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(54) **INITIAL DOWNLINK TRANSMIT POWER ADJUSTMENT FOR NON-REAL-TIME SERVICES USING DEDICATED OR SHARED CHANNEL**

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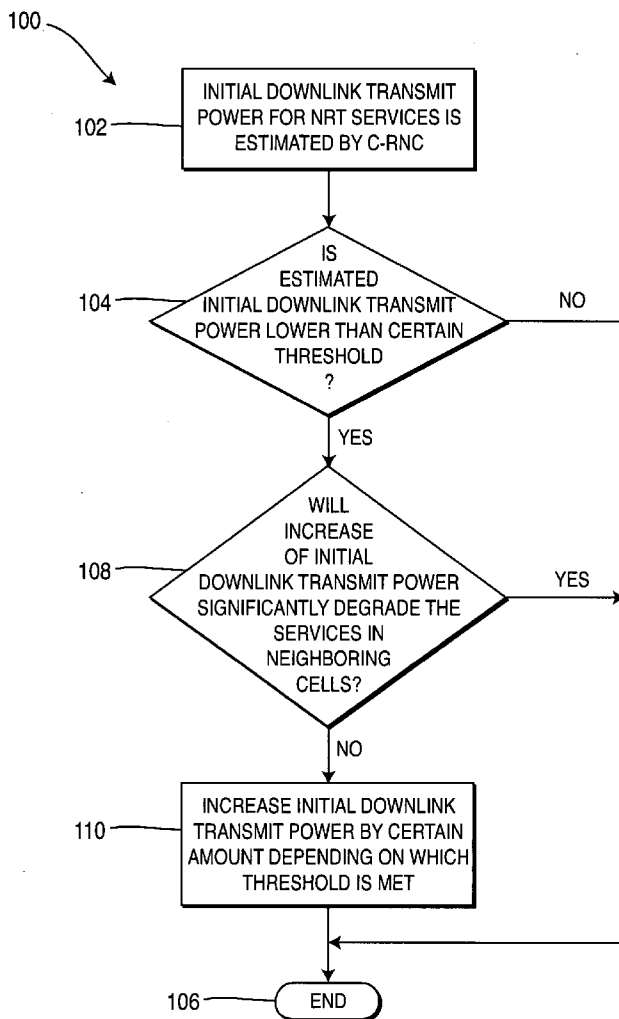(21) Appl. No.: **11/804,929**

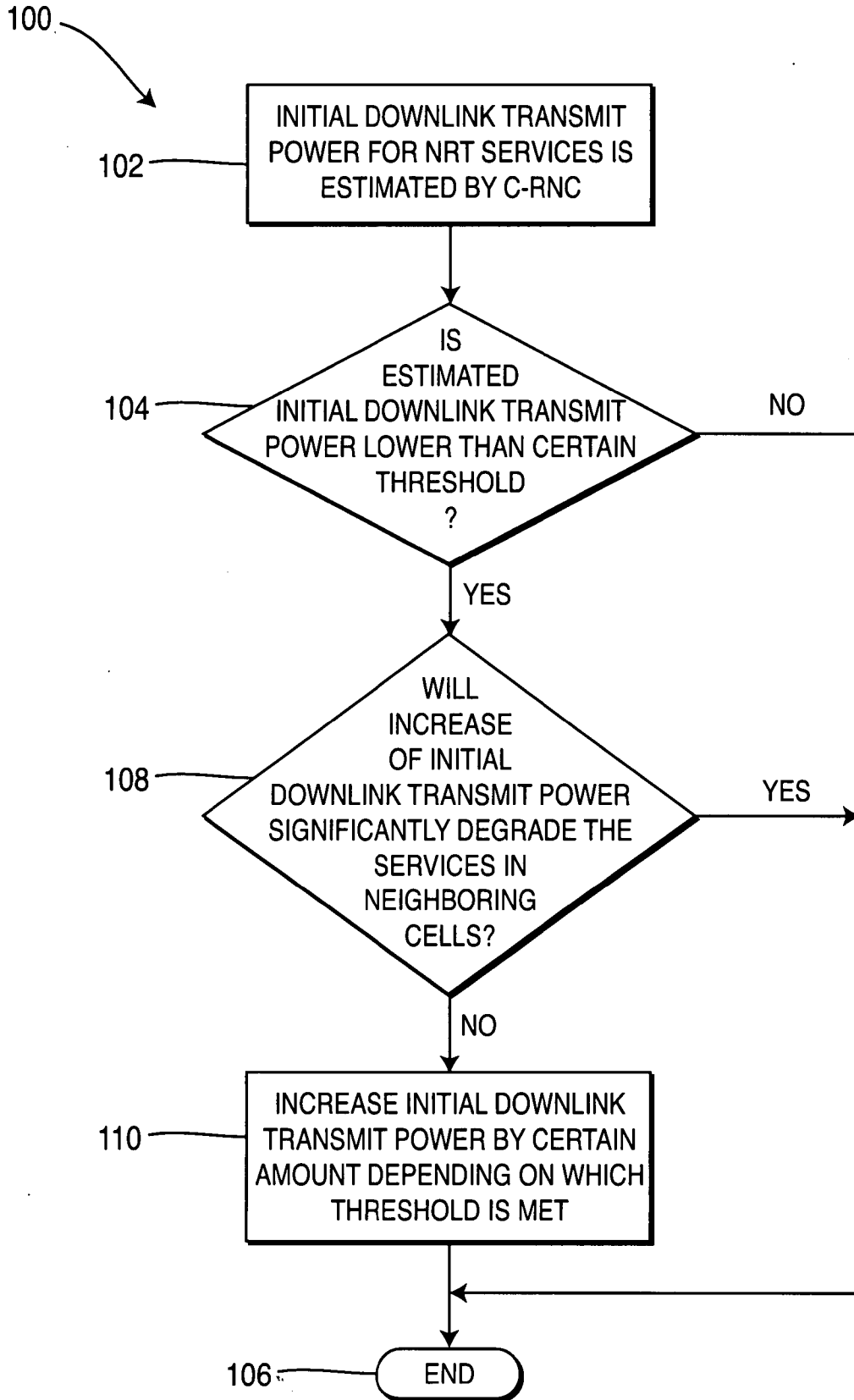(22) Filed: **May 21, 2007**

(57) **ABSTRACT**

A system for initial downlink transmit power adjustment for non-real time (NRT) services in a wireless communications network includes a controlling radio network controller and a Node B. The controlling radio network controller includes a medium access controller and an initial NRT transmission power determining device. The Node B includes a physical layer processor, an initial NRT transmission power adjustment device, and an amplifier.

100

102 — INITIAL DOWNLINK TRANSMIT POWER FOR NRT SERVICES IS ESTIMATED BY C-RNC

104 — IS ESTIMATED INITIAL DOWNLINK TRANSMIT POWER LOWER THAN CERTAIN THRESHOLD ? — NO

YES

108 — WILL INCREASE OF INITIAL DOWNLINK TRANSMIT POWER SIGNIFICANTLY DEGRADE THE SERVICES IN NEIGHBORING CELLS? — YES

NO

110 — INCREASE INITIAL DOWNLINK TRANSMIT POWER BY CERTAIN AMOUNT DEPENDING ON WHICH THRESHOLD IS MET

106 — END

100

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106 — END

FIG. 1

200

202 — INITIAL DOWNLINK TRANSMIT POWER FOR NRT SERVICES IS ESTIMATED BY C-RNC

204 — ESTIMATED SLOT CARRIER POWER IS LOWER THAN CERTAIN THRESHOLD ?

<= MINIMUM CARRIER POWER

> THRES $_{Own\_CaPwr}$

> MINIMUM CARRIER POWER AND <= THRES $_{Own\_CaPwr}$

206

INCREASE INITIAL DOWNLINK TRANSMIT POWER SO THAT CARRIER POWER = MINIMUM CARRIER POWER PLUS MARGIN$_{low}$

210 — AVERAGE SLOT CARRIER POWER OF NEIGHBORING CELLS < THRES $_{Neighbor\_CaPwr}$?

NO

214

NO ADJUSTMENT OF INITIAL DOWNLINK TRANSMIT POWER WILL BE MADE

212

YES

INCREASE INITIAL DOWNLINK TRANSMIT POWER SO THAT TOTAL CARRIER POWER = MAX(MINIMUM CARRIER POWER PLUS MARGIN$_{medium}$, ORIGINAL ESTIMATED TOTAL CARRIER POWER PLUS MARGIN$_{original}$)
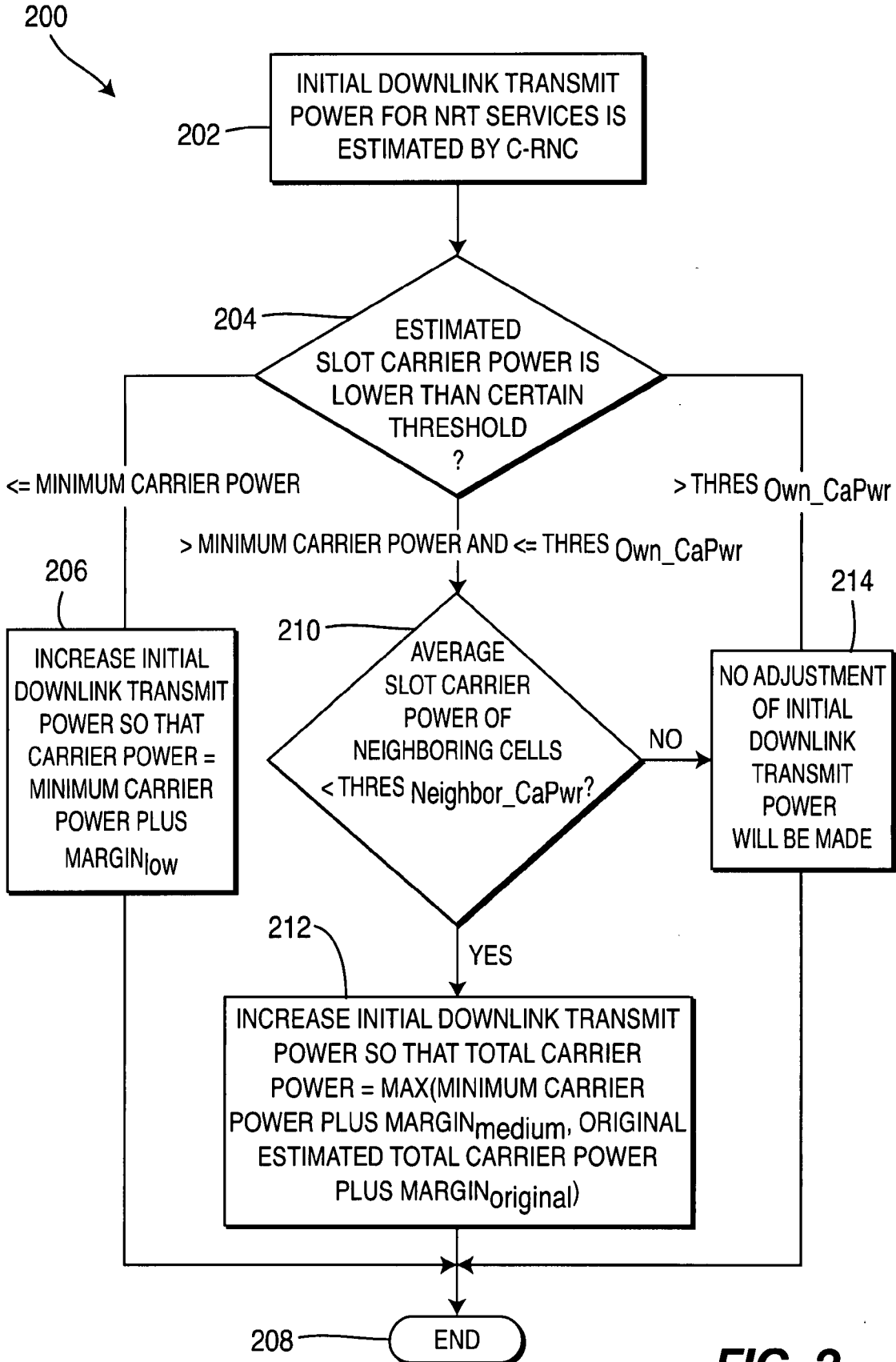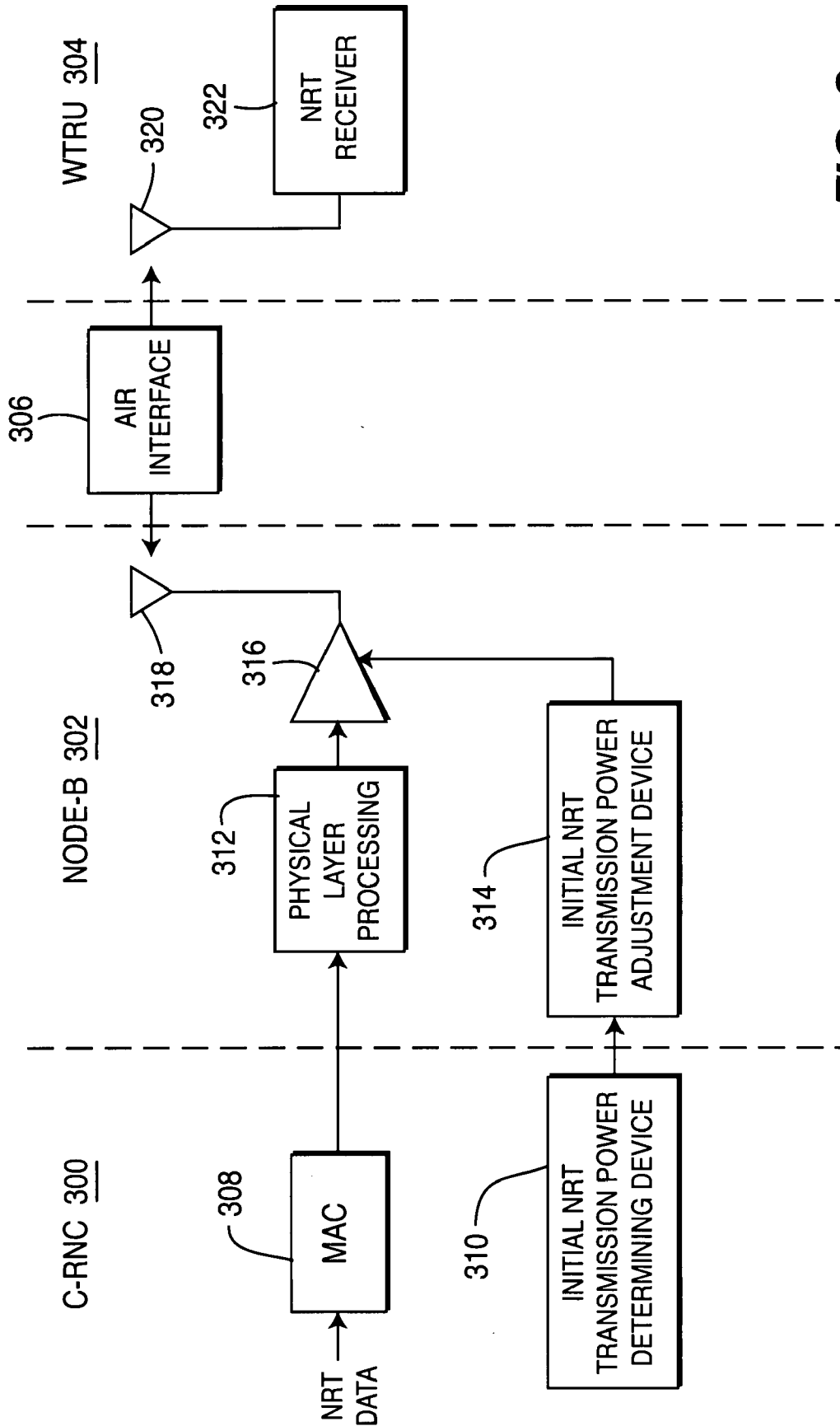
208 — END

FIG. 2

FIG. 3

INITIAL DOWNLINK TRANSMIT POWER ADJUSTMENT FOR NON-REAL-TIME SERVICES USING DEDICATED OR SHARED CHANNEL

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application is a continuation of U.S. patent application Ser. No. 10/725,789, filed Dec. 2, 2003, which claims the benefit of U.S. Provisional Application No. 60/517,698 filed on Nov. 5, 2003, which is incorporated by reference as if fully set forth herein.

FIELD OF THE INVENTION

[0002] The present invention relates to adjusting initial downlink transmit power in cellular networks, and more particularly, to adjusting initial downlink transmit power for non-real-time services to improve the experienced quality of service.

BACKGROUND OF THE INVENTION

[0003] Due to the bursty nature of non-real-time (NRT) services, the allocation of physical resources for NRT services is also bursty and short. For each allocation, the accuracy of initial downlink transmit power is important to the experienced quality of service, such as the block error rate (BLER), of the allocation. Currently, the initial downlink transmit power is estimated by the controlling radio network controller (C-RNC) using two different schemes according to the availability of measurements.

[0004] Due to factors such as fading, mobility, measurement reporting delay, and errors, the initial downlink transmit power can be significantly different from the actual required power to support the signal to interference ratio (SIR). If the initial downlink transmit power is significantly lower than the actual required power, the actual SIR in the beginning of the allocation will be much lower than the required SIR, which will cause many transmission errors. Since the allocation for NRT services is usually short, errors encountered in the beginning of the allocation may not be averaged out through the short allocation duration to meet the required BLER.

SUMMARY

[0005] The present invention proposes a solution for cellular networks to adjust the initial downlink transmit power for non-real-time services to improve the experienced quality of service.

[0006] A method for initial downlink transmit power adjustment for non-real time services in a wireless communications network begins by estimating an initial downlink transmit power level for non-real-time services. The estimated power level is then compared with a threshold. A determination is made whether an increase in the estimated power level would affect neighboring cells. If an increase would not affect neighboring cells, then the initial downlink transmit power level is adjusted by a predetermined amount.

[0007] A method for initial downlink transmit power adjustment for non-real time services in a wireless communications network begins by estimating an initial downlink transmit power level for non-real-time services. An estimated slot carrier power is calculated and is compared with a threshold. The initial downlink transmit power is adjusted based upon the comparison result. Based on the threshold used for the comparison, the initial downlink transmit power may be increased or may remain at the initial setting.

[0008] A system for initial downlink transmit power adjustment for non-real time (NRT) services in a wireless communications network includes a controlling radio network controller and a Node B. The controlling radio network controller includes a medium access controller and an initial NRT transmission power determining device. The Node B includes a physical layer processor, an initial NRT transmission power adjustment device, and an amplifier.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] A more detailed understanding of the invention may be had from the following description of preferred embodiments, given by way of example, and to be understood with reference to the accompanying drawings in which:

[0010] FIG. 1 is a flowchart of a general strategy of initial downlink transmit power adjustment for non-real-time services; and

[0011] FIG. 2 is a flowchart of an implementation of the strategy shown in FIG. 1 for wideband code division multiple access (WCDMA) time division duplex (TDD) systems.

[0012] FIG. 3 is a simplified block diagram of a system using initial downlink transmit power adjustment for non-real-time services.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0013] FIG. 1 shows a flowchart of a method 100 of the initial downlink transmit power as estimated by the C-RNC, which uses a full-measurement based algorithm or a common-measurement based algorithm. The full-measurement based algorithm is used when dedicated and common measurements are available to the RNC, while the common-measurement based algorithm is used when only common measurements are available to the RNC. The method 100 begins by the C-RNC estimating the initial downlink transmit power for NRT services (step 102). The estimated initial downlink transmit power is compared to a threshold (step 104), and if the estimated power is above the threshold, the method terminates (step 106).

[0014] If the estimated power is lower than the threshold (step 104), then a determination is made whether an increase of the initial downlink transmit power would significantly degrade the services in neighboring cells (step 108). If there would be a significant degrade in the services in a neighboring cell, then no power adjustment is made, and the method terminates (step 106). However, if there would not be a significant degrade in the services in a neighboring cell, then the initial downlink transmit power is increased by a certain amount (step 110), depending on which threshold was met in step 104. The method then terminates (step 106).

[0015] Intuitively, increasing the initial downlink transmit power properly when conditions allow improves performance. In one embodiment, the initial downlink transmit power is increased only if the following conditions are met:

[0016] 1) The initial downlink transmit power estimated by the C-RNC is lower than a certain threshold.

[0017] 2) The increase of the initial downlink transmit power will not degrade the services in neighboring cells significantly (for example, by causing congestion conditions). This effect can be gauged by the carrier power of a neighboring base station (BS) or the downlink interference.

[0018] There can also be multiple thresholds for the initial downlink transmit power. Each threshold has an amount of transmit power increase associated with it. The amount of the increase and the value of the thresholds also depend on the required BLER of the NRT services, because the required BLER is an indicator of the tolerance of initial transmission errors.

[0019] A solution to the initial downlink transmit power problem for NRT services in a WCDMA TDD system is shown in FIG. 2. A method 200 begins by the C-RNC estimating the initial downlink transmit power for NRT services (step 202). Next, a determination is made whether the estimated slot carrier power, which is equal to the estimated initial downlink transmit power plus the current slot carrier power, is lower than a certain threshold (step 204). If the estimated slot carrier power is less than the minimum Node B carrier power, then the initial downlink transmit power is increased so that the total slot carrier power equals the minimum Node B carrier power plus a margin, which is denoted by $Margin_{low}$ (step 206). $Margin_{low}$ is a design parameter whose typical value is in the range of 2-5 dB. The lower the value of required BLER, the higher the value of $Margin_{low}$. The method then terminates (step 208).

[0020] If the estimated slot carrier power is greater than the minimum Node B carrier power but less than a carrier power threshold ($Thres_{Own\_CaPwr}$; step 204), a determination is made whether the average slot carrier power of neighboring cells is below a certain threshold, which is denoted by $Thres_{Neighbor\_CaPwr}$ (step 210). Alternatively, the interference signal code power (ISCP) of this wireless transmit/receive unit (WTRU) in the timeslot of this cell may be used, and is designated by $Thres_{Neighbor\_ISCP}$. These thresholds are determined jointly by the maximum allowed slot carrier power of the Node B and the required BLER of the NRT services. The higher the maximum allowed slot carrier power, the higher the thresholds will be. Additionally, the lower the value of the required BLER, the higher these thresholds will be.

[0021] If the average slot carrier power is below $Thres_{Neighbor\_CaPwr}$, the initial downlink transmit power is increased such that the total slot carrier power is equal to the greater of: the minimum Node B carrier power plus a margin, denoted by $Margin_{medium}$, or the original estimated total slot carrier power plus a margin, denoted by $Margin_{original}$ (step 212). $Margin_{medium}$ is determined as the highest value of a margin so that the interference caused by the minimum Node B carrier power plus $Margin_{medium}$ will not cause the slot carrier power of a neighboring cell to approach its maximum allowed value. $Margin_{original}$ is determined as the highest value of a margin so that the interference caused by the Node B carrier power at the level of $Thres_{Own\_CaPwr}$ plus $Margin_{original}$ will not cause the slot carrier power of a neighboring cell to approach its maximum allowed value. The method then terminates (step 208).

[0022] If, in step 210, the average slot carrier power of neighboring cells is greater than $Thres_{Neighbor\_CaPwr}$, then no adjustment of initial downlink transmit power is made (step 214) and the method terminates (step 208). If the estimated slot carrier power is greater than the carrier power threshold ($Thres_{Own\_CaPwr}$; step 204), then no adjustment of initial downlink transmit power is made (step 214) and the method terminates (step 208).

[0023] It is noted that all the parameters (i.e., the margins and the thresholds) used in the method 200 are related to BLER either directly or indirectly. In practice, all of the parameters can be fine-tuned through simulations or field tests/trials.

[0024] FIG. 3 is a simplified block diagram of an embodiment for initial downlink transmit power adjustment for non-real-time services. A C-RNC 300 receives NRT data. A medium access controller 308 schedules the NRT data for transmission. The C-RNC 300 also has an initial NRT transmission power determining device 310 for determining an initial transmission power level for the NRT data.

[0025] The scheduled NRT data is sent to physical layer processing 312 at the Node B 302 to be formatted for transmission over the air interface 306. An initial NRT transmission power adjustment device 314 adjusts the initial transmission power level estimate as previously described. The adjusted initial transmission power level determination is used to adjust the gain of an amplifier 316. The amplified NRT signal is radiated by an antenna 318 or an antenna array through the air interface 306. The WTRU 304 receives the NRT signal using its antenna 320 or antenna array and recovers the NRT data using an NRT receiver 322.

[0026] While specific embodiments of the present invention have been shown and described, many modifications and variations could be made by one skilled in the art without departing from the scope of the invention. The above description serves to illustrate and not limit the particular invention in any way.

What is claimed is:

1. A system for initial downlink transmit power adjustment for non-real time (NRT) services in a wireless communications network, comprising:

a controlling radio network controller, including:

a medium access controller; and

an initial NRT transmission power determining device; and

a Node B, including:

a physical layer processor;

an initial NRT transmission power adjustment device; and

an amplifier.

2. The system according to claim 1, wherein said medium access controller is configured to schedule NRT data for transmission.

3. The system according to claim 2, wherein said medium access controller is further configured to send the NRT data to said physical layer processor.

4. The system according to claim 3, wherein said physical layer processor is configured to receive the NRT data from said medium access controller and to format the NRT data for transmission.

5. The system according to claim 2, wherein said initial NRT transmission power determining device is configured to determine an initial transmission power level for the NRT data.

6. The system according to claim 5, wherein said initial NRT transmission power adjustment device is configured to receive the initial transmission power level from said initial transmission power determining device and to adjust the initial transmission power level.

7. The system according to claim 6, wherein the adjusted initial transmission power level is used to adjust a gain of said amplifier.

8. The system according to claim 1, further comprising a wireless transmit/receive unit including an NRT receiver configured to recover NRT data received from said Node B.

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