless communications network is a heterogeneous wireless communications network and the cooperation between different cell layers relate to the cooperation between a first cell layer and a second cell layer wherein at least one of the first and second cell layers comprises a small cell. However, it should be understood that embodiments herein also relate to a homogenous wireless communications network comprising a small cell. By the term "small cell" when used herein is meant a cell having a cell size that is below a threshold. This will be described in more detail below in the section "Size of the second cell".
In some embodiments, a small cell served by a Secondary eNB (SeNB) may be overlaid by a larger cell served by a Master eNB (MeNB), wherein the SeNB and the MeNB cooperate to provide the wireless device with superior service and wherein the MeNB may have the main responsibility for certain procedures. However, it should be understood that the cell served by the MeNB does not have to be larger than the small cell served by the SeNB. For example, the cell served by the MeNB may be smaller than the small cell or it may be of the same size as the small cell. Further, in this description, the MeNB is sometimes referred to as a first Radio Network Node (RNN) and the SeNB is sometimes referred to as a second RNN.

As embodiments herein relate to at least one small cell, it is assumed that the Timing Advance may be approximated to zero at typical access attempts in the small cell. By such an assumption it is possible to perform the access by skipping the RA procedure e.g. at handover or when adding the small cell to the set of serving cells. However, the required Timing Advance will still not be zero in all situations, e.g. in cases where the wireless device is handed over to the small cell at a longer distance from the SeNB antenna than typically expected. For instance, in cases of handover because of a coverage hole in the overlaying macro cell, which causes the weak transmissions from the SeNB in the small cell to be stronger than the transmissions from the MeNB in the macro cell. To avoid interference between UE transmissions in these cases a safety guard time is used for the initial uplink transmission from the wireless device in the small cell. Such disadvantageous interference could otherwise occur, e.g. if the wireless device transmits in the small cell on the same frequency, but in the preceding timeslot, as another wireless device.

Embodiments herein also comprise methods of informing the wireless device of when the Random Access procedure may be skipped and what guard time to use for the initial uplink transmission. In addition, methods for allocation of resources for the wireless device's initial uplink transmission in the small cell are provided.

Hence, in very brief summary, embodiments herein comprise the combination of skipping the RA procedure, using a zero or very small configured Timing Advance value, but a guard time for the initial uplink transmission in the small cell, and methods for providing the necessary instructions and resource allocation to the wireless device.

Below, embodiments herein will be illustrated in more detail by a number of exemplary embodiments. It should be noted that these embodiments are not mutually
exclusive. Components from one embodiment may be tacitly assumed to be present in another embodiment and it will be obvious to a person skilled in the art how those components may be used in the other exemplary embodiments.

As schematically illustrated in Figure 1 embodiments herein relate to a wireless communications network 100. The wireless communications network 100 may be a wireless communications network such as an LTE, WCDMA, GSM network, any 3GPP cellular network, Wimax, or any cellular network or system. The wireless communications network 100 may be a homogenous wireless communications network or a heterogeneous wireless communications network.

The wireless communications network 100 comprises a first Radio Network Node (RNN) 110 for transmitting signals in downlink (DL) to a wireless device 130 when the wireless device 130 is located within a first geographical area 112, herein sometimes referred to as a first cell 112, served by the first RNN 110. Further, the first RNN 110 is configured to receive signals in uplink (UL) from the wireless device 130 when the wireless device 130 is located within the first cell 112.

The wireless communications network 100 comprises further a second Radio Network Node (RNN) 120 for transmitting signals in downlink to the wireless device 130 when the wireless device 130 is located within a second geographical area 122, herein sometimes referred to as a second cell 122, served by the second RNN 120. Further, the second RNN 120 is configured to receive signals in uplink from the wireless device 130 when the wireless device 130 is located within the second cell 122.

The first and second RNN 110,120 may each be a transmission point, or a node serving or equipped with one or more remotely located transmission point(s) (e.g. antenna site(s)), such as a radio base station, for example an eNB, an eNodeB, or an Home Node B, an Home eNode B or any other network node capable to serve a wireless device such as a user equipment or a machine type communication device comprised in the wireless communications network.

The wireless device 130 is sometimes also referred to as a User Equipment (UE).

The wireless device 130 may e.g. be a mobile terminal or a wireless terminal, a mobile phone, a smartphone, a computer such as e.g. a laptop, a Personal Digital Assistant (PDA) or a tablet computer, sometimes referred to as a surf plate, with wireless capability, or any other radio network unit capable to communicate over a radio link in a wireless communications network. Please note the term user equipment used in this document
also covers other wireless devices such as Machine to Machine (M2M) devices, even though they do not have any human user.

Further, a core network 102 may be comprised in the wireless communications network 100 and connected to the respective first and second RNN 110, 120. It should be understood that the wireless communications network 100 may comprise a plurality of network nodes. However, only three network nodes; the first and second radio network nodes 110, 120 and the wireless device 130, are depicted in Figure 1.

A method in the wireless communications network 100 for assisting the wireless device 130 to perform an uplink transmission to the second RNN 120 will now be described with reference to a flow chart depicted in Figure 2. As mentioned above, the first RNN 110, the second RNN 120 and the wireless device 130 are operated in the wireless communications network 100. Further, the first RNN 110 is configured to serve the wireless device 130 when located in a first cell 112 and the second RNN 120 is configured to serve the wireless device 130 when located in a second cell 122, wherein the second cell 122 has a size that is below a threshold and arranged to at least partly overlap the first cell 112. The cell size of the second cell 122 will be described in more detail below under the section "Cell size of the second cell". The method comprises one or more of the following actions. It should be understood that actions may be taken in another suitable order and that actions may be combined.

**Action 201**

The first RNN 110 may transmit a trigger to the wireless device 130 in order to trigger the wireless device 130 to perform the uplink transmission to the second RNN 120.

**Action 201'**

Alternatively, or in addition to a trigger transmitted from the first RNN 110 to the wireless device 130, the second RNN 120 may transmit a trigger the wireless device 130 in order to trigger the wireless device 130 to perform an uplink transmission to the second RNN 120.

The trigger from the first RNN 110 and/or the second RNN 120 may comprise or relate to implicit or explicit information of a Timing Advance (TA) value to use. The TA
value is sometimes herein referred to as a configured TA value. Further, the trigger may comprise or relate to an implicit or explicit instruction to apply a guard time and possibly also the length of the guard time. As will be described below in e.g. the section "Configured TA value and guard time", the information relating to the configured TA value and/or the guard time may be provided in different ways.

**Action 202**
The wireless device 130 receives the trigger. The trigger is received from the first RNN 110 and/or the second RNN 120.

**Action 203**
The second RNN 120 may transmit resource allocation information to the first RNN 110, whereby the first RNN 110, in Action 204, may inform the wireless device 130 about resources allocated for the uplink transmission.

**Action 204**
The first RNN 100 transmit resource allocation information to the wireless device 130.

**Action 204’**
Alternatively, or in addition to transmitting resource allocation information to the first RNN 110, the second RNN 120 may transmit the resource allocation information the wireless device 130. If only the second RNN 120 transmits the resource allocation information to the wireless device 130, then the second RNN 120 may not transmit resource allocation information to the first RNN 110 in action 203, i.e. it may omit action 203.

**Action 205**
The wireless device 130 receives the resource allocation information. The resource allocation information is received from the first RNN 110 and/or the second RNN 120.

**Action 206**
The wireless device 130 performs the uplink transmission to the second RNN 120 without performing a preceding random access procedure in the second cell 122. The
uplink transmission may be performed by means of the received resource allocation information on the resources allocated. As will be described in more detail below, the wireless device 130 performs the uplink transmission using a configured Timing Advance, TA, value and a guard time without performing a preceding random access procedure in the second cell 122 towards the second RNN 120.

A method in the first RNN 100 for assisting the wireless device 130 to perform the uplink transmission to the second RNN 120 will now be described with reference to a flow chart depicted in Figure 3. As mentioned above, the first RNN 110, the second RNN 120 and the wireless device 130 are operated in the wireless communications network 100. Further, the first RNN 110 is configured to serve the wireless device 130 when located in the first cell 112 and the second RNN 120 is configured to serve the wireless device 130 when located in the second cell 122, wherein the second cell 122 has a size that is below a threshold and arranged to at least partly overlap the first cell 112. In some embodiments herein, the threshold is determined based on a maximum TA value used by one or more wireless devices when performing an uplink transmission in the second cell 122. However, as previously mentioned, the cell size of the second cell 122 will be described in more detail below under the section "Cell size of the second cell". The method comprises one or more of the following actions. It should be understood that actions may be taken in another suitable order and that actions may be combined.

Action 301

The first RNN 110 triggers the wireless device 130 to perform the uplink transmission using a configured Timing Advance, TA, value and a guard time without performing a preceding random access procedure in the second cell 122 towards the second RNN 120.

However, it should be understood that the wireless device 130 earlier may have performed a random access procedure towards the second RNN 120. For example, the wireless device 130 may have been configured to use both the first RNN 110 and the second RNN 120 since it was needing high throughput. And then, the wireless device 130 may have been performing a random access procedure towards the second RNN, e.g. due to positioning reasons. Later, the traffic ends and therefore the wireless device 130 no longer needs the second RNN 120 so it is deconfigured. However, a while later the wireless device 130 may start a service that needs high throughput and then the
communications network may configure the second RNN 120 for the wireless device 130. In such a case and according to embodiments, the wireless device 130 may be triggered to perform the uplink transmission using a configured Timing Advance, TA, value and a guard time without performing a preceding random access procedure in the second cell 122 towards the second RNN 120, as described herein.

In some embodiments, the first RNN 110 triggers the wireless device 130 by transmitting, to the wireless device 130, configuration information that is configured to instruct the wireless device 130 to use the configured TA value and the guard time when performing the uplink transmission. The first RNN 110 may transmit system information comprising the configured TA value and/or the guard time. Further, the first RNN 110 may transmit a cell list comprising the configured TA value and/or the guard time for one or more of cells of the cell list, wherein the cell list is a neighbor cell list or a measurement target list. Furthermore, the first RNN 110 may transmit the configured TA value and/or the guard time in a message ordering the wireless device 130 to perform handover to the second RNN 120 or to add the second cell to the wireless device's set of serving cells. Yet further, the first RNN 110 may transmit the initial TA value and/or the guard time in a message configuring the wireless device 130 with additional radio resources for the uplink transmission to the second RNN 120.

In some embodiments, the configured TA value is zero or at least less than \( N \times 16 \times T_s \), wherein \( N \) is an integer larger than zero and \( T_s \) is a basic time unit used in the communications network 100. For example, in LTE \( T_s = 1/(15000 \times 2048) \approx 32.55 \) nanoseconds.

The guard time may have a length that is determined based on information relating to a coverage of the second cell 122. However, the guard time may have a length that is determined based on information relating to a distance between the wireless device 130 and the second RNN 120.

Further, it should be understood that the TA value may be configured in several ways. For example, the TA value may be configured in the wireless device 130 in conjunction with the triggering, e.g. in the same message, at an earlier point in time via broadcast system information in the first cell 112, or at an earlier point in time via broadcast system information in the second cell 122. Further, the TA value may be configured at an earlier point in time in a dedicated and/or unicast message, i.e. transmitted only to that particular wireless device 130, in the first cell 112, or in conjunction with an attach procedure when the wireless device 130 attached to the
wireless communications network 100. Furthermore, the TA value may be configured at an earlier point in time in the form of configuration data stored in a Universal Subscriber Identity Module (USIM) of the wireless device 130, or when the wireless device 130 was manufactured just to mention some possible ways of configuring of the TA value.

**Action 302**

The first RNN 110 transmits, to the wireless device 130, information relating to one or more resources allocated for the uplink transmission to the second RNN 120. This is performed in order to inform the wireless device 130 about one or more resources available at the second RNN 120 for the uplink transmission to the second RNN 120.

To perform the method in the first RNN 110 to assist the wireless device 130 to perform the uplink transmission to the second RNN 120, the first RNN 110 may comprise an arrangement depicted in **Figure 4**. As previously mentioned, the first RNN 110, the second RNN 120 and the wireless device 130 are operated in the wireless communications network 100.

In some embodiments, the first RNN 110 comprises an input and/or output interface 400 configured to communicate with one or more other communication devices, one or more radio network nodes or one or more wireless devices.

The first RNN 110 may comprise a receiving module 401 configured to receive information such as e.g. user code bits from the wireless device 130. The receiving module 401 may be a wireless receiver of the first RNN 110.

The first RNN 110 comprises means, such as e.g. a triggering module 402, adapted to trigger the wireless device 130 to perform the uplink transmission to the second RNN 120. The means is adapted to trigger the wireless device 130 to perform the uplink transmission using a configured Timing Advance, TA, value and a guard time without performing a preceding random access procedure in the second cell 122 towards the second RNN 120.

The configured TA value may be zero or at least less than \( N \times 16 \times T_s \), wherein \( N \) is an integer larger than zero, and \( T_s \) is a basic time unit used in the communications network 100.
The guard time may have a length that is determined based on information relating to a coverage of the second cell 122. In some embodiments, the guard time has a length that is determined based on information relating to a distance between the wireless device 130 and the second RNN 120.

The means adapted to trigger may further be adapted to transmit, to the wireless device 130, configuration information that is configured to instruct the wireless device 130 to use the configured TA value and the guard time when performing the uplink transmission.

In some embodiments, the means adapted to trigger is adapted to transmit system information comprising the configured TA value and/or the guard time.

The means adapted to trigger may further be adapted to transmit a cell list comprising the configured TA value and/or the guard time for one or more cells of the cell list, wherein the cell list is a neighbor cell list or a measurement target list.

In some embodiments, the means adapted to trigger is adapted to transmit the configured TA value and/or the guard time in a message ordering the wireless device to perform handover to the second RNN 120.

The means adapted to trigger may further be adapted to transmit the configured TA value and/or the guard time in a message configuring the wireless device 130 with additional radio resources.

The triggering module 402 may be implemented as a processor 405 of the first RNN 110.

Further, the first RNN 110 comprises means, such as e.g. a transmitting module 403, adapted to transmit, to the wireless device 130, information relating to one or more resources allocated for the uplink transmission for the uplink transmission to the second RNN 120.

The transmitting module 403 may be a wireless transmitter of the first RNN 110.

The threshold may be determined based on a maximum TA value used by one or more wireless devices when performing an uplink transmission in the second cell 122.

The first RNN 110 may also comprise means for storing data such as user code data. In some embodiments, the first RNN 110 comprises a memory 404 configured to store the data. The user code data may be processed or non-processed user code data or data and/or information relating thereto. The memory 404 may comprise one or more
memory units. Further, the memory 404 may be a computer data storage or a semiconductor memory such as a computer memory, a read-only memory, a volatile memory or a non-volatile memory. The memory is arranged to be used to store obtained information, data, configurations, schedulings, and applications etc. to perform the methods herein when being executed in the first RNN 110.

Embodiments herein for assisting the wireless device 130 to perform the uplink transmission to the second RNN 120 may be implemented through one or more processors, such as the processor 405 in the arrangement depicted in Fig. 4, together with computer program code for performing the functions and/or method actions of embodiments herein. The program code mentioned above may also be provided as a computer program product, for instance in the form of a data carrier carrying computer program code for performing the embodiments herein when being loaded into the first RNN 110. One such carrier may be in the form of an electronic signal, optical signal, radio signal or computer readable storage medium. The computer readable storage medium may be a CD ROM disc or a memory stick.

The computer program code may furthermore be provided as pure program code on a server and downloaded to the first RNN 110.

Those skilled in the art will also appreciate that the receiving module, the triggering module, and the transmitting module described above may refer to a combination of analog and digital circuits, and/or one or more processors configured with software and/or firmware, e.g. stored in the memory, that when executed by the one or more processors such as the processors in the first RNN 110 perform as described above. One or more of these processors, as well as the other digital hardware, may be included in a single application-specific integrated circuitry (ASIC), or several processors and various digital hardware may be distributed among several separate components, whether individually packaged or assembled into a System-on-a-Chip (SoC).

A method in the second RNN 120 for assisting the wireless device 130 to perform the uplink transmission to the second RNN 120 will now be described with reference to a flow chart depicted in Figure 5. As mentioned above, the first RNN 110, the second RNN 120 and the wireless device 130 are operated in the wireless communications network 100. Further, the first RNN 110 is configured to serve the wireless device 130 when located in the first cell 112 and the second RNN 120 is configured to serve the wireless
device 130 when located in the second cell 122, wherein the second cell 122 has a size
that is below a threshold and arranged to at least partly overlap the first cell 112. In some
embodiments, the threshold is determined based on a maximum TA value used by one or
more wireless devices when performing an uplink transmission in the second cell 122. As
previously mentioned, the cell size of the second cell 122 will be described in more detail
below under the section "Cell size of the second cell". The method comprises one or more
of the following actions. It should be understood that actions may be taken in another
suitable order and that actions may be combined.

**Action 501**

The second RNN 120 triggers the wireless device 130 to perform the uplink
transmission using a configured Timing Advance, TA, value and a guard time without
performing a preceding random access procedure in the second cell 122 towards the
second RNN 120.

In some embodiments, the configured TA value is zero or at least less than
N*16xT_s, wherein N is an integer larger than zero, and T_s is a basic time unit used in the
communications network 100. For example, in LTE T_s = 1/(15000 x 2048) ≈ 32.55
nanoseconds.

The guard time may have a length that is determined based on information relating
to a coverage of the second cell 122. However, the guard time may have a length that is
determined based on information relating to a distance between the wireless device 130
and the second RNN 120.

In some embodiments, the second RNN 120 transmits, to the wireless device 130,
configuration information that is configured to instruct the wireless device 130 to use the
configured TA value and the guard time when performing the uplink transmission.

The second RNN 120 may transmit system information comprising the configured
TA value and/or the guard time.

As previously mentioned and exemplified, the TA value may be configured in
several ways.

**Action 502**

The second RNN 120 transmits, to the wireless device 130, information relating to
one or more resources allocated for the uplink transmission to the second RNN 120. This
is performed in order to inform the wireless device 130 about one or more resources
available for the uplink transmission to the second RNN 120.
To perform the method for assisting the wireless device 130 to perform the uplink transmission to the second RNN 120, the second RNN 120 may comprise an arrangement depicted in Figure 6. As mentioned above, the first RNN 110, the second RNN 120 and the wireless device 130 are operated in the wireless communications network 100. Further, the first RNN 110 is configured to serve the wireless device 130 when located in the first cell 112 and the second RNN 120 is configured to serve the wireless device 130 when located in the second cell 122, wherein the second cell 122 has a size that is below a threshold and arranged to at least partly overlap the first cell 112. The threshold may be determined based on a maximum TA value used by one or more wireless devices when performing an uplink transmission in the second cell 122. As previously mentioned, the cell size of the second cell 122 will be described in more detail below under the section "Cell size of the second cell".

In some embodiments, the second RNN 120 comprises an input and/or output interface 600 configured to communicate with one or more other communication devices, one or more radio network nodes, or one or more wireless devices.

The second RNN 120 comprises means, such as e.g. a receiving module 601, adapted to receive information such as e.g. user code bits from the wireless device 130. The receiving module 601 may be a wireless receiver of the second RNN 120.

The second RNN 120 comprises further means, such as e.g. a triggering module 602, adapted to trigger the wireless device 130 to perform the uplink transmission to the second RNN 120.

The means may be adapted to trigger the wireless device 130 to perform the uplink transmission using a configured Timing Advance, TA, value and a guard time without performing a preceding random access procedure in the second cell 122 towards the second RNN 120.

The configured TA value may be zero or at least less than N*16*T_s, wherein N is an integer larger than zero, and T_s is a basic time unit used in the communications network 100.

The guard time may have a length that is determined based on information relating to a coverage of the second cell 122. However, the guard time may have a length that is
determined based on information relating to a distance between the wireless device 130 and the second RNN 120.

In some embodiments, the means adapted to trigger is further adapted to transmit, to the wireless device 130, configuration information that is configured to instruct the wireless device 130 to use the configured TA value and the guard time when performing the uplink transmission.

The means adapted to trigger may further be adapted to transmit system information comprising the configured TA value and/or the guard time.

The triggering module 602 may be implemented as a processor 605 of the second RNN 120.

Further, the second RNN 120 may comprise means, such as e.g. a transmitting module 603, adapted to transmit e.g. a signal to one or more other communications devices.

The means may be adapted to transmit, to the wireless device 130, information relating to one or more resources allocated for the uplink transmission for the uplink transmission to the second RNN 120.

The transmitting module 603 may be a wireless transmitter of the second RNN 120.

The second RNN 120 may also comprise means for storing data such as user code data. In some embodiments, the second RNN 120 comprises a memory 604 configured to store the data. The user code data may be processed or non-processed user code data or data and/or information relating thereto. The memory 604 may comprise one or more memory units. Further, the memory 604 may be a computer data storage or a semiconductor memory such as a computer memory, a read-only memory, a volatile memory or a non-volatile memory. The memory is arranged to be used to store obtained information, data, configurations, schedulings, and applications etc. to perform the methods herein when being executed in the second RNN 120.

Embodiments herein for assisting the wireless device 130 to perform the uplink transmission to the second RNN 120 may be implemented through one or more processors, such as the processor 605 in the arrangement depicted in Fig. 6, together with computer program code for performing the functions and/or method actions of
embodiments herein. The program code mentioned above may also be provided as a
computer program product, for instance in the form of a data carrier carrying computer
program code for performing the embodiments herein when being loaded into the second
RNN 120. One such carrier may be in the form of an electronic signal, optical signal, radio
signal or computer readable storage medium. The computer readable storage medium
may be a CD ROM disc or a memory stick.

The computer program code may furthermore be provided as pure program code on
a server and downloaded to the second RNN 120.

Those skilled in the art will also appreciate that the receiving module, the triggering
module, and the transmitting module above may refer to a combination of analog and
digital circuits, and/or one or more processors configured with software and/or firmware,
e.g. stored in the memory, that when executed by the one or more processors such as the
processors in the second RNN 120 perform as described above. One or more of these
processors, as well as the other digital hardware, may be included in a single application-
specific integrated circuitry (ASIC), or several processors and various digital hardware
may be distributed among several separate components, whether individually packaged
or assembled into a System-on-a-Chip (SoC).

A method in the wireless device 130 to perform the uplink transmission to the
second RNN 120 will now be described with reference to a flow chart depicted in Figure
7. As mentioned above, the first RNN 110, the second RNN 120 and the wireless device
130 are operated in the wireless communications network 100. Further, the first RNN 110
is configured to serve the wireless device 130 when located in a first cell 112 and the
second RNN 120 is configured to serve the wireless device 130 when located in a second
cell 122, wherein the second cell 122 has a size that is below a threshold and arranged to
at least partly overlap the first cell 112. The threshold may be determined based on a
maximum TA value used by one or more wireless devices when performing an uplink
transmission in the second cell 122. As previously mentioned, the cell size of the second
cell 122 will be described in more detail below under the section "Cell size of the second
cell". The method comprises one or more of the following actions. It should be understood
that actions may be taken in another suitable order and that actions may be combined.

Action 701
The wireless device 130 receives a trigger configured to trigger the wireless device 130 to perform the uplink transmission using a configured Timing Advance, TA, value and a guard time. As previously, the trigger may be received from the first RNN 110 or the second RNN 120.

The configured TA value may be zero or at least less than $N \times 16 \times T_s$, wherein $N$ is an integer larger than zero, and $T_s$ is a basic time unit used in the communications network 100. For example, in LTE $T_s = 1/(15000 \times 2048) \approx 32.55$ nanoseconds.

In some embodiments, the guard time has a length that is determined based on information relating to a coverage of the second cell 122. However, the guard time may have a length that is determined based on information relating to a distance between the wireless device 130 and the second RNN 120.

In some embodiments, the wireless device 130 receives configuration information that is configured to instruct the wireless device 130 to use the configured TA value and the guard time when performing the uplink transmission.

The wireless device 130 may receive system information comprising the configured TA value and/or the guard time.

In some embodiments, the wireless device 130 receives a cell list comprising the configured TA value and/or the guard time for one or more cells of the cell list. The cell list may be a neighbor cell list or a measurement target list.

The wireless device 130 may receive the configured TA value and/or the guard time in a message ordering the wireless device 130 to perform handover to the second RNN 120.

In some embodiments, the wireless device 130 receives the configured TA value and/or the guard time in a message configuring the wireless device 130 with additional radio resources for the uplink transmission to the second RNN 120.

As previously mentioned and exemplified, the TA value may be configured in several ways.

**Action 702**

In some embodiments, the wireless device 130 receives information relating to one or more resources allocated for the uplink transmission to the second RNN 120.

**Action 703**

The wireless device 130 performs, by means of the configured TA value and the guard time, the uplink transmission to the second RNN 120 without performing a
preceding random access procedure in the second cell 122 towards the second RNN 120.

To perform the method of performing the uplink transmission to the second RNN 120, the wireless device 130 may comprise an arrangement depicted in Figure 8. As mentioned above, the first RNN 110, the second RNN 120 and the wireless device 130 are operated in the wireless communications network 100. Further, the first RNN 110 is configured to serve the wireless device 130 when located in a first cell 112 and the second RNN 120 is configured to serve the wireless device 130 when located in a second cell 122, wherein the second cell 122 has a size that is below a threshold and arranged to at least partly overlap the first cell 112. The threshold may be determined based on a maximum TA value used by one or more wireless devices when performing an uplink transmission in the second cell 122. As previously mentioned, the cell size of the second cell 122 will be described in more detail below under the section "Cell size of the second cell 122".

In some embodiments, the wireless device 130 comprises an input and/or output interface 800 configured to communicate with one or more other communication devices, one or more radio network nodes, or one or more wireless devices.

The wireless device 130 comprises means, such as e.g. a receiving module 801, adapted to receive a trigger configured to trigger the wireless device 130 to perform the uplink transmission using a configured Timing Advance, TA, value and a guard time. The configured TA value may be zero or at least less than N*16xT_s, wherein N is an integer larger than zero, and T_s is a basic time unit used in the communications network 100.

In some embodiments, the guard time has a length that is determined based on information relating to a coverage of the second cell 122. However, the guard time has a length that is determined based on information relating to a distance between the wireless device 130 and the second RNN 120.

In some embodiments, the means adapted to receive is further adapted to receive configuration information that is configured to instruct the wireless device 130 to use the configured TA value and the guard time when performing the uplink transmission.

Further, the means adapted to receive may further be adapted to receive system information comprising the configured TA value and/or the guard time.
In some embodiments, the means adapted to receive is further adapted to receive a cell list comprising the configured TA value and/or the guard time for one or more cells of the cell list, wherein the cell list is a neighbor cell list or a measurement target list.

The means adapted to receive may further be adapted to receive the configured TA value and/or the guard time in a message ordering the wireless device 130 to perform handover to the second RNN 120.

In some embodiments, the means adapted to receive is adapted to receive the configured TA value and/or the guard time in a message configuring the wireless device with additional radio resources for the uplink transmission to the second RNN.

The means adapted to receive may further be adapted to receive information relating to one or more resources allocated for the uplink transmission to the second RNN 120.

The receiving module 801 may be a wireless receiver of the wireless device 130.

The wireless device 130 comprises further means, such as e.g. a performing module 902, adapted to perform, by means of the configured TA value and the guard time, the uplink transmission to the second RNN 120 without performing a preceding random access procedure in the second cell 122 towards the second RNN 120.

The performing module 802 may be implemented as a processor 805 of the wireless device 130.

Further, the wireless device 130 may comprise means, such as e.g. a transmitting module 803, adapted to transmit e.g. a signal to one or more other communications devices.

The wireless device 130 may also comprise means for storing data such as user code data. In some embodiments, the wireless device 130 comprises a memory 804 configured to store the data. The user code data may be processed or non-processed user code data or data and/or information relating thereto. The memory 804 may comprise one or more memory units. Further, the memory 804 may be a computer data storage or a semiconductor memory such as a computer memory, a read-only memory, a volatile memory or a non-volatile memory. The memory is arranged to be used to store obtained information, data, configurations, schedulings, and applications etc. to perform the methods herein when being executed in the wireless device 130.
Embodiments herein for performing the uplink transmission to the second RNN 120 may be implemented through one or more processors, such as the processor 805 in the arrangement depicted in Fig. 8, together with computer program code for performing the functions and/or method actions of embodiments herein. The program code mentioned above may also be provided as a computer program product, for instance in the form of a data carrier carrying computer program code for performing the embodiments herein when being loaded into the wireless device 130. One such carrier may be in the form of an electronic signal, optical signal, radio signal or computer readable storage medium. The computer readable storage medium may be a CD ROM disc or a memory stick.

The computer program code may furthermore be provided as pure program code on a server and downloaded to the wireless device 130.

Those skilled in the art will also appreciate that the receiving module, the performing module, and the transmitting module above may refer to a combination of analog and digital circuits, and/or one or more processors configured with software and/or firmware, e.g. stored in the memory, that when executed by the one or more processors such as the processors in the wireless device 130 perform as described above. One or more of these processors, as well as the other digital hardware, may be included in a single application-specific integrated circuitry (ASIC), or several processors and various digital hardware may be distributed among several separate components, whether individually packaged or assembled into a System-on-a-Chip (SoC).

Embodiments herein also relate to a computer program, comprising instructions which, when executed on at least one processor, causes the at least one processor to carry out the method according to any one of the methods described herein.

Further, embodiments herein also relate to a carrier containing the computer program of embodiments desired herein, wherein the carrier is one of an electronic signal, optical signal, radio signal or computer readable storage medium.

Cell size of the second cell

As previously mentioned, the second cell 122 has a size that is below a threshold and arranged to at least partly overlap the first cell 112. Thus, the second cell 122 should have a size that is below an upper limit. Alternatively, this may be expressed as the
second cell 122 should have a size smaller than a maximum size or as the second cell 122 is smaller than a maximum size. Further, as previously mentioned the second cell 122 may be referred to as a small cell, and the first cell 112 may have a cell size that is smaller than, equal to or larger than the cell size of the second cell 122.

In some embodiments herein, the threshold mentioned above is determined based on a maximum TA value used by one or more wireless devices when performing an uplink transmission in the second cell 122. Thus, the size of the second cell 122 may be defined in relation to the maximum TA value used by one or more wireless device when transmitting data in the second cell 122. The used maximum TA value may in turn be defined as a TA value which is exceeded only by a certain fraction of the uplink transmissions in the second cell 122, where this fraction may be e.g. 5%, 2.5% or 0.25%. In such an example the threshold may be expressed as \( N_{TA} = X \). Thus, the cell size of the second cell may be such that the second cell is a cell in which statistics of TA values assigned to (and used by) wireless devices in the cell indicate that the TA values used by wireless devices in the cell exceed \( X \) less than a fraction \( Y \) of the times, wherein \( X \) may be e.g. \( 2 \times 16 \times T_s \), and wherein \( T_s = 1/(15000 \times 2048) \approx 32.55 \) nanoseconds in LTE, and \( Y \) may be e.g. 2.5%. The statistics on which such cell size estimation are based may be gathered by the base station serving the cell, e.g. the eNB in LTE, or some other network node during a short or long period or continuously, e.g. using an exponential average or some other principle for moving average calculation. However, note that this is only an example of how the size of the second cell 122 may be defined. Other definitions may be used without affecting the applicability of embodiments described herein.

One example of another definition of the size of the second cell 122 may be a definition in relation to the maximum TA value assigned to one or more wireless device that are handed over to the second cell 122, wherein the maximum TA value is based on the timing of the reception of a random access preamble transmitted by the wireless device in the second cell 122 in conjunction with a handover into the second cell 122. The maximum TA value assigned in conjunction with a handover into the second cell 122 may in turn be defined as a TA value which is exceeded only a certain fraction of the times a wireless device is assigned a TA value in conjunction with a handover into the second cell 122, wherein this fraction may be e.g. 10%, 5% or 2%. In such an example the threshold may be expressed \( N_{TA} = X \). Thus, the cell size of the second cell may be such that the second cell is a cell in which statistics of TA values assigned to wireless devices being handed over to the cell indicate that these TA values exceed \( X \) less than a fraction \( Y \) of the times, where \( X \) may be e.g. \( 2 \times 16 \times T_s \) (where \( T_s = 1/(15000 \times 2048) \approx 32.55 \) nano-
seconds in LTE), and Y may be e.g. 5%. Such statistics may be kept per target cell (i.e. the cell to which the wireless devices are handed over) or per combination of source and target cell (i.e. one set of statistics for each combination of cell handing over the wireless device and cell to which the wireless device is handed over), wherein the latter principle may result in different statistics for different source cells for the same target cell.

It should be noted that during a RA procedure the communications network may calculate which TA value the wireless device should use. According to current specifications, the wireless device sends the RA preamble upon reception of the DL transmission, i.e. synchronized with the reception of DL transmissions, e.g. DL subframes, so the communications network knows that when it receives the preamble it has passed 2*propagation delay since the communications network sent the DL. Thus, the 2* (two times) comes from the round trip time. For example, the communications network may in a "learning phase" record typical propagation delays in a cell and then use this information to determine the cell size. The communications network, preferably the base station service the concerned cell, e.g. the eNB in LTE, may also record the Timing Advance assigned to a UE in conjunction with a RA procedure and subsequently keep track of modifications of this Timing Advance (which are ordered by the base station). This way, the base station may record statistics of Timing Advance values used for all or a part of all uplink transmissions UEs perform in the cell.

An alternative specification text for defining the cell size of the second cell could be to refer to a cell for which coverage maps created at the cell planning phase or through drive tests indicate that the longest distance from the cell border to an antenna site would require a TA value no larger than X, where X may be e.g. 2*16*T_s (where \( T_s = 1/(15000 \times 2048) \approx 32.55 \) nanoseconds in LTE). By recalculating the TA to a distance the same definition becomes that cell size of the second cell is such that the second cell is a cell for which coverage maps created at the cell planning phase or through drive tests indicate that the longest distance from the cell border to an antenna site is no longer than 313 meters.

Configured TA value and guard time

As previously mentioned, embodiments herein are based on the fact that a small cell, e.g. the second cell 122, as the name implies, is typically small and thus has a very short propagation delay for communication between a wireless device 130 when located in the small cell and its serving RNN, e.g. the second RNN 120. Thus, for a small cell, e.g.
the second cell 122, it may be assumed that no Timing Advance (TA) is needed for uplink transmissions in the small cell. That is, the TA value, $T_A$, is equal to zero, i.e. $T_A = 0$, or, almost equal to zero.

However, in slightly larger small cells, the TA value, $T_A$, is larger than zero but within a small range. For example, the TA value, $T_A$, is smaller than or equal to $N \times 16^\chi T_s$, wherein $N$ is in the range $[0, 1, 2, 3, 4, 5, ...]$, $16^\chi T_s$ is the basic adjustment step of the Timing Advance and $T_s$ is the basic time unit of LTE ($T_s = 1/(15000 \times 2048) \approx 32.55$ nanoseconds), i.e. $16^\chi T_s = 16/(15000 \times 2048) \approx 520$ nanoseconds.

Thus, in embodiments herein it is assumed that a reasonable TA value, $T_A$, may be set in advance for the wireless device 130. This initial TA value may be zero, but TA values slightly above zero are, as mentioned above, also conceivable. The rationale of using a very small, but non-zero TA value is that an eNB, e.g. the second RNN 120, typically may handle reception of an uplink transmission with a small Timing Advance error, such as errors of up to two or three adjustment steps, i.e. up to $2 \times 16^\chi T_s$ or $3 \times 16^\chi T_s$. Thus, assuming an uplink timing error acceptance range of $\pm 2 \times 16^\chi T_s$, an uplink transmission transmitted with a TA value, $T_A$, of $2 \times 16^\chi T_s$ (i.e. two adjustment steps above zero) would be acceptable in small cells ranging from the really small ones, for which $T_A = 0$ is suitable all over the cell, to slightly larger ones, for which the ideal TA value varies between zero close to the receiving antenna and $4 \times 16^\chi T_s$ at the cell edge. Hence, leveraging the marginal Timing Advance error tolerance of a typical eNB, it is possible to preset a TA value for a wireless device for a larger range of small cells than if the TA value is always set to zero.

When the TA value is known beforehand, the Random Access (RA) procedure may be skipped, thereby eliminating the control overhead and delay induced by this procedure.

The purpose of the RA procedures may in some scenarios only be to establish a valid TA value and hence if the TA value is known beforehand the RA procedure may be avoided in order to save or reduce time delay as well as radio resources and energy. However, even when the second cell 122 in typical situations is small enough to allow a zero, or very small, TA value to be used, this may not apply in all situations. For example, this may not apply in cases where the wireless device 130 is handed over to the second cell 122 at a longer distance from the antenna of the second RNN 120 than typically expected, for instance because of a temporary or permanent coverage hole in the overlaying or partly overlapping first cell 112, which causes the weak transmissions from the second RNN 120 in the second cell 122 to be stronger than the transmissions from the first RNN 110 in the first cell 112.
To ensure that uplink transmissions from a wireless device 130 does not adversely interfere with subsequent transmissions (on the same frequency/frequencies) from other wireless devices in the second cell 122 in such situations, the wireless device 130 may use a guard time in its initial uplink transmission in the second cell 122 as a safety precaution. As the wireless device 130 cannot distinguish these situations from the typical situations with shorter propagation times, the wireless device 130 has to apply the safety margin in the form of the guard time in all cases. However, the wireless device 130 only has to use this guard time in the first uplink transmission(s) in the second cell 122, until for example the reception of a Timing Advance Command MAC Control Element from the second RNN 120 confirms that the TA value used by the wireless device 130 is a correct assumption. The timing Advance Command MAC Control Element may be a Timing Advance adjustment instruction. Alternatively, the second RNN 120 may provide the wireless device 130 with another, correct TA value through the Timing Advance Command MAC Control Element. Optionally, a lack of a Timing Advance Command MAC Control Element in the first downlink MAC transmission may also be interpreted as a confirmation that the TA value the wireless device 130 is using is correct or at least good enough. By the expression "that the TA value is at least good enough" when used herein is meant that uplink transmissions by the wireless device using such a TA value will not degrade the system performance above a threshold, e.g. not result in interference above a certain threshold, and will not result in failure to correctly receive the transmission at the RNN, e.g. the eNB in LTE. Note that the use of a guard time as a safety margin still assumes that the wireless device 130 uses a TA value initiated prior to the first uplink transmission in the second cell 122, but that the wireless device 130 does not utilize the full transmission resource, leaving the last part in the time domain of the transmission resource unused. This initial TA value may be initiated by the wireless device 130 based on more or less explicit information or instruction from the wireless communications network 100, e.g. to use $T_A = 0$ or a very small TA value such as $T_A \leq 2^{16xT_s}$. A prerequisite for this scheme is that the wireless device 130 is informed of which TA value that it should use before its initial access to the second cell 122. TA value initiation may be carried out in several ways. For example, the wireless device 130 may, upon TA group creation, initiate the associated TA value, e.g. to zero. However, TA value initiation will not be described in more detail in this document.

As previously mentioned, together with the implicit or explicit information of the configured TA value to use, the wireless device 130 may be provided with an implicit or
explicit instruction to apply a guard time and possibly also the length of the guard time, as well as whether or not to skip the Random Access procedure. By an implicit instruction is meant that the wireless device 130 assumes whether or not to use a guard time from the information of which TA value it should use. The information and/or instruction may be provided to the wireless device 130 in several ways. Below, seven exemplifying ways will be described in more detail.

In a first exemplifying way, the information and/or instruction may be provided to the wireless device 130 by means of the system information in the first cell 112, wherein the initial access information, such as configured TA value, e.g. $T_A = 0$ or $T_A \leq 2 \times 16 \times T_s$, and possible guard time, is associated with an identity of the concerned small cell, e.g. as a part of a neighbor cell list. The indication in the neighbor cell list may also be implicit in the form of a Tracking Area Code of the neighboring small cell within a dedicated range.

In a second exemplifying way, the information and/or instruction may be provided to the wireless device 130 by means of a neighbor cell list or a measurement target cell list sent to the wireless device 130 from the first RNN 110. This may be used in parallel with the system information method. In some embodiments, this message may override any different information in the system information.

In a third exemplifying way, the information and/or instruction may be provided to the wireless device 130 by means of a message ordering the wireless device 130 to execute the handover, such as a handover command like message, e.g. in the form of a RRCConnectionReconfiguration RRC message containing a MobilityControllInfo IE, see 3GPP TS 36.331 V11.5.0, "3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC); Protocol specification (Release 11)", September 2013. This may be used in parallel with the system information method. In some embodiments, this message may override any different information in the system information.

In a fourth exemplifying way, the information and/or instruction may be provided to the wireless device 130 by means of a message configuring the wireless device 130 with additional radio resources. For example, in the concepts of Dual Connectivity and Carrier Aggregation the network may configure the wireless device 130 to utilize multiple carriers. It would be possible that the instruction(s) are provided in the configuration message or messages related to Dual Connectivity and/or Carrier Aggregation, e.g. an RRCConnectionReconfiguration RRC message. This may be used in parallel with the system information method, wherein this message may override any different information in the system information.
In a fifth exemplifying way, the information and/or instruction may be provided to the wireless device 130 by means of a special kind of Timing Advance instruction from the first RNN 110 on the MAC protocol layer, e.g. a special indication and/or a new field in a Timing Advance Command MAC Control Element. This may be used in parallel with the system information method. In some embodiments, this message may override any different information in the system information.

In a sixth exemplifying way, the information and/or instruction may be provided to the wireless device 130 by means of a special kind of Timing Advance instruction from the second RNN 120 on the MAC protocol layer, e.g. a special indication and/or a new Information Element (IE) in a Timing Advance Command MAC Control Element. This may be used in parallel with the system information method. In some embodiments, this message may override any different information in the system information.

In a seventh exemplifying way, the information and/or instruction may be provided to the wireless device 130 by means of the system information in the second cell 122, explicit information or implicit, e.g. in the form of a Tracking Area Code within a dedicated range. This alternative may be less preferred, since it requires that the wireless device 130 acquire the system information in the second cell 122 prior to performing handover to the second cell 122, e.g. in conjunction with measurements the wireless device 130 performs on the small cell's downlink transmissions.

Hence, in all the above exemplifying methods, the configured TA information may optionally be accompanied by an indication of a guard time, e.g. a safety guard time, to be used by the wireless device 130 for the initial uplink transmission in the second cell 122 when the RA procedure towards the second RNN 120 is skipped.

Which length of the guard time is suitable depends on the distance from the wireless device 130 to a receiving antenna of the second RNN 120 where a longer wireless device to antenna distance deems a longer guard time suitable. The wireless communications network 100 may know a suitable guard time length based on information about the coverage of the second cell 122. If there is a risk that one or more other wireless devices far away from the second RNN's 120 antenna get associated with the second cell 122, then a large guard time is needed. However, if there is no risk that one or more wireless devices far away from the antenna are associated with the second cell 122, then no, or a small, guard time may be used. A suitable guard time depends on the propagation delay in a cell. For example, in a cell with X seconds propagation delay, the guard time could be set to X seconds. Further, one TA step in LTE (which is 16 x T_s
31

is the basic adjustment step of the Timing Advance and \( T_s \) is the basic time unit of LTE (\( T_s = 1/(15000 \times 2048) \approx 32.55 \) nanoseconds), i.e. \( 16 \times T_s = 16/(15000 \times 2048) \approx 520 \) nanoseconds) compensates for -70 meters (one way) propagation delay. Furthermore, a small cell may have a coverage (propagation delay) of a few 10's of meters, a larger cell may have a coverage (propagation delay) of 100's of meters, and a very large cell may have a coverage (propagation delay) of all the way up to 100 km. Thus, a large guard time may be exemplified as 6 microseconds and a small guard time may be exemplified as 1 microsecond.

10 The wireless communications network 100 may be aware of the coverage of a network node, e.g. the first and/or second RNN, for example by configuration where the network operator has configured the wireless communications network 100 with suitable settings concerning guard times. Other alternatives also exist for how the wireless communications network 100 acquires information about suitable guard times, such as from Minimization of Drive Tests (MDT) and/or Self-organizing Network (SON) features. This is described e.g. in 3GPP TS 37.320 V11.3.0 ("3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Universal Terrestrial Radio Access (UTRA) and Evolved Universal Terrestrial Radio Access (E-UTRA); Radio measurement collection for Minimization of Drive Tests (MDT); Overall description; Stage 2 (Release 11)", March 2013), 3GPP TS 32.500 V11.1.0 ("3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Telecommunication Management; Self-Organizing Networks (SON); Concepts and requirements (Release 11)", December 2011), and in 3GPP TS 36.902 V9.3.1 ("3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Self-configuring and Self-Optimizing Network (SON) use cases and solutions (Release 9)", March 2011).

From MDT reports the first RNN 110 may become aware of coverage holes or coverage dips in its own cell(s), which may cause handovers to the small cell, e.g. the second cell 122, at a longer distance than usual. When leveraging SON features, the same or similar input may be used as for certain SON features, e.g. SON features for adjusting handover thresholds, DL transmission power and antenna tilt. This self-tuning of the guard time may effectively become a SON feature in itself. Other possible means for acquiring information from which suitable guard times may be derived comprise data in the Mobility Information IE in Handover Request X2AP messages at handovers from the second RNN 120 of the small cell to the first RNN 110, positioning of wireless devices in
handover situations or situations of poor coverage, such as using a Global Positioning System (GPS), triangulation methods or $T_A + \text{Angle of Arrival}$ measurements. Another attractive method would be to introduce means for the second RNN 120, e.g. the pico eNB/Secondary eNB, to report measurements of the reception timing for initial UL transmissions for wireless devices handed over to the second RNN 120. This type of information may be comprised in the Mobility Change Request X2AP message from the second RNN 120 to the first RNN 110 or a new X2AP message may be introduced for this purpose. X2AP, which stands for X2 Application Protocol, is the Application Protocol (AP) used in the interface between two eNBs (i.e. the X2 interface), e.g. between the first RNN 110 and the second RNN 120.

It would also be possible that the guard time is specified in the standard and hardcoded in the wireless device 130. It may be so that the wireless device 130 uses this specified guard time only as a default guard time and if the wireless device 130 has received a guard time from the wireless communications network 100, the wireless device 130 applies the network indicated guard time. That is, the wireless device 130 may give higher priority to the network indicated guard time compared to the default guard time specified in the standard. The wireless communications network 100 may then determine whether the standardized guard time is suitable and if so, not indicate a guard time to the wireless device 130, in which case the wireless device 130 would apply the standardized guard time. However, if the wireless communications network 100 has determined that the standardized guard time is not suitable in a situation, the wireless communications network 100 may indicate to a wireless device 130 another guard time which the wireless device 130 may then apply.

Resource allocation

Some embodiments herein relate to the allocation of uplink transmission resources for the wireless device's 130 initial transmission in the second cell 122. Some different approaches exists and will be described below with reference to a first, a second and a third exemplifying approach, respectively. However, it should be understood that the second RNN 120, in some way, always is involved in the allocation of transmission resources in its cell(s), since the second RNN 120 "owns" its own radio resources. The second RNN 120 may itself directly inform the wireless device 130 of the resource allocation or delegate to the first RNN 110 to inform the wireless device 130 about the resource allocation.
In the first exemplifying approach, the wireless device 130 is allocated uplink transmission resources in advance, which uplink transmission resources are to be used for transmission to the second RNN 120 in the second cell 122. In some embodiments, the wireless device 130 is proactively allocated uplink transmission resources. This may be performed from the second RNN 120 to the first RNN 110 and then to the wireless device 130, e.g. in the message configuring the wireless device 130 with RRC configuration suitable for the second cell 122, e.g. a handover command like message, e.g. in the shape of an RRCConnectionReconfiguration RRC message in LTE.

Alternatively, this may be performed through an unsolicited uplink transmission resource allocation, e.g. an uplink grant without a preceding scheduling request, from the second RNN 120 to the wireless device 130.

In the above-mentioned two cases, the wireless device 130 may transmit a Buffer Status Report (BSR) indicating empty uplink transmission buffer(s), if it does not have any other uplink data to transmit.

Yet another alternative is that the first RNN 110 sends an uplink transmission resource allocation, e.g. an uplink grant in response to a scheduling request from the wireless device 130.

In the second exemplifying approach, the wireless device 130 is not allocated uplink transmission resources in advance, which uplink transmission resources are to be used for transmission to the second RNN 120 in the second cell 122. In such a case, the wireless device 130 may send a scheduling request in the second cell 122 to the second RNN 120 in order to be allocated uplink transmission resources when needed. If the RA procedure is to be skipped in the second cell 122, this method requires that the wireless device 130 is configured with Physical Uplink Control Channel (PUCCH) resources for transmission of scheduling requests in the second cell 122. This may be performed in the message configuring the wireless device 130 with RRC configuration suitable for the second cell 122, e.g. a handover command like message, e.g. in the shape of an RRCConnectionReconfiguration RRC message in LTE.

In the third exemplifying approach, the wireless device 130 is selectively allocated uplink transmission resources to the second RNN 120 in the second cell 122. In some embodiments, the wireless device 130 is proactively and selectively allocated uplink transmission resources to be used for transmission to the second RNN 120 in the second cell 122. Further, the wireless device 130 may selectively be allocated uplink transmission
resources based on the first RNN's 110 knowledge about the status of the wireless device's 130 transmission buffer(s). That is based on possible pending uplink data in the wireless device 130.

As a first example, the first RNN 110 may be aware of the status of the wireless device's 130 uplink transmission buffer(s) based on previous BSR(s) transmitted from the wireless device 130. In some embodiments, the first RNN 110 is aware of the status of the wireless device's 130 uplink transmission buffer(s) based on a BSR transmitted from the wireless device 130 to the first RNN 110 in the MAC PDU that contains the MeasurementReport RRC message that includes the measurement report that triggers the handover decision. This is described in more detail in 3GPP TS 36.321 V11.3.0, "3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); Medium Access Control (MAC) protocol specification (Release 11)", June 2013, which describes the MeasurementReport RRC message that comprises the measurement report that triggers the handover decision. Further, in some embodiments, the first RNN 110 is aware of the status of the wireless device's 130 uplink transmission buffer(s) based on a pending Scheduling Request from the wireless device 130 in the first cell 112.

As a second example, the first RNN 110 may inform the wireless device 130 of the transmission resource allocation in the second cell 122. This may be performed in the message configuring the wireless device 130 with RRC configuration suitable for the second cell 122, such as in a handover command like message, e.g. in the shape of an RRCConnectionReconfiguration RRC message in LTE. For example, the first RNN 110 may first inform the second RNN 120 of the pending uplink data in the wireless device 130 and the second RNN 120 may respond with an indication of the resources to be allocated to the wireless device 130. This information exchange may take place in messages involved in the handover procedure, e.g. messages like the currently used X2AP messages; HANOVER REQUEST and HANOVER REQUEST ACKNOWLEDGEMENT.

As a third example, the wireless device 130 is informed of the transmission resource allocation by the second RNN 120 through an unsolicited uplink transmission resource allocation from the second RNN 120 to the wireless device 130. The unsolicited uplink transmission resource allocation may for example be an uplink grant without a preceding scheduling request. For example, the second RNN 120 is informed of the pending uplink data in the wireless device 130 by the first RNN 110 in a message involved
in the handover procedure, e.g. a message like the currently used X2AP message HANDOVER REQUEST.

5 When using the word "comprise" or "comprising" it shall be interpreted as non-limiting, i.e. meaning "consist at least of".

In the drawings and specification, there have been disclosed exemplary embodiments. However, many variations and modifications can be made to these embodiments. Accordingly, although specific terms are employed, they are used in a generic and descriptive sense only and not for purposes of limitation, the scope of the embodiments herein being defined by the following claims.
CLAIMS

1. A method in a first Radio Network Node, RNN, (110) for assisting a wireless device (130) to perform an uplink transmission to a second RNN (120), wherein the first RNN (110), the second RNN (120) and the wireless device (130) are operated in a wireless communications network (100), wherein the first RNN (110) is configured to serve the wireless device (130) when located in a first cell (112) and the second RNN (120) is configured to serve the wireless device (130) when located in a second cell (122), wherein the second cell (122) has a size that is below a threshold and arranged to at least partly overlap the first cell (112), and wherein the method comprises:
   - triggering (201,301) the wireless device (130) to perform the uplink transmission using a configured Timing Advance, TA, value and a guard time without performing a preceding random access procedure in the second cell (122) towards the second RNN (120).

2. The method of claim 1, wherein the triggering (201,301) further comprises:
   - transmitting, to the wireless device (130), configuration information that is configured to instruct the wireless device (130) to use the configured TA value and the guard time when performing the uplink transmission.

3. The method of claim 2, wherein the transmitting further comprises:
   - transmitting system information comprising the configured TA value and/or the guard time.

4. The method of any of claims 2-3, wherein the transmitting further comprises:
   - transmitting a cell list comprising the configured TA value and/or the guard time for one or more of cells of the cell list, wherein the cell list is a neighbor cell list or a measurement target list.

5. The method of any of claims 2-3, wherein the transmitting further comprises:
   - transmitting the configured TA value and/or the guard time in a message ordering the wireless device to perform handover to the second RNN (120) or to add the second cell to the wireless device's set of service cells.
6. The method of any of claims 2-3, wherein the transmitting further comprises:

- transmitting the initial TA value and/or the guard time in a message configuring the wireless device (130) with additional radio resources for the uplink transmission to the second RNN (120).

7. The method of any of claims 1-6, wherein the configured TA value is zero or at least less than $N^*16xT_s$, wherein $N$ is an integer larger than zero and $T_s$ is a basic time unit used in the communications network (100).

8. The method of any of claims 1-7, wherein the guard time has a length that is determined based on information relating to a coverage of the second cell (122).

9. The method of any of claims 1-7, wherein the guard time has a length that is determined based on information relating to a distance between the wireless device (130) and the second RNN (120).

10. The method of any of claims 1-9, further comprising:

- transmitting (204,302), to the wireless device (130), information relating to one or more resources allocated for the uplink transmission for the uplink transmission to the second RNN (120).

11. The method of any of claims 1-10, wherein the threshold is determined based on a maximum TA value used by one or more wireless devices when performing an uplink transmission in the second cell (122).

12. A first Radio Network Node, RNN, (110) for assisting a wireless device (130) to perform an uplink transmission to a second RNN (120), wherein the first RNN (110), the second RNN (120) and the wireless device (130) are operated in a wireless communications network (100), wherein the first RNN (110) is configured to serve the wireless device (130) when located in a first cell (112) and the second RNN (120) is configured to serve the wireless device (130) when located in a second cell (122), wherein the second cell (122) has a size that is below a threshold and arranged to at least partly overlap the first cell (112), and wherein the first RNN (110) comprises means adapted to:

- trigger the wireless device (130) to perform the uplink transmission using a
configured Timing Advance, TA, value and a guard time without performing a preceding random access procedure in the second cell (122) towards the second RNN (120).

13. The first RNN (110) of claim 12, wherein the means adapted to trigger further is adapted to:
   - transmit, to the wireless device (130), configuration information that is configured to instruct the wireless device (130) to use the configured TA value and the guard time when performing the uplink transmission.

14. The first RNN (110) of claim 13, wherein the means adapted to trigger further is adapted to:
   - transmit system information comprising the configured TA value and/or the guard time.

15. The first RNN (110) of any of claims 12-13, wherein the means adapted to trigger further is adapted to:
   - transmit a cell list comprising the configured TA value and/or the guard time for one or more cells of the cell list, wherein the cell list is a neighbor cell list or a measurement target list.

16. The first RNN (110) of any of claims 12-13, wherein the means adapted to trigger further is adapted to:
   - transmit the configured TA value and/or the guard time in a message ordering the wireless device to perform handover to the second RNN (120) or to add the second cell to the wireless device's set of service cells.

17. The first RNN (110) of any of claims 12-13, wherein the means adapted to trigger further is adapted to:
   - transmit the configured TA value and/or the guard time in a message configuring the wireless device (130) with additional radio resources.

18. The first RNN (110) of any of claims 12-17, wherein the configured TA value is zero or at least less than \(N \times 16 \times T_s\), wherein \(N\) is an integer larger than zero, and \(T_s\) is a basic
time unit used in the communications network (100).

19. The first RNN (110) of any of claims 12-18, wherein the guard time has a length that is determined based on information relating to a coverage of the second cell (122).

20. The first RNN (110) of any of claims 12-18, wherein the guard time has a length that is determined based on information relating to a distance between the wireless device (130) and the second RNN (120).

21. The first RNN (110) of any of claims 12-20, further comprising means adapted to:
   - transmit, to the wireless device (130), information relating to one or more resources allocated for the uplink transmission for the uplink transmission to the second RNN (120).

22. The first RNN (110) of any of claims 12-21, wherein the threshold is determined based on a maximum TA value used by one or more wireless devices when performing an uplink transmission in the second cell (122).

23. A method in a second Radio Network Node, RNN, (120) for assisting a wireless device (130) to perform an uplink transmission to the second RNN (120), wherein the second RNN (120) and the wireless device (130) are operated in a wireless communications network (100), wherein the second RNN (120) is configured to serve the wireless device (130) when located in a second cell (122), wherein the second cell (122) has a size that is below a threshold and arranged to at least partly overlap the first cell (112), and wherein the method comprises:
   - triggering (201', 501) the wireless device (130) to perform the uplink transmission using a configured Timing Advance, TA, value and a guard time without performing a preceding random access procedure in the second cell (122) towards the second RNN (120).

24. The method of claim 23, wherein the triggering (201', 501) further comprises:
   - transmitting, to the wireless device (130), configuration information that is configured to instruct the wireless device (130) to use the configured TA value and the guard time when performing the uplink transmission.
25. The method of claim 24, wherein the transmitting further comprises:
   - transmitting system information comprising the configured TA value and/or the
     guard time.

26. The method of any of claims 23-25, wherein the configured TA value is zero or at least
   less than N*16*T_s, wherein N is an integer larger than zero, and T_s is a basic time unit
   used in the communications network (100).

27. The method of any of claims 23-26, wherein the guard time has a length that is
   determined based on information relating to a coverage of the second cell (122).

28. The method of any of claims 23-26, wherein the guard time has a length that is
   determined based on information relating to a distance between the wireless device
   (130) and the second RNN (120).

29. The method of any of claims 23-28, further comprising:
   - transmitting (204', 502), to the wireless device (130), information relating to one or
     more resources allocated for the uplink transmission for the uplink transmission to the
     second RNN (120).

30. The method of any of claims 23-29, wherein the threshold is determined based on a
   maximum TA value used by one or more wireless devices when performing an uplink
   transmission in the second cell (122).

31. A second Radio Network Node, RNN, (120) for assisting a wireless device (130) to
   perform an uplink transmission to the second RNN (120), wherein the second RNN
   (120) and the wireless device (130) are operated in a wireless communications
   network (100), wherein the second RNN (120) is configured to serve the wireless
   device (130) when located in a second cell (122), wherein the second cell (122) has a
   size that is below a threshold and arranged to at least partly overlap the first cell (112),
   and wherein the second RNN (120) comprises means adapted to:
   - trigger the wireless device (130) to perform the uplink transmission using a
     configured Timing Advance, TA, value and a guard time without performing a
     preceding random access procedure in the second cell (122) towards the second
RNN (120).

32. The second RNN (120) of claim 31, wherein the means adapted to trigger further is adapted to:
   - transmit, to the wireless device (130), configuration information that is configured to instruct the wireless device (130) to use the configured TA value and the guard time when performing the uplink transmission.

33. The second RNN (120) of claim 31 or 32, wherein the means adapted to trigger further is adapted to:
   - transmit system information comprising the configured TA value and/or the guard time.

34. The second RNN (120) of any of claims 31-33, wherein the configured TA value is zero or at least less than \( N \times 16 \times T_s \), wherein \( N \) is an integer larger than zero, and \( T_s \) is a basic time unit used in the communications network (100).

35. The second RNN (120) of any of claims 31-34, wherein the guard time has a length that is determined based on information relating to a coverage of the second cell (122).

36. The second RNN (120) of any of claims 31-34, wherein the guard time has a length that is determined based on information relating to a distance between the wireless device (130) and the second RNN (120).

37. The second RNN (120) of any of claims 31-36, further comprising means adapted to:
   - transmit, to the wireless device (130), information relating to one or more resources allocated for the uplink transmission for the uplink transmission to the second RNN (120).

38. The second RNN (120) of any of claims 31-37, wherein the threshold is determined based on a maximum TA value used by one or more wireless devices when performing an uplink transmission in the second cell (122).
39. A method in a wireless device (130) to perform an uplink transmission to a second RNN (120), wherein the second RNN (120) and the wireless device (130) are operated in a wireless communications network (100), wherein the second RNN (120) is configured to serve the wireless device (130) when located in a second cell (122), wherein the second cell (122) has a size that is below a threshold and arranged to at least partly overlap a first cell (112) served by a first RNN (110) comprised in the wireless communications network (100), and wherein the method comprises:

- receiving (202,701) a trigger configured to trigger the wireless device (130) to perform the uplink transmission using a configured Timing Advance, TA, value and a guard time; and
- performing (206,703), by means of the configured TA value and the guard time, the uplink transmission to the second RNN (120) without performing a preceding random access procedure in the second cell (122) towards the second RNN (120).

40. The method of claim 39, wherein the receiving (202,701) further comprises:

- receiving configuration information that is configured to instruct the wireless device (130) to use the configured TA value and the guard time when performing the uplink transmission.

41. The method of claim 39 or 40, wherein the receiving (202,701) further comprises:

- receiving system information comprising the configured TA value and/or the guard time.

42. The method of any of claims 39-41, wherein the receiving (202,701) further comprises:

- receiving a cell list comprising the configured TA value and/or the guard time for one or more cells of the cell list, wherein the cell list is a neighbor cell list or a measurement target list.

43. The method of any of claims 39-41, wherein the receiving (202,701) further comprises:

- receiving the configured TA value and/or the guard time in a message ordering the wireless device (130) to perform handover to the second RNN (120).
44. The method of any of claims 39-41, wherein the receiving (202,701) further comprises:
   - receiving the configured TA value and/or the guard time in a message
   configuring the wireless device (130) with additional radio resources for the uplink
   transmission to the second RNN (120).

45. The method of any of claims 39-44, wherein the configured TA value is zero or at least
   less than N*16xT_s, wherein N is an integer larger than zero, and T_s is a basic time unit
   used in the communications network (100).

46. The method of any of claims 39-45, wherein the guard time has a length that is
   determined based on information relating to a coverage of the second cell (122).

47. The method of any of claims 39-45, wherein the guard time has a length that is
   determined based on information relating to a distance between the wireless device
   (130) and the second RNN (120).

48. The method of any of claims 39-47, further comprising:
   - receiving (205,702) information relating to one or more resources allocated for
     the uplink transmission to the second RNN (120).

49. The method of any of claims 39-48, wherein the threshold is determined based on a
   maximum TA value used by one or more wireless devices when performing an uplink
   transmission in the second cell (122).

50. A wireless device (130) to perform an uplink transmission to a second RNN (120),
   wherein the second RNN (120) and the wireless device (130) are operated in a
   wireless communications network (100), wherein the second RNN (120) is configured
   to serve the wireless device (130) when located in a second cell (122), wherein the
   second cell (122) has a size that is below a threshold and arranged to at least partly
   overlap a first cell (112) served by a first RNN (110) comprised in the wireless
   communications network (100), and wherein the wireless device (130) comprises
   means adapted to:
   - receive a trigger configured to trigger the wireless device (130) to perform the
     uplink transmission using a configured Timing Advance, TA, value and a guard time;
and
- perform, by means of the configured TA value and the guard time, the uplink transmission to the second RNN (120) without performing a preceding random access procedure in the second cell (122) towards the second RNN (120).

51. The wireless device (130) of claim 50, wherein the means adapted to receive further is adapted to:
- receive configuration information that is configured to instruct the wireless device (130) to use the configured TA value and the guard time when performing the uplink transmission.

52. The wireless device (130) of claim 50 or 51, wherein the means adapted to receive further is adapted to:
- receive system information comprising the configured TA value and/or the guard time.

53. The wireless device (130) of any of claims 50-52, wherein the means adapted to receive further is adapted to:
- receive a cell list comprising the configured TA value and/or the guard time for one or more cells of the cell list, wherein the cell list is a neighbor cell list or a measurement target list.

54. The wireless device (130) of any of claims 50-52, wherein the means adapted to receive further is adapted to:
- receive the configured TA value and/or the guard time in a message ordering the wireless device (130) to perform handover to the second RNN (120).

55. The wireless device (130) of any of claims 50-52, wherein the means adapted to receive further is adapted to:
- receive the configured TA value and/or the guard time in a message configuring the wireless device (130) with additional radio resources for the uplink transmission to the second RNN (120).

56. The wireless device (130) of any of claims 50-55, wherein the configured TA value is zero or at least less than $N \times 16 \times T_s$ where $N$ is an integer larger than zero, and $T_s$ is
a basic time unit used in the communications network (100).

57. The wireless device (130) of any of claims 50-56, wherein the guard time has a length that is determined based on information relating to a coverage of the second cell (122).

58. The wireless device (130) of any of claims 50-56, wherein the guard time has a length that is determined based on information relating to a distance between the wireless device (130) and the second RNN (120).

59. The wireless device (130) of any of claims 50-58, wherein the means adapted to receive further is adapted to:
   - receive information relating to one or more resources allocated for the uplink transmission to the second RNN (120).

60. The wireless device (130) of any of claims 50-59, wherein the threshold is determined based on a maximum TA value used by one or more wireless devices when performing an uplink transmission in the second cell (122).

61. A computer program, comprising instructions which, when executed on at least one processor, causes the at least one processor to carry out the method according to any one of claims 1-11, 23-30, or 39-49.

62. A carrier containing the computer program of claim 61, wherein the carrier is one of an electronic signal, optical signal, radio signal or computer readable storage medium.
Figure 1
Figure 2
301. Trigger the wireless device 130 to perform an uplink transmission using a configured TA value and a guard time without performing a preceding random access procedure

302. Transmit, to the wireless device 130, information relating to one or more resources allocated for the uplink transmission

Figure 3 Method in the first RNN 110
First RNN 110

400. I/O

401. Receiving Module

402. Triggering Module

403. Transmitting Module

Memory 404

405. Processor

Fig. 4
501. Trigger the wireless device 130 to perform an uplink transmission using a configured TA value and a guard time without performing a preceding random access procedure

502. Transmit, to the wireless device 130, information relating one or more resources allocated for the uplink transmission

End

Figure 5 Method in the second RNN 120
Fig. 6
Figure 7 Method in the wireless device 130

701. Receive a trigger to perform an uplink transmission using a configured TA value and a guard time

702. Receive information relating to one or more resources allocated for the transmission

703. Perform the uplink transmission, using the configured TA value and the guard time, without performing a preceding random access procedure
INTERNATIONAL SEARCH REPORT

PCT/SE201 4/050858

A. CLASSIFICATION OF SUBJECT MATTER

IPC: see extra sheet
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

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

SE, DK, FI, NO classes as above

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

EPO-Internal, PAJ, WPI data, COMPENDEX, EMBASE, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category*</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
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<tr>
<td>A</td>
<td>3GPP TR 36.842 v12.0.0 (201 3-1 2) 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Study on Small Cell enhancements for E-UTRA and E-UTRAN; Higher layer aspects; (Release 12) URL: <a href="http://www.3gpp.org/dynareport/36842.htm">http://www.3gpp.org/dynareport/36842.htm</a>; section 7 - 8 and Annex G.</td>
<td>1-62</td>
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<tr>
<td>A</td>
<td>EP 2733874 A2 (LG ELECTRONICS INC), 21 May 2014 (201 4-05-21 ); abstract; paragraphs [0006]-[0020]</td>
<td>1-62</td>
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Further documents are listed in the continuation of Box C.

See patent family annex.

* Special categories of cited documents:
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Date of the actual completion of the international search
13-04-2015

Date of mailing of the international search report
14-04-2015

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International Patent Classification (IPC)
H04W 74/08 (2009.01)
H04W 84/04 (2009.01)