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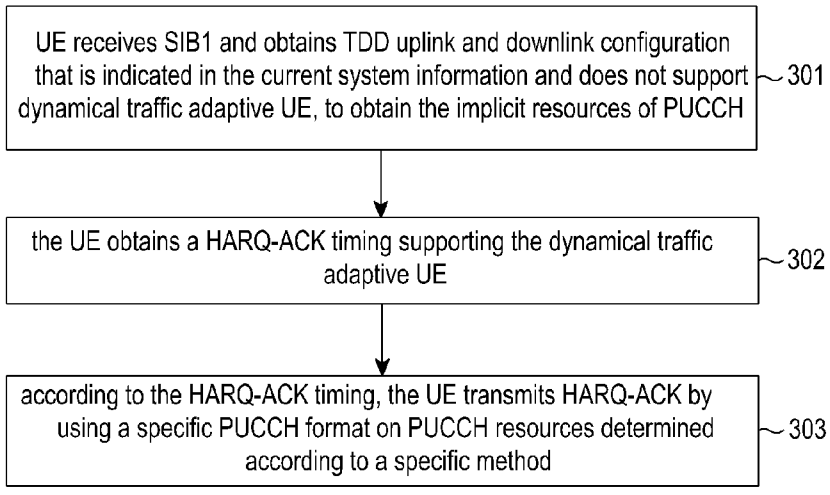
(54) Title: METHOD AND APPARATUS FOR HARQ-ACK TRANSMISSION IN TRAFFIC ADAPTIVE TDD SYSTEM



(57) Abstract: The present application discloses a method and an apparatus for HARQ-ACK feedback information transmission in a traffic adaptive TDD system. The UE receives a System Information Block (SIB) and obtains TDD uplink and downlink configuration that is indicated by current system information and does not support traffic adaptive UE, to learn implicit resources of PUCCH; the UE obtains a HARQ-ACK timing supporting the traffic adaptive UE; and the UE transmits, according to the obtained HARQ-ACK timing, HARQ-ACK feedback information on determined PUCCH resources by using a determined PUCCH format. The present application may dynamically adjust the assigned PUCCH resources according to actual uplink and downlink configuration, thereby effectively saving physical resources of uplink subframes.

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Description

Title of Invention: METHOD AND APPARATUS FOR HARQ-ACK TRANSMISSION IN TRAFFIC ADAPTIVE TDD SYSTEM

Technical Field

[1] The present application relates to radio communication technologies, and more particularly to a method and an apparatus for transmitting Hybrid Automatic Repeat reQuest-Acknowledge (HARQ-ACK) of Physical Downlink Shared Channel (PDSCH) in a traffic adaptive Time Division Duplexing (TDD) system when a TDD uplink and downlink configuration of cell dynamically changes with uplink and downlink traffic.

Background Art

[2] Long Term Evolution (LTE) technology supports a Frequency Division Duplexing (FDD) mode and a TDD mode.

[3] **Figure 1** is a schematic diagram illustrating the frame structure in a LTE TDD system. In the LTE TDD system, the length of each radio frame is 10ms, and each radio frame is divided into two half frames with the length of 5ms. Each half frame contains 8 time slots with the length of 0.5ms and 3 special domains with the length of 1ms. The 3 special domains contain a Downlink Pilot Time Slot (DwPTS), a Guard Partition (GP) and an Uplink Pilot Time Slot (UpPTS), and each subframe is composed of two continuous time slots.

[4] The transmission in the TDD system includes transmission from a base station to User Equipment (UE) (called downlink transmission) and transmission from the UE to the base station (called uplink transmission). According to the frame structure shown in Figure 1, the uplink transmission and the downlink transmission in each 10ms period of time share 10 subframes, and each subframe is assigned to the uplink transmission or the downlink transmission. The subframe assigned to the uplink transmission is called an uplink subframe, and the subframe assigned to the downlink transmission is called a downlink subframe. The TDD system supports 7 types of uplink and downlink configurations, as shown in Table 1. "D" in Table 1 indicates downlink subframes, "U" indicates uplink subframes, and "S" indicates special subframes containing the above 3 special domains.

[5] [Table 1]

[6]

TDD UL/DL configuration index	switching point period	subframe index									
		0	1	2	3	4	5	6	7	8	9
0	5 ms	D	S	U	U	U	D	S	U	U	U
1	5 ms	D	S	U	U	D	D	S	U	U	D
2	5 ms	D	S	U	D	D	D	S	U	D	D
3	10 ms	D	S	U	U	U	D	D	D	D	D
4	10 ms	D	S	U	U	D	D	D	D	D	D
5	10 ms	D	S	U	D	D	D	D	D	D	D
6	10 ms	D	S	U	U	U	D	S	U	U	D

[7] In order to increase the transmission rate of users, a LTE technology of high version is put forward. A LTE TDD system of high version and the LTE TDD system have the same HARQ transmission timing. The HARQ transmission timing of downlink data in the LTE TDD system and the LTE TDD system of high version will be illustrated hereinafter.

[8] The HARQ-ACK of PDSCH may be transmitted in a Physical Uplink Shared Channel (PUSCH) and a Physical Uplink Control Channel (PUCCH). For a timing from the PDSCH to the PUCCH, suppose the UE transmits the HARQ-ACK in the PUCCH of uplink subframe n, the PUCCH indicates the PDSCH in downlink subframe n-k and the HARQ-ACK released by Semi-Persistent Scheduling (SPS), where $k \in K$. The value of K is defined in Table 2, and K is a set of M elements, represented as $\{k_0, k_1, ...k_{M-1}\}$. K relates to the serial number of subframe and TDD uplink and downlink and is called a downlink association set, and element k is called a downlink association element. Hereinafter, downlink subframes corresponding to the downlink association set are called a bundling window, i.e. for all k elements in K, the downlink subframes are a set $\{n-k,\ k \in K\}$ composed of n-k elements. In a PUCCH subframe, each PDSCH of each downlink subframe is assigned PUCCH resources for transmitting the HARQ-ACK.

[9] [Table 2]

[10]

TDD UL/DL configuration index	subframe *n*									
	0	1	2	3	4	5	6	7	8	9
0	-	-	6	-	4	-	-	6	-	4
1	-	-	7, 6	4	-	-	-	7, 6	4	-
2	-	-	8, 7, 4, 6	-	-	-	-	8, 7, 4, 6	-	-
3	-	-	7, 6, 11	6, 5	5, 4	-	-	-	-	-
4	-	-	12, 8, 7, 11	6, 5, 4, 7	-	-	-	-	-	-
5	-	-	13, 12, 9, 8, 7, 5, 4, 11, 6	-	-	-	-	-	-	-
6	-	-	7	7	5	-	-	7	7	-

[11] With the increasing requirements of users on data transmission rate, a traffic adaptive TDD technology is put forward in the LTE of high version. Through dynamically adjusting the ratio between uplink subframes and downlink subframes, the current uplink and downlink configuration more accords with the ratio between the current uplink traffic and downlink traffic, thereby improving the uplink and downlink peak rate of users and system throughput.

[12] In the traffic adaptive TDD system, a TDD uplink and downlink configuration followed by the HARQ-ACK timing from the PDSCH to the PUCCH may be different from an actual TDD uplink and downlink configuration. For example, high-layer signaling or physical layer signaling may indicate a reference TDD uplink and downlink configuration, and whatever the actual TDD uplink and downlink configuration is, the HARQ-ACK of PDSCH is transmitted according to the HARQ-ACK timing corresponding to the reference TDD uplink and downlink configuration indicated by the high-layer signaling or the physical layer signaling. For example, if the indicated reference TDD uplink and downlink configuration is TDD uplink and downlink configuration 2 and the actual TDD uplink and downlink configuration is TDD uplink and downlink configuration 0, 1 or 6, because downlink subframes of the actual TDD uplink and downlink configuration are a subset of downlink subframes of the reference TDD uplink and downlink configuration, all downlink subframes of the actual TDD uplink and downlink configuration may obtain uplink subframes for transmitting the HARQ-ACK of PDSCH.

[13] In an actual system, UE of high version and backward UE coexist. For the HARQ-ACK timing from the PDSCH to the PUCCH, the backward UE and the UE of high version may follow different TDD uplink and downlink configurations. For different TDD uplink and downlink configurations, when the HARQ-ACK of downlink data is

transmitted on the same one uplink subframe, there are different bundling windows, as shown in **Figure 2.**

[14] Letters "D" and "S" in subframes shown in Figures indicate downlinks subframes, and letter "U" indicates downlink subframes. The UE of high version transmits the HARQ-ACK of PDSCH according to the HARQ-ACK timing of TDD uplink and downlink configuration 2, where the TDD uplink and downlink configuration used by the UE of high version is the reference TDD uplink and downlink configuration indicated by the high-layer signaling or the physical layer signaling. The backward UE uses the HARQ-ACK timing of TDD uplink and downlink configuration 0, where the TDD uplink and downlink configuration used by the backward UE is a TDD uplink and downlink configuration indicated in system information (e.g., a System Information Block 1 (SIB1)) by a TDD UE that does not support a traffic adaptive. When the UE of high version and the backward UE transmit the HARQ-ACK of PDSCH on the same uplink subframe 2 according to respective HARQ-ACK timing, what the UE of high version transmits is the HARQ-ACK of downlink subframes 4, 5, 6 and 8, and what the backward UE transmits is the HARQ-ACK of downlink subframe 6. For the resources needed for transmitting the HARQ-ACK of downlink subframes 4, 5, 6 and 8 corresponding to the UE of high version, the downlink subframe 6 corresponding to the backward UE has PUCCH format 1a/1b resources on the uplink subframe 2, and the downlink subframes 4, 5 and 8 have no the PUCCH format 1a/1b resources on the uplink subframe 2, where the PUCCH format 1a/1b resources are obtained according to the smallest Control Channel Element (CCE) index for scheduling the PDCCH.

[15] For the UE of high version, if PUCCH resources are reserved for each downlink subframe according to conventional technologies, because the number of downlink subframes in the reference TDD uplink and downlink configuration indicated by the high-layer signaling or the physical layer signaling is larger than the number of actually configured downlink subframes, so much PUCCH resources are not needed, thereby wasting the PUCCH resources.

[16] As can be seen, when the HARQ-ACK of PDSCH in the traffic adaptive TDD system is transmitted, there is a problem how the UE of high version is compatible with the backward UE and a problem that the PUCCH resources are wasted in the prior art.

Disclosure of Invention

Technical Problem

[17] The present application provides a HARQ-ACK transmission method and apparatus in a traffic adaptive TDD system, so as to make UE of high version compatible with backward UE and solve the problem that PUCCH resources are wasted.

Solution to Problem

[18] The HARQ-ACK transmission method in the traffic adaptive TDD system provided by the present application includes:

[19] receiving, by User Equipment (UE), a System Information Block (SIB), and obtaining TDD uplink and downlink configuration that is indicated by current system information and does not support dynamical traffic adaptive UE, to know implicit resources of Physical Uplink Control Channel (PUCCH);

[20] obtaining, by the UE, a HARQ-ACK timing supporting the dynamical traffic adaptive UE; and

[21] transmitting, by the UE according to the obtained HARQ-ACK timing, HARQ-ACK on determined PUCCH resources by using a determined PUCCH format.

[22] Preferably, the HARQ-ACK is transmitted by using PUCCH format 3.

[23] A preferred method of determining PUCCH resources and PUCCH format used for HARQ-ACK transmission includes:

[24] Transmit Power Control (TPC) element in a Physical Downlink Control Channel (PDCCH) scheduling a Physical Downlink Shared Channel (PDSCH) on all downlink subframes in a HARQ-ACK bundling window are used as HARQ-ACK Resource Indicators (ARIs), which indicate PUCCH format 3 resources for transmitting the HARQ-ACK; and a power control command of PDCCH format 3/3A is used to implement the power control of the PUCCH transmitting the HARQ-ACK; and

[25] the UE transmits the HARQ-ACK on the PUCCH format 3 resources indicated by the ARIs.

[26] Another preferred method of determining PUCCH resources and PUCCH format used for HARQ-ACK transmission includes:

[27] TPC element in a PDCCH on downlink subframes in a bundling window are used as a power control command of the PUCCH transmitting the HARQ-ACK, wherein the downlink subframes' Downlink Assignment Index (DAI) is equal to 1 and the downlink subframes have implicit resources, and TPC element in a PDCCH on the other downlink subframes are used as ARIs which indicate PUCCH format 3 resources for transmitting the HARQ-ACK;

[28] when the UE only receives the PDCCH of downlink subframe whose DAI is equal to 1, and the downlink subframe has implicit resources, the UE transmits the HARQ-ACK on the implicit resources by using PUCCH format 1a/1b; and

[29] when the UE receives the PDCCH of downlink subframes whose DAI is unequal to 1 or only receives the PDCCH of downlink subframe whose DAI is equal to 1 and that has no implicit resources, the UE transmits the HARQ-ACK by using the PUCCH format 3 on the PUCCH format 3 resources obtained according to the ARIs in the

PDCCH.

[30] Another preferred method of determining PUCCH resources and PUCCH format used for HARQ-ACK transmission includes:

[31] the UE obtains PUCCH format 1a/1b resources corresponding to each bundling window through high-layer signaling, TPC element in a PDCCH on downlink subframes whose DAI is unequal to 1 are used as ARIs, which indicate the PUCCH format 3 resources for transmitting the HARQ-ACK, and TPC element in a PDCCH on downlink subframe whose DAI is equal to 1 are used as a power control command of the PUCCH transmitting the HARQ-ACK; and

[32] when the UE only receives the PDCCH of downlink subframe whose DAI is equal to 1, the UE transmits the HARQ-ACK by using the PUCCH format 1a/1b on the PUCCH format 1a/1b resources obtained according to high-layer signaling; when the UE receives the PDCCH of downlink subframes whose DAI is unequal to 1, the UE transmits the HARQ-ACK by using the PUCCH format 3 on the PUCCH format 3 resources obtained according to the ARIs in the PDCCH.

[33] Another preferred method of determining PUCCH resources and PUCCH format used for HARQ-ACK transmission includes:

[34] the UE obtains PUCCH format 1a/1b resources corresponding to each bundling window through high-layer signaling, TPC element in a PDCCH on downlink subframes whose DAI is unequal to 1 are used as ARIs, which indicate the PUCCH format 3 resources for transmitting the HARQ-ACK, and TPC element in a PDCCH on downlink subframe whose DAI is equal to 1 are used as a power control command of the PUCCH transmitting the HARQ-ACK; and

[35] when the UE only receives the PDCCH of downlink subframe whose DAI is equal to 1, and the downlink subframe has implicit resources, the UE transmits the HARQ-ACK on the implicit resources by using the PUCCH format 1a/1b; when the UE receives the PDCCH of downlink subframes whose DAI is equal to 1, and the downlink subframes have no implicit resources, the UE transmits the HARQ-ACK by using the PUCCH format 1a/1b on the PUCCH format 1a/1b resources obtained according to the high-layer signaling; when the UE receives the PDCCH of downlink subframes whose DAI is unequal to 1, the UE transmits the HARQ-ACK by using the PUCCH format 3 on the PUCCH format 3 resources obtained according to the ARIs in the PDCCH.

[36] Another preferred method of determining PUCCH resources and PUCCH format used for HARQ-ACK transmission includes:

[37] TPC element in a PDCCH on downlink subframes having implicit resources are used as a power control command of the PUCCH transmitting the HARQ-ACK, and TPC element in a PDCCH on downlink subframes having no implicit resources are used as

ARIs, which indicate the PUCCH format 3 resources for transmitting the HARQ-ACK; and

[38] when the UE receives the PDCCH of downlink subframes having the implicit resources, the UE transmits the HARQ-ACK on the implicit resources by using PUCCH format 1b or PUCCH format 1a/1b with a channel selection ; when the UE receives the PDCCH of downlink subframes having no implicit resources, the UE transmits the HARQ-ACK by using the PUCCH format 3 on the PUCCH format 3 resources obtained according to the ARIs in the PDCCH.

[39] Another preferred method of determining the PUCCH resources and PUCCH format used for the HARQ-ACK transmission includes:

[40] the UE obtains the PUCCH format 3 resource corresponding to each bundling window through the high-layer signaling, and the TPC element in the PDCCH on all downlink subframes within each bundling window are used as a power control command of the PUCCH transmitting the HARQ-ACK; and

[41] when the UE only receives the PDCCH of downlink subframe whose DAI is equal to 1, and the downlink subframe has implicit resources, the UE transmits the HARQ-ACK on the implicit resources by using the PUCCH format 1a/1b. If the downlink subframe has no implicit resources, the UE transmits the HARQ-ACK by using the PUCCH format 3 on the PUCCH format 3 resources obtained according to the high-layer signaling. When the UE receives the PDCCH of downlink subframe whose DAI is unequal to 1, the UE transmits the HARQ-ACK by using the PUCCH format 3 on the PUCCH format 3 resources obtained according to the ARIs in the PDCCH.

[42] Another preferred method of determining the PUCCH resources and PUCCH format used for the HARQ-ACK transmission includes:

[43] the UE obtains the PUCCH format 3 resource corresponding to each bundling window through the high-layer signaling, and the TPC element in the PDCCH on the downlink subframes whose DAI is unequal to 1 are used as a power control command of the PUCCH transmitting the HARQ-ACK; and

[44] when the UE only receives the PDCCH of downlink subframe whose DAI is equal to 1, and the downlink subframe has implicit resources, the UE transmits the HARQ-ACK on the implicit resources by using the PUCCH format 1a/1b. If the downlink subframe has no implicit resources, the UE transmits the HARQ-ACK by using the PUCCH format 3 on the PUCCH format 3 resources obtained according to the high-layer signaling. When the UE receives the PDCCH of downlink subframe whose DAI is unequal to 1, the UE transmits the HARQ-ACK by using the PUCCH format 3 on the PUCCH format 3 resources obtained according to the ARIs in the PDCCH.

[45] Preferably, the HARQ-ACK is transmitted by using PUCCH format 1b with a channel selection.

[46] In this case, a preferred method of determining PUCCH resources and PUCCH format used for HARQ-ACK transmission includes:

[47] TPC element in a PDCCH on downlink subframes having implicit resources are used as a power control command of the PUCCH transmitting the HARQ-ACK, and TPC element in a PDCCH on downlink subframes having no implicit resources are used as ARIs, which indicate PUCCH format 1a/1b resources for transmitting the HARQ-ACK; and

[48] the UE transmits the HARQ-ACK by using the PUCCH format 1b with the channel selection on the implicit resources or the PUCCH format 1a/1b resources obtained according to the ARIs in the PDCCH.

[49] Another preferred method of determining PUCCH resources and PUCCH format used for HARQ-ACK transmission includes:

[50] TPC element in a PDCCH on all downlink subframes in a bundling window are used as a power control command of the PUCCH transmitting the HARQ-ACK; the UE obtains PUCCH format 1a/1b resource for each downlink subframe having no implicit resources according to high-layer signaling; and

[51] the UE transmits the HARQ-ACK by using the PUCCH format 1b with the channel selection on the implicit resources or the PUCCH format 1a/1b resources obtained according to the high-layer signaling.

[52] Another preferred method of determining PUCCH resources and PUCCH format used for HARQ-ACK transmission includes:

[53] TPC element in a PDCCH on all downlink subframes in a bundling window are used as ARIs, which indicate PUCCH format 1a/1b resources for transmitting the HARQ-ACK, and a power control command of PDCCH format 3/3A is used to implement the power control of the PUCCH transmitting the HARQ-ACK; and

[54] the UE transmits the HARQ-ACK by using the PUCCH format 1b with the channel selection on the implicit resources or the PUCCH format 1a/1b resources obtained according to the ARIs in the PDCCH.

[55] As can be seen from the above solution, the HARQ-ACK transmission method in the traffic adaptive TDD system provided by the present application discloses the PUCCH resource mapping method and the method of determining the PUCCH format used for HARQ-ACK transmission, thereby dynamically adjusting the assigned PUCCH resources according to actual uplink and downlink configuration when the uplink and downlink configuration changes dynamically. Moreover, the existent PUCCH resources can be fully utilized, thereby effectively saving the physical resources of uplink subframes.

Brief Description of Drawings

[56] Figure 1 is a schematic diagram illustrating the frame structure in a LTE TDD system.

[57] Figure 2 is a schematic diagram illustrating problems in the prior art.

[58] Figure 3 is a flowchart illustrating a HARQ-ACK transmission method in a traffic adaptive TDD system according to the present application.

[59] Figure 4 is a schematic diagram of obtaining resources and format used for HARQ-ACK transmission according to a first embodiment of the present application.

[60] Figure 5 is a schematic diagram of obtaining resources and format used for HARQ-ACK transmission according to a second embodiment of the present application.

[61] Figure 6 is a schematic diagram of obtaining resources and format used for HARQ-ACK transmission according to a third embodiment of the present application.

[62] Figure 7 is a schematic diagram of obtaining resources and format used for HARQ-ACK transmission according to a fourth embodiment of the present application.

[63] Figure 8 is a schematic diagram of obtaining resources and format used for HARQ-ACK transmission according to the fourth embodiment of the present application.

[64] Figure 9 is a schematic diagram of obtaining resources and format used for HARQ-ACK transmission according to a fifth embodiment of the present application.

[65] Figure 10 is a schematic diagram of obtaining resources and format used for HARQ-ACK transmission according to a sixth embodiment of the present application.

[66] Figure 11 is a schematic diagram of obtaining resources and format used for HARQ-ACK transmission according to a seventh embodiment of the present application.

[67] Figure 12 is a schematic diagram of obtaining resources and format used for HARQ-ACK transmission according to an eighth embodiment of the present application.

[68] Figure 13 is a block diagram of an user equipment in accordance with en embodiment of the present invention.

Mode for the Invention

[69] In order to make the object, technical solution and merits of the present application clearer, the present application will be illustrated in detail hereinafter with reference to the accompanying drawings and specific embodiments.

[70] The concept of PUCCH implicit resources is illustrated herein. In LTE Release8, for a PDSCH scheduled by a PDCCH on a downlink subframe, the HARQ-ACK of the PDSCH is transmitted on corresponding uplink subframes. The PUCCH format 1a/1b resources for transmitting the HARQ-ACK are obtained through scheduling the PDCCH of the PDSCH, i.e., the PUCCH format 1a/1b resources are obtained according to the lowest CCE index of the PDCCH. Herein, the PUCCH format 1a/1b resources obtained according to the lowest CCE index of the PDCCH are called implicit resources.

[71] **Figure 3** is a flowchart illustrating a HARQ-ACK transmission method in a traffic adaptive TDD system according to the present application.

[72] In block 301, UE receives SIB1 and obtains TDD uplink and downlink configuration that is indicated in the current system information and does not support dynamical traffic adaptive UE, to obtain the implicit resources of PUCCH.

[73] According to this block, the UE can obtain the implicit resources of PUCCH according to the TDD uplink and downlink configuration that does not support the dynamical traffic adaptive UE.

[74] In block 302, the UE obtains a HARQ-ACK timing supporting the dynamical traffic adaptive UE.

[75] For example, through receiving high-layer signaling, the UE may obtain the HARQ-ACK timing supporting the dynamical traffic adaptive UE.

[76] In block 303, according to the HARQ-ACK timing, the UE transmits HARQ-ACK by using a specific PUCCH format on PUCCH resources determined according to a specific method.

[77] Preferred methods of determining the PUCCH resources and PUCCH format used for the HARQ-ACK transmission in block 303 are illustrated hereinafter.

[78] 1) When the HARQ-ACK is transmitted by using PUCCH format 3, the present application provides five preferred methods.

[79] A first method of determining the PUCCH resources and PUCCH format used for the HARQ-ACK transmission includes:

[80] Transmit Power Control (TPC) element in a PDCCH that schedules a PDSCH on all downlink subframes in a HARQ-ACK bundling window are all used as HARQ-ACK Resource Indicators (ARIs), which indicate PUCCH format 3 resources for transmitting the HARQ-ACK for the UE;

[81] the UE transmits the HARQ-ACK on the PUCCH format 3 resources indicated by the ARIs; and

[82] a power control command of PUCCH format 3/3A is used to implement the power control of the PUCCH transmitting the HARQ-ACK.

[83] A first embodiment is illustrated hereinafter.

[84] Suppose the TDD uplink and downlink configuration that is indicated by the current system information obtained by the UE from the SIB1 and does not support the dynamical traffic adaptive UE is TDD uplink and downlink configuration 1, the TDD uplink and downlink configuration used by the HARQ-ACK timing that is obtained by the UE through receiving the high-layer signaling and supports the dynamical traffic adaptive UE is TDD uplink and downlink configuration 2, and the TPC element in the PDCCH that schedules the PDSCH on downlink subframes 4, 5, 6 and 8 in the HARQ-ACK bundling window transmitting the HARQ-ACK on uplink subframe 2 are all

used as ARIs, which indicate the PUCCH format 3 resources for transmitting the HARQ-ACK.

[85] And thus, when the UE receives the PDCCH from one or more than one of downlink subframes 4, 5, 6 and 8, the TPC element in the PDCCH are all used as the ARIs. That is to say, when the UE receives the PDCCH from one or more than one of downlink subframes 4, 5, 6 and 8, the PUCCH format 3 resources indicated by the ARIs in the PDCCH are used to transmit the HARQ-ACK, as shown in **Figure 4**.

[86] A second method of determining the PUCCH resources and PUCCH format used for the HARQ-ACK transmission includes:

[87] when a downlink subframe whose Downlink Assignment Index (DAI) is equal to 1 in the HARQ-ACK bundling window has implicit resources, the TPC element in the PDCCH on the downlink subframe is used as a TPC command, which is taken as a power control command of the PUCCH transmitting the HARQ-ACK. Besides, the TPC element in the PDCCH on other downlink subframes are used as the ARIs, which indicate the PUCCH format 3 resources for transmitting the HARQ-ACK; and

[88] when the UE only receives the PDCCH of downlink subframe whose DAI is equal to 1 and the downlink subframe has implicit resources, the UE transmits the HARQ-ACK on the implicit resources by using PUCCH format 1a/1b. If the downlink subframe has no implicit resources, the UE transmits the HARQ-ACK by using PUCCH format 3 on the PUCCH format 3 resources obtained according to the ARI in the PDCCH. When the UE receives the PDCCH of downlink subframe whose DAI is unequal to 1, the UE transmits the HARQ-ACK by using the PUCCH format 3 on the PUCCH format 3 resources obtained according to the ARI in the PDCCH.

[89] A second embodiment is illustrated hereinafter.

[90] Suppose the TDD uplink and downlink configuration that is indicated by the current system information obtained by the UE from the SIB1 and does not support the dynamical traffic adaptive UE is TDD uplink and downlink configuration 1, and the TDD uplink and downlink configuration used by the HARQ-ACK timing that is obtained by the UE through receiving the high-layer signaling and supports the dynamical traffic adaptive UE is TDD uplink and downlink configuration 2. Suppose the PDCCH scheduling the PDSCH is detected only on the downlink subframe 5 and the DAI in the PDCCH is equal to 1, according to the TDD uplink and downlink configuration 1 that does not support the dynamical traffic adaptive UE, the downlink subframe 5 has implicit resources on the uplink subframe 2. The TPC element in the PDCCH on the downlink subframe 5 is used as a TPC command, and the HARQ-ACK is transmitted on the implicit resources of the downlink subframe 5 by using the PUCCH format 1a/1b, as shown in **Figure 5**.

[91] A third method of determining the PUCCH resources and PUCCH format used for

the HARQ-ACK transmission includes:

[92] the UE obtains the PUCCH format 1a/1b resource corresponding to each bundling window through the high-layer signaling, the TPC element in the PDCCH on the downlink subframes whose DAI is unequal to 1 are used as the ARIs, which indicates the PUCCH format 3 resources for transmitting the HARQ-ACK. The TPC element in the PDCCH on the downlink subframes whose DAI is equal to 1 are used as a power control command of PUCCH transmitting the HARQ-ACK; and

[93] when the UE only receives the PDCCH of downlink subframe whose DAI is equal to 1, the UE transmits the HARQ-ACK by using the PUCCH format 1a/1b on the PUCCH format 1a/1b resources obtained according to the high-layer signaling, and when the UE receives the PDCCH of downlink subframe whose DAI is unequal to 1, the UE transmits the HARQ-ACK by using the PUCCH format 3 on the PUCCH format 3 resources obtained according to the ARIs in the PDCCH.

[94] A third embodiment is illustrated hereinafter.

[95] Suppose the TDD uplink and downlink configuration that is indicated by the current system information obtained by the UE from the SIB1 and does not support the dynamical traffic adaptive UE is TDD uplink and downlink configuration 1, and the TDD uplink and downlink configuration used by the HARQ-ACK timing that is obtained by the UE through receiving the high-layer signaling and supports the dynamical traffic adaptive UE is TDD uplink and downlink configuration 2. Suppose the PDCCH scheduling the PDSCH is detected only on the downlink subframe 4 and the DAI in the PDCCH is equal to 1, according to the TDD uplink and downlink configuration 1 that does not support the dynamical traffic adaptive UE, the TPC element in the PDCCH on the downlink subframe 4 is used as a TPC command, and the HARQ-ACK is transmitted by using the PUCCH format 1a/1b on the PUCCH format 1a/1b resources obtained according to the high-layer signaling, as shown in **Figure 6.**

[96] A fourth method of determining the PUCCH resources and PUCCH format used for the HARQ-ACK transmission includes:

[97] the UE obtains the PUCCH format 1a/1b resource corresponding to each bundling window through the high-layer signaling, the TPC element in the PDCCH on the downlink subframes whose DAI is unequal to 1 are used as the ARIs, which indicate the PUCCH format 3 resources for transmitting the HARQ-ACK, and the TPC element in the PDCCH on the downlink subframes whose DAI is equal to 1 are used as a power control command of the PUCCH transmitting the HARQ-ACK; and

[98] when the UE only receives the PDCCH of downlink subframe whose DAI is equal to 1, and the downlink subframe has implicit resources, the UE transmits the HARQ-ACK on the implicit resources by using the PUCCH format 1a/1b. If the downlink subframe has no implicit resources, the UE transmits the HARQ-ACK by using the

PUCCH format 1a/1b on the PUCCH format 1a/1b resources obtained according to the high-layer signaling. When the UE receives the PDCCH of downlink subframe whose DAI is unequal to 1, the UE transmits the HARQ-ACK by using the PUCCH format 3 on the PUCCH format 3 resources obtained according to the ARIs in the PDCCH.

[99] A fourth embodiment is illustrated hereinafter.

[100] Suppose the TDD uplink and downlink configuration that is indicated by the current system information obtained by the UE from the SIB1 and does not support the dynamical traffic adaptive UE is TDD uplink and downlink configuration 1, and the TDD uplink and downlink configuration used by the HARQ-ACK timing that is obtained by the UE through receiving the high-layer signaling and supports the dynamical traffic adaptive UE is TDD uplink and downlink configuration 2.

[101] Suppose the PDCCH scheduling the PDSCH is detected only on the downlink subframe 5 and the DAI in the PDCCH is equal to 1, according to the TDD uplink and downlink configuration 1 that does not support the dynamical traffic adaptive UE, the downlink subframe 5 has implicit resources on the uplink subframe 2, the TPC element in the PDCCH on the downlink subframe 5 is used as a TPC command, and the HARQ-ACK is transmitted on the implicit resources of the downlink subframe 5 by using the PUCCH format 1a/1b, as shown in **Figure 7**.

[102] Suppose the PDCCH scheduling the PDSCH is detected only on the downlink subframe 4 and the DAI in the PDCCH is equal to 1, according to the TDD uplink and downlink configuration 1 that does not support the dynamical traffic adaptive UE, the downlink subframe 4 has no implicit resources on the uplink subframe 2, the TPC element in the PDCCH on the downlink subframe 4 is used as a TPC command, and the HARQ-ACK is transmitted by using the PUCCH format 1a/1b on the PUCCH format 1a/1b resources obtained according to the high-layer signaling, as shown in **Figure 8**.

[103] A fifth method of determining the PUCCH resources and PUCCH format used for the HARQ-ACK transmission includes:

[104] the TPC element in the PDCCH on downlink subframes having implicit resources are used as a power control command of the PUCCH transmitting the HARQ-ACK, and the TPC element in the PDCCH on downlink subframes having no implicit resources are used as the ARIs, which indicate the PUCCH format 3 resources for transmitting the HARQ-ACK; and

[105] when the UE only receives the PDCCH having implicit resources, the UE transmits the HARQ-ACK on the implicit resources by using the PUCCH format 1b or PUCCH format 1a/1b with a channel selection; when the UE receives the PDCCH having no implicit resources, the UE transmits the HARQ-ACK by using the PUCCH format 3 on the PUCCH format 3 resources obtained according to the ARIs in the PDCCH.

[106] A fifth embodiment is illustrated hereinafter.

[107] Suppose the TDD uplink and downlink configuration that is indicated by the current system information obtained by the UE from the SIB1 and does not support the dynamical traffic adaptive UE is TDD uplink and downlink configuration 1, and the TDD uplink and downlink configuration used by the HARQ-ACK timing that is obtained by the UE through receiving the high-layer signaling and supports the dynamical traffic adaptive UE is TDD uplink and downlink configuration 2. Suppose the PDCCH scheduling the PDSCH is detected on the downlink subframes 5 and 6, according to the TDD uplink and downlink configuration 1 that does not support the dynamical traffic adaptive UE, the downlink subframes 5 and 6 have implicit resources on the uplink subframe 2, the TPC element in the PDCCH on the downlink subframes 5 and 6 are used as a TPC command, and the HARQ-ACK is transmitted on the implicit resources of the downlink subframes 5 and 6 by using the PUCCH format 1b with the channel selection, as shown in **Figure 9**.

[108] 2) When the HARQ-ACK is transmitted by using the PUCCH format 1b with the channel selection, the present application provides three preferred methods.

[109] A sixth method of determining the PUCCH resources and PUCCH format used for the HARQ-ACK transmission includes:

[110] the TPC element in the PDCCH on the downlink subframes having implicit resources are used as a power control command of the PUCCH transmitting the HARQ-ACK, and the TPC element in the PDCCH on the downlink subframes having no implicit resources are used as the ARIs, which indicate the PUCCH format 1a/1b resources for transmitting the HARQ-ACK; and

[111] the UE transmits the HARQ-ACK by using the PUCCH format 1b with the channel selection on the implicit resources or the PUCCH format 1a/1b resources obtained according to the ARIs in the PDCCH.

[112] A sixth embodiment is illustrated hereinafter.

[113] Suppose the TDD uplink and downlink configuration that is indicated by the current system information obtained by the UE from the SIB1 and does not support the dynamical traffic adaptive UE is TDD uplink and downlink configuration 1, and the TDD uplink and downlink configuration used by the HARQ-ACK timing that is obtained by the UE through receiving the high-layer signaling and supports the dynamical traffic adaptive UE is TDD uplink and downlink configuration 2. According to the TDD uplink and downlink configuration 1 that does not support the dynamical traffic adaptive UE, the downlink subframes 5 and 6 have implicit resources on the uplink subframe 2, and the TPC element in the PDCCH on the downlink subframes 5 and 6 are used as a TPC command. According to the TDD uplink and downlink configuration 1 that does not support the dynamical traffic adaptive UE, the downlink

subframes 4 and 8 have no implicit resources on the uplink subframe 2, and the TPC element in the PDCCH on the downlink subframes 4 and 8 are used as the ARIs, which indicate the PUCCH format 1a/1b resources, as shown in **Figure 10**.

[114] A seventh method of determining the PUCCH resources and PUCCH format used for the HARQ-ACK transmission includes:

[115] the TPC element in the PDCCH on all downlink subframes in the bundling window are used as a power control command of the PUCCH transmitting the HARQ-ACK; the UE obtains PUCCH format 1a/1b resources for each subframe having no PUCCH format 1a/1b resources according to the high-layer signaling; and

[116] the UE transmits the HARQ-ACK by using the PUCCH format 1b with the channel selection on the implicit resources or the PUCCH format 1a/1b resources obtained according to the high-layer signaling.

[117] A seventh embodiment is illustrated hereinafter.

[118] Suppose the TDD uplink and downlink configuration that is indicated by the current system information obtained by the UE from the SIB1 and does not support the dynamical traffic adaptive UE is TDD uplink and downlink configuration 1, and the TDD uplink and downlink configuration used by the HARQ-ACK timing that is obtained by the UE through receiving the high-layer signaling and supports the dynamical traffic adaptive UE is TDD uplink and downlink configuration 2. The TPC element in the PDCCH on the downlink subframes 4, 5, 6 and 8 are used as a TPC command. According to the TDD uplink and downlink configuration 1 that does not support the dynamical traffic adaptive UE, the downlink subframes 5 and 6 have implicit resources on the uplink subframe 2, the downlink subframes 4 and 8 have no implicit resources on the uplink subframe 2, and the UE obtains the PUCCH format 1a/1b resources of the subframes 4 and 8 according to the high-layer signaling, as shown in **Figure 11**.

[119] An eighth method of determining the PUCCH resources and PUCCH format used for the HARQ-ACK transmission includes:

[120] the TPC element in the PDCCH on all downlink subframes in the bundling window are used as the ARIs, which indicates the PUCCH format 1a/1b resources for transmitting the HARQ-ACK, and a power control command of PDCCH format 3/3A is used to implement the power control of the PUCCH transmitting the HARQ-ACK; and

[121] the UE transmits the HARQ-ACK by using the PUCCH format 1b with the channel selection on the PUCCH format 1a/1b resources obtained according to the ARIs in the PDCCH.

[122] An eighth embodiment is illustrated hereinafter.

[123] Suppose the TDD uplink and downlink configuration that is indicated by the current

system information obtained by the UE from the SIB1 and does not support the dynamical traffic adaptive UE is TDD uplink and downlink configuration 1, and the TDD uplink and downlink configuration used by the HARQ-ACK timing that is obtained by the UE through receiving the high-layer signaling and supports the dynamical traffic adaptive UE is TDD uplink and downlink configuration 2. The TPC element in the PDCCH on the downlink subframes 4, 5, 6 and 8 are used as the ARIs, which indicate the PUCCH format 1a/1b resources. The UE transmits the HARQ-ACK by using the PUCCH format 1b with the channel selection on the PUCCH format 1a/1b resources obtained according to the ARIs in the PDCCH, and the power control command of PUCCH format 3/3A is used to implement the power control of the PUCCH transmitting the HARQ-ACK, as shown in **Figure 12.**

[124] An ninth method of determining the PUCCH resources and PUCCH format used for the HARQ-ACK transmission includes:

[125] the UE obtains the PUCCH format 3 resource corresponding to each bundling window through the high-layer signaling, and the TPC element in the PDCCH on all downlink subframes within each bundling window are used as a power control command of the PUCCH transmitting the HARQ-ACK; and

[126] when the UE only receives the PDCCH of downlink subframe whose DAI is equal to 1, and the downlink subframe has implicit resources, the UE transmits the HARQ-ACK on the implicit resources by using the PUCCH format 1a/1b. If the downlink subframe has no implicit resources, the UE transmits the HARQ-ACK by using the PUCCH format 3 on the PUCCH format 3 resources obtained according to the high-layer signaling. When the UE receives the PDCCH of downlink subframe whose DAI is unequal to 1, the UE transmits the HARQ-ACK by using the PUCCH format 3 on the PUCCH format 3 resources obtained according to the ARIs in the PDCCH.

[127] An tenth method of determining the PUCCH resources and PUCCH format used for the HARQ-ACK transmission includes:

[128] the UE obtains the PUCCH format 3 resource corresponding to each bundling window through the high-layer signaling, and the TPC element in the PDCCH on the downlink subframes whose DAI is unequal to 1 are used as a power control command of the PUCCH transmitting the HARQ-ACK; and

[129] when the UE only receives the PDCCH of downlink subframe whose DAI is equal to 1, and the downlink subframe has implicit resources, the UE transmits the HARQ-ACK on the implicit resources by using the PUCCH format 1a/1b. If the downlink subframe has no implicit resources, the UE transmits the HARQ-ACK by using the PUCCH format 3 on the PUCCH format 3 resources obtained according to the high-layer signaling. When the UE receives the PDCCH of downlink subframe whose DAI is unequal to 1, the UE transmits the HARQ-ACK by using the PUCCH format 3 on

the PUCCH format 3 resources obtained according to the ARIs in the PDCCH.

[130] **Figure 13** is a block diagram of an UE in accordance with an embodiment of the present invention.

[131] Referring to Figure 13, the UE 1300 is configured to comprise a transmitter 1310, a receiver 1320, and a controller 1330. The transmitter 1310 and the receiver 1320 respectively include a transmission circuitry and a reception circuitry for communicating with the network entity such as the base station under the control of the controller 1330 according to an exemplary embodiment of the present invention. The controller 1330 controls a reception of HARQ-ACK feedback information by the receiver 1320, and a transmission of the HARQ-ACK by the transmitter 1310.

[132] Similarly, the base station may be configured to comprise a transmitter, a receiver, and a controller, and performing a reverse operation of the UE. Specifically, the controller generates the SIB according TDD uplink and downlink configuration, and control a HARQ-ACK timing. The transmitter of the base station transmits the SIB to the UE and the receiver receives HARQ-ACK from the UE.

[133] The foregoing is only preferred embodiments of the present application and is not used to limit the protection scope of the present application. Any modification, equivalent substitution and improvement without departing from the spirit and principle of the present application are within the protection scope of the present application.

Claims

[Claim 1] A method for transmitting Hybrid Automatic Repeat reQuest-Acknowledge (HARQ-ACK) feedback information in a traffic adaptive Time Division Duplexing (TDD) system, the method comprising:
receiving, by User Equipment (UE), a System Information Block (SIB), and obtaining TDD uplink and downlink configuration that is indicated by current system information and does not support traffic adaptive UE, to learn implicit resources of Physical Uplink Control Channel (PUCCH);
obtaining, by the UE, a HARQ-ACK timing supporting the traffic adaptive UE; and
transmitting, by the UE according to the obtained HARQ-ACK timing, HARQ-ACK on determined PUCCH resources by using a determined PUCCH format.

[Claim 2] The method of claim 1, wherein the HARQ-ACK is transmitted by using PUCCH format 3.

[Claim 3] The method of claim 2, wherein
a method of determining the PUCCH resources and the PUCCH format used for the HARQ-ACK transmission comprises that:
Transmit Power Control (TPC) elements in a Physical Downlink Control Channel (PDCCH) scheduling a Physical Downlink Shared Channel (PDSCH) on all downlink subframes in a HARQ-ACK bundling window are used as HARQ-ACK Resource Indicators (ARIs), which indicate a PUCCH format 3 resource for transmitting the HARQ-ACK; and a power control command of PDCCH format 3/3A is used to implement the power control of the PUCCH transmitting the HARQ-ACK; and
the UE transmits the HARQ-ACK on the PUCCH format 3 resource indicated by the ARIs.

[Claim 4] The method of claim 2, wherein
a method of determining the PUCCH resources and the PUCCH format used for the HARQ-ACK transmission comprises that:
TPC elements in a PDCCH on downlink subframes in a bundling window are used as a power control command of the PUCCH transmitting the HARQ-ACK, wherein the downlink subframe's Downlink Assignment Index (DAI) is equal to 1 and the downlink subframe has implicit resources, and TPC element in a PDCCH on the

other downlink subframes are used as ARIs which indicate PUCCH format 3 resources for transmitting the HARQ-ACK;

when the UE only receives the PDCCH of downlink subframe whose DAI is equal to 1, and the downlink subframe has implicit resources, the UE transmits the HARQ-ACK on the implicit resources by using PUCCH format 1a/1b; and

when the UE receives the PDCCH of downlink subframes whose DAI is unequal to 1 or receives the PDCCH of downlink subframe whose DAI is equal to 1 and that has no implicit resources, the UE transmits the HARQ-ACK by using the PUCCH format 3 on the PUCCH format 3 resources obtained according to the ARIs in the PDCCH.

[Claim 5] The method of claim 2, wherein

a method of determining the PUCCH resources and the PUCCH format used for the HARQ-ACK transmission comprises that:

the UE obtains PUCCH format 1a/1b resources corresponding to each bundling window through high-layer signaling, TPC element in a PDCCH on downlink subframes whose DAI is unequal to 1 are used as ARIs, which indicate the PUCCH format 3 resources for transmitting the HARQ-ACK, and TPC element in a PDCCH on downlink subframe whose DAI is equal to 1 are used as a power control command of the PUCCH transmitting the HARQ-ACK; and

when the UE only receives the PDCCH of downlink subframe whose DAI is equal to 1, the UE transmits the HARQ-ACK by using the PUCCH format 1a/1b on the PUCCH format 1a/1b resources obtained according to high-layer signaling; when the UE receives the PDCCH of downlink subframes whose DAI is unequal to 1, the UE transmits the HARQ-ACK by using the PUCCH format 3 on the PUCCH format 3 resources obtained according to the ARIs in the PDCCH.

[Claim 6] The method of claim 2, wherein

a method of determining the PUCCH resources and the PUCCH format used for the HARQ-ACK transmission comprises that:

the UE obtains PUCCH format 1a/1b resources corresponding to each bundling window through high-layer signaling, TPC element in a PDCCH on downlink subframes whose DAI is unequal to 1 are used as ARIs, which indicate the PUCCH format 3 resources for transmitting the HARQ-ACK, and TPC element in a PDCCH on downlink subframe whose DAI is equal to 1 is used as a power control command of the PUCCH transmitting the HARQ-ACK; and

when the UE only receives the PDCCH of downlink subframe whose DAI is equal to 1, and the downlink subframe has implicit resources, the UE transmits the HARQ-ACK on the implicit resources by using the PUCCH format 1a/1b; when the UE receives the PDCCH of downlink subframe whose DAI is equal to 1, and the downlink subframe has no implicit resources, the UE transmits the HARQ-ACK by using the PUCCH format 1a/1b on the PUCCH format 1a/1b resources obtained according to the high-layer signaling; when the UE receives the PDCCH of downlink subframes whose DAI is unequal to 1, the UE transmits the HARQ-ACK by using the PUCCH format 3 on the PUCCH format 3 resources obtained according to the ARIs in the PDCCH.

[Claim 7] The method of claim 2, wherein

a method of determining the PUCCH resources and the PUCCH format used for the HARQ-ACK transmission comprises that:

TPC element in a PDCCH on downlink subframes having implicit resources are used as a power control command of the PUCCH transmitting the HARQ-ACK, and TPC element in a PDCCH on downlink subframes having no implicit resources are used as ARIs, which indicate the PUCCH format 3 resources for transmitting the HARQ-ACK; and

when the UE receives the PDCCH of downlink subframes having the implicit resources, the UE transmits the HARQ-ACK on the implicit resources by using PUCCH format 1b or PUCCH format 1a/1b with a channel selection; when the UE receives the PDCCH of downlink subframes having no implicit resources, the UE transmits the HARQ-ACK by using the PUCCH format 3 on the PUCCH format 3 resources obtained according to the ARIs in the PDCCH.

[Claim 8] The method of claim 2, wherein

a method of determining the PUCCH resources and PUCCH format used for the HARQ-ACK transmission includes:

the UE obtains the PUCCH format 3 resource corresponding to each bundling window through the high-layer signaling, and the TPC element in the PDCCH on all downlink subframes within each bundling window are used as a power control command of the PUCCH transmitting the HARQ-ACK; and

when the UE only receives the PDCCH of downlink subframe whose DAI is equal to 1, and the downlink subframe has implicit resources,

the UE transmits the HARQ-ACK on the implicit resources by using the PUCCH format 1a/1b. If the downlink subframe has no implicit resources, the UE transmits the HARQ-ACK by using the PUCCH format 3 on the PUCCH format 3 resources obtained according to the high-layer signaling. When the UE receives the PDCCH of downlink subframe whose DAI is unequal to 1, the UE transmits the HARQ-ACK by using the PUCCH format 3 on the PUCCH format 3 resources obtained according to the ARIs in the PDCCH.

[Claim 9] The method of claim 2, wherein

a method of determining the PUCCH resources and PUCCH format used for the HARQ-ACK transmission includes:

the UE obtains the PUCCH format 3 resource corresponding to each bundling window through the high-layer signaling, and the TPC element in the PDCCH on the downlink subframes whose DAI is unequal to 1 are used as a power control command of the PUCCH transmitting the HARQ-ACK; and

when the UE only receives the PDCCH of downlink subframe whose DAI is equal to 1, and the downlink subframe has implicit resources, the UE transmits the HARQ-ACK on the implicit resources by using the PUCCH format 1a/1b. If the downlink subframe has no implicit resources, the UE transmits the HARQ-ACK by using the PUCCH format 3 on the PUCCH format 3 resources obtained according to the high-layer signaling. When the UE receives the PDCCH of downlink subframe whose DAI is unequal to 1, the UE transmits the HARQ-ACK by using the PUCCH format 3 on the PUCCH format 3 resources obtained according to the ARIs in the PDCCH.

[Claim 10] The method of claim 1, wherein the HARQ-ACK is transmitted by using PUCCH format 1b with a channel selection.

[Claim 11] The method of claim 10, wherein

a method of determining the PUCCH resources and the PUCCH format used for the HARQ-ACK transmission comprises that:

TPC element in a PDCCH on downlink subframes having implicit resources are used as a power control command of the PUCCH transmitting the HARQ-ACK, and TPC element in a PDCCH on downlink subframes having no implicit resources are used as ARIs, which indicate PUCCH format 1a/1b resources for transmitting the HARQ-ACK; and

the UE transmits the HARQ-ACK by using the PUCCH format 1b with

the channel selection on the implicit resources or the PUCCH format 1a/1b resources obtained according to the ARIs in the PDCCH.

[Claim 12] The method of claim 10, wherein
a method of determining the PUCCH resources and the PUCCH format used for the HARQ-ACK transmission comprises that:
TPC element in a PDCCH on all downlink subframes in a bundling window are used as a power control command of the PUCCH transmitting the HARQ-ACK; the UE obtains PUCCH format 1a/1b resource for each downlink subframe having no implicit resources according to high-layer signaling; and
the UE transmits the HARQ-ACK by using the PUCCH format 1b with the channel selection on the implicit resources or the PUCCH format 1a/1b resources obtained according to the high-layer signaling.

[Claim 13] The method of claim 10, wherein
a method of determining the PUCCH resources and the PUCCH format used for the HARQ-ACK transmission comprises that:
TPC elements in a PDCCH on all downlink subframes in a bundling window are used as ARIs, which indicate PUCCH format 1a/1b resources for transmitting the HARQ-ACK, and a power control command of PDCCH format 3/3A is used to implement the power control of the PUCCH transmitting the HARQ-ACK; and
the UE transmits the HARQ-ACK by using the PUCCH format 1b with the channel selection on the implicit resources or the PUCCH format 1a/1b resources obtained according to the ARIs in the PDCCH.

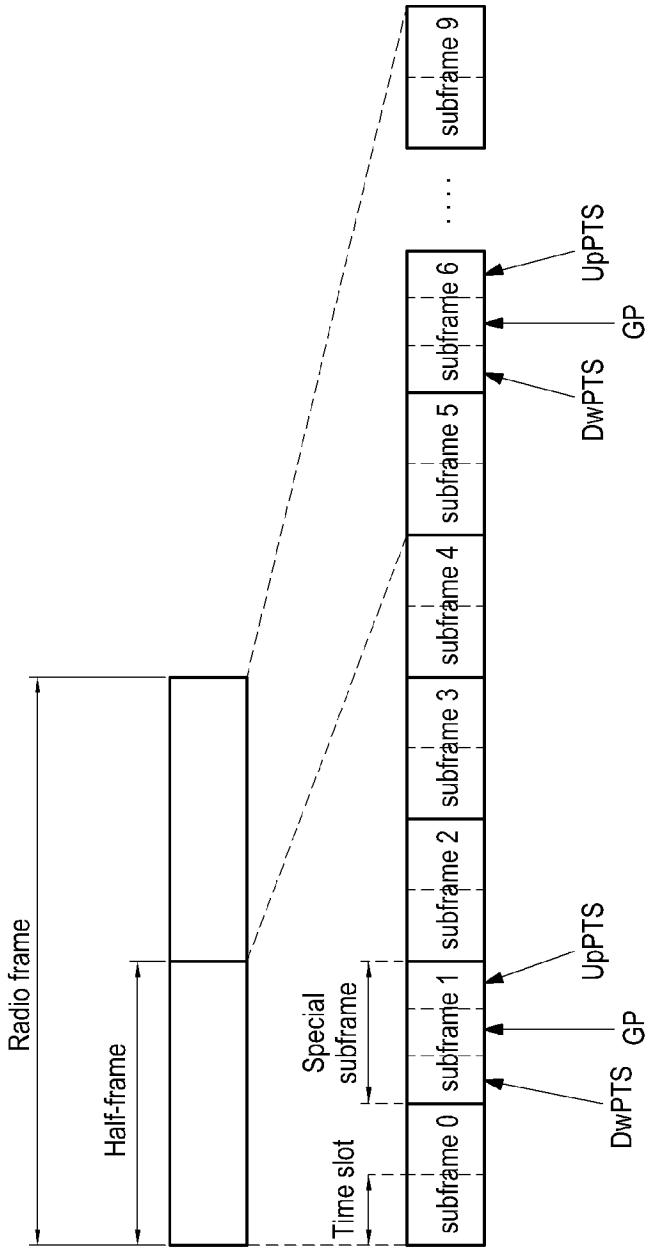
[Claim 14] An apparatus for transmitting Hybrid Automatic Repeat reQuest-Acknowledge (HARQ-ACK) feedback information in a traffic adaptive Time Division Duplexing (TDD) system, the apparatus comprising:
a receiver being arranged for receiving a System Information Block (SIB), and obtaining TDD uplink and downlink configuration that is indicated by current system information and does not support traffic adaptive UE, to learn implicit resources of Physical Uplink Control Channel (PUCCH);
a controller being arranged for obtaining a HARQ-ACK timing supporting the traffic adaptive UE; and
a transmitter being arranged for transmitting, according to the obtained HARQ-ACK timing, HARQ-ACK on determined PUCCH resources by using a determined PUCCH format.

[Claim 15] A method for receiving Hybrid Automatic Repeat reQuest-Ac-

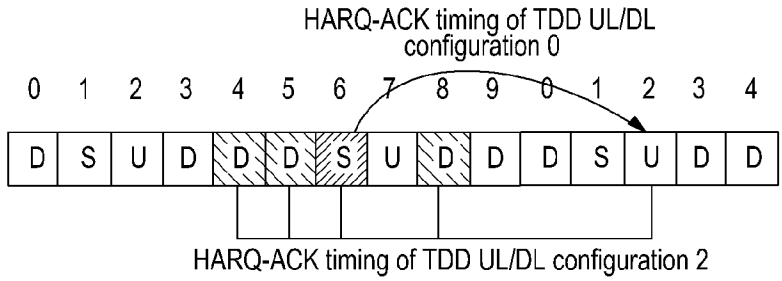
knowledge (HARQ-ACK) feedback information in a traffic adaptive Time Division Duplexing (TDD) system, the method comprising:
obtaining, by a base station (BS), a HARQ-ACK timing supporting a traffic adaptive UE;
transmitting, by the BS, a System Information Block (SIB), and obtaining TDD uplink and downlink configuration that is indicated by current system information and does not support the traffic adaptive UE, to learn implicit resources of Physical Uplink Control Channel (PUCCH); and
receiving, by the BS according to the obtained HARQ-ACK timing, HARQ-ACK on determined PUCCH resources by using a determined PUCCH format.

[Claim 16] An apparatus for receiving Hybrid Automatic Repeat reQuest-Acknowledge (HARQ-ACK) feedback information in a traffic adaptive Time Division Duplexing (TDD) system, the apparatus comprising:
a controller being arranged for obtaining a HARQ-ACK timing supporting a traffic adaptive UE;
a transmitter being arranged for transmitting a System Information Block (SIB), and obtaining TDD uplink and downlink configuration that is indicated by current system information and does not support the traffic adaptive UE, to learn implicit resources of Physical Uplink Control Channel (PUCCH); and
a receiver being arranged for receiving, according to the obtained HARQ-ACK timing, HARQ-ACK on determined PUCCH resources by using a determined PUCCH format.

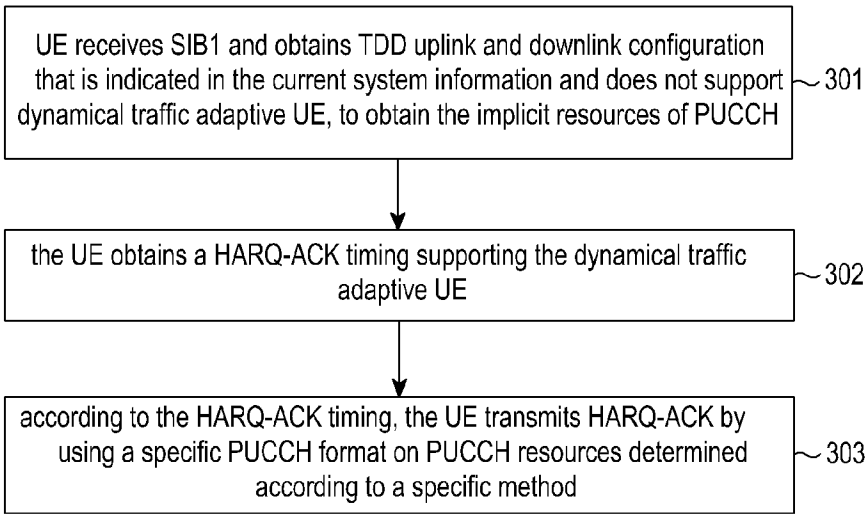
[Fig. 1]


subframe 9
subframe 6
subframe 5
subframe 4
subframe 3
subframe 2
subframe 1
subframe 0
UpPTS
GP
DwPTS
UpPTS
GP
DwPTS
Radio frame
Half-frame
Special subframe
Time slot

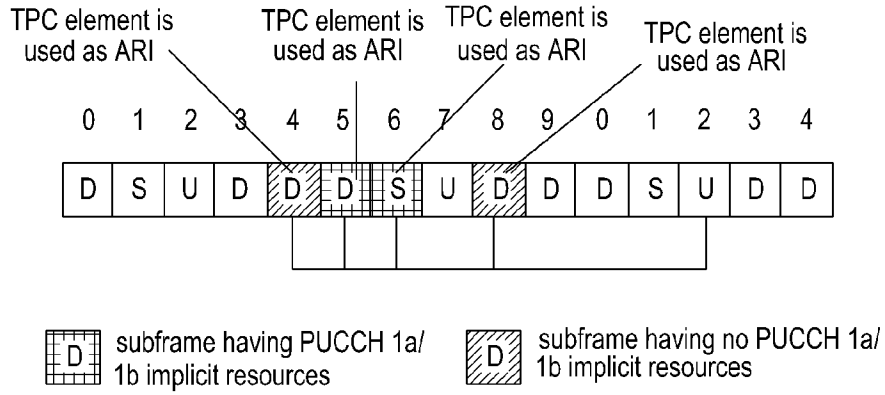
[Fig. 2]


HARQ-ACK timing of TDD UL/DL configuration 0
0 1 2 3 4 5 6 7 8 9 0 1 2 3 4
D S U D D D S U D D D S U D D
HARQ-ACK timing of TDD UL/DL configuration 2

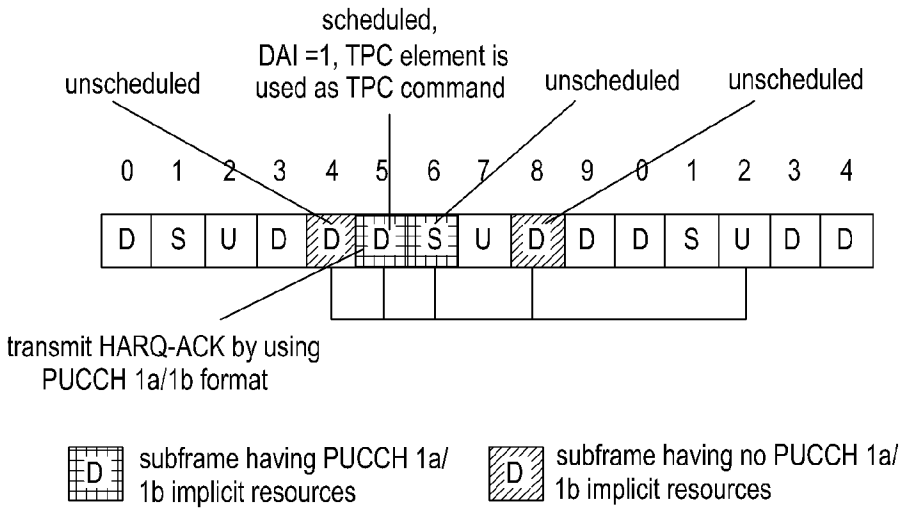
[Fig. 3]



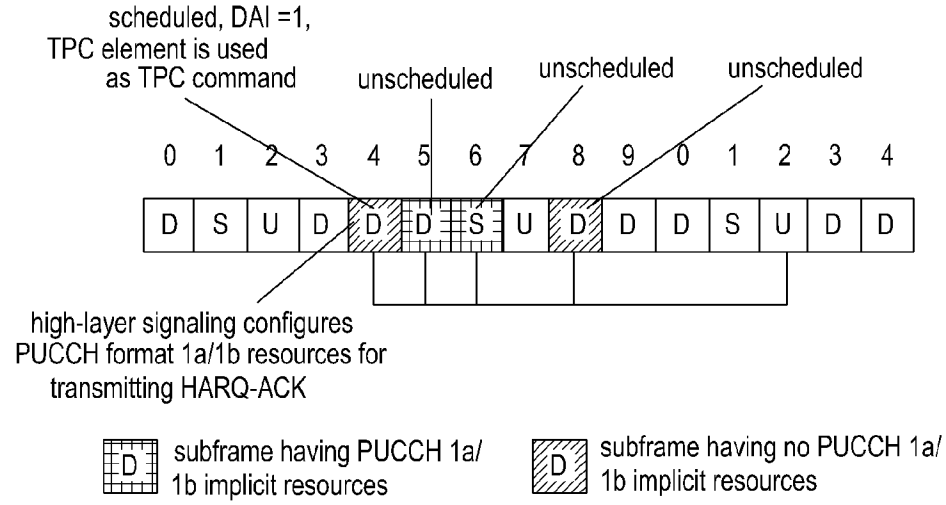
[Fig. 4]



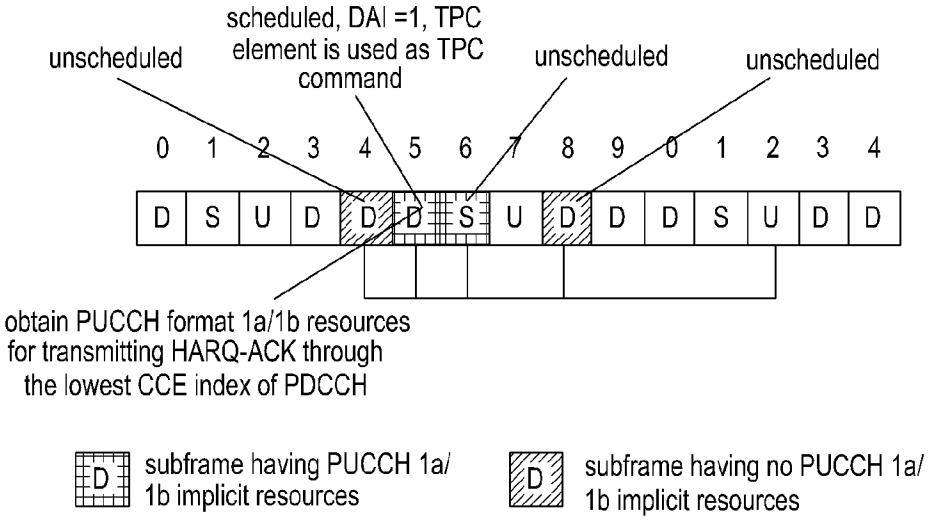
[Fig. 5]



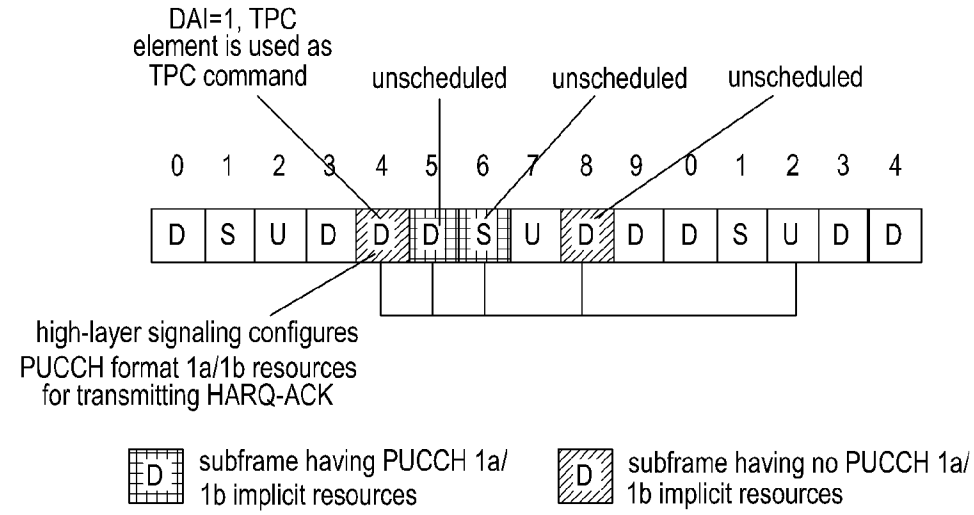
[Fig. 6]



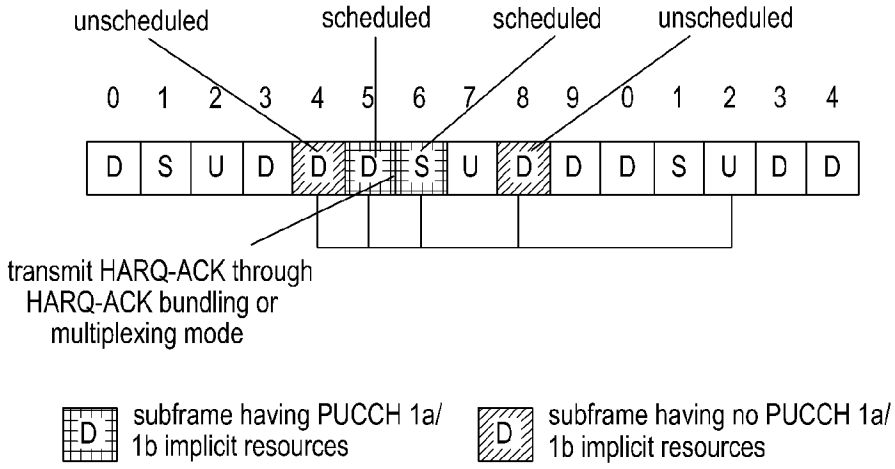
[Fig. 7]



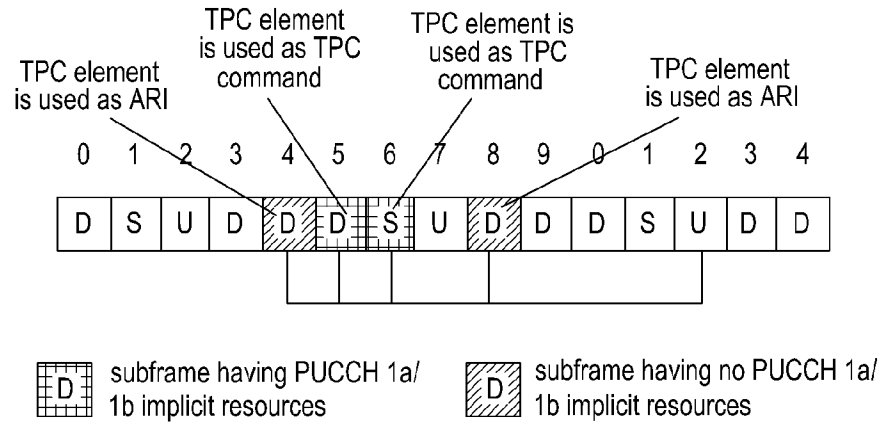
[Fig. 8]



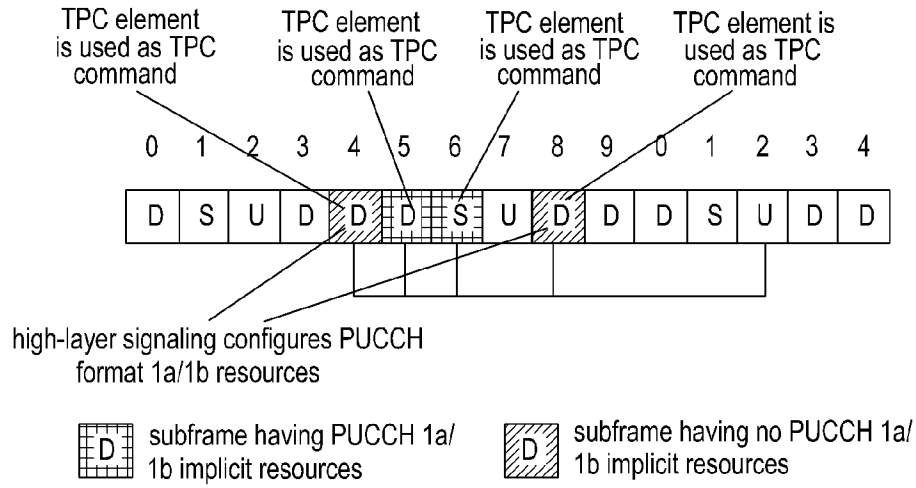
[Fig. 9]



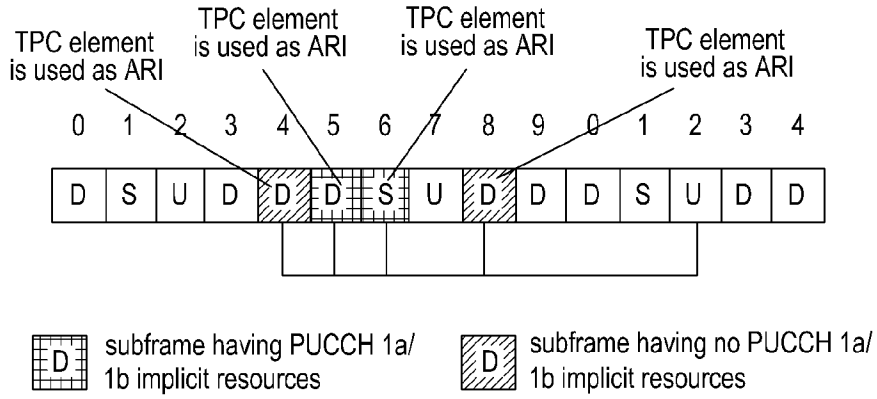
[Fig. 10]



[Fig. 11]



[Fig. 12]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TPC element is used as ARI
TPC element is used as ARI
TPC element is used as ARI
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D S U D D D S U D D D S U D D
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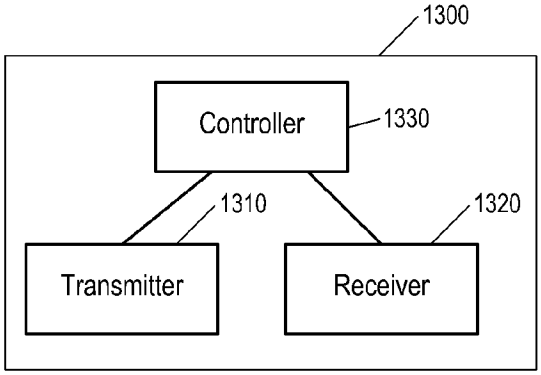
D subframe having no PUCCH 1a/ 1b implicit resources

[Fig. 13]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1310
1320
Transmitter
Receiver

INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2013/006750

A. CLASSIFICATION OF SUBJECT MATTER

H04L 1/18(2006.01)i, H04J 3/00(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H04L 1/18; H04Q 7/38; H04L 1/16; G08C 25/02; H04W 72/04; H04J 3/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Korean utility models and applications for utility models
Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
eKOMPASS(KIPO internal) & Keywords: HARQ-ACK, traffic adaptive, TDD, SIB(System Information Block), PUCCH, implicit resource

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2007-0245202 A1 (YI-CHUL KIM et al.) 18 October 2007 See paragraphs [0017]-[0021], [0079]-[0083]; claims 1-5; and figure 10b.	1-16
A	US 2012-0044889 A1 (YU-CHIH JEN) 23 February 2012 See paragraphs [0014]-[0015], [0030]-[0040]; and figures 4, 5.	1-16
A	US 2009-0257388 A1 (AAMOD D. KHANDEKAR et al.) 15 October 2009 See paragraphs [0046]-[0050], [0068]-[0069]; and figures 2, 8.	1-16
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A	JP 2006-319715 A (MATSUSHITA ELECTRIC IND CO., LTD.) 24 November 2006 See paragraphs [0007]-[0010]; and figures 3, 4.	1-16

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
19 November 2013 (19.11.2013)	**20 November 2013 (20.11.2013)**

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INTERNATIONAL SEARCH REPORT

Information on patent family members

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