

EXHIBIT B-6

Summary of Invalidity Analysis of U.S. Patent No. 10,181,931 in view of U.S. Patent Application Publication No. 2014/0092790 to Zhang et al. (“Zhang”)

U.S. Patent Application Publication No. 2014/0092790 to Zhang et al. (“Zhang”), published on April 3, 2014, filed on September 30, 2013, and claims priority to PCT/EP2012/069193 (“PCT 193”) filed on September 28, 2012. PCT 193 supports at least claim 1 of Zhang. By way of example only, at least the following disclosures of PCT 193 are sufficient to support claim 1 of Zhang. *See, e.g.*, PCT 193 at claim 1, 1:33-2:5, 2:15-24, 3:15-20, 3:32-4:2, 5:6-19, 6:3-35, 7:6-11, 7:18-7:24, 10:21-29, 13:18-34, 14:29-35. Therefore, Zhang qualifies as prior art to the ’931 Patent under at least 35 U.S.C. § 102(a). As described in the following claim chart, at least under Pegasus’s apparent infringement theory, the asserted claims of the ’931 Patent are invalid as expressly and/or inherently anticipated by Zhang.

To the extent that Zhang is found not to anticipate, expressly or inherently, one or more of the asserted claims of the ’931 Patent, at least under Pegasus’s apparent infringement theory, these claims are invalid as obvious in view of Zhang in view of the background knowledge and ordinary creativity of a person having ordinary skill in the art at the time of the alleged invention, or in combination with other prior art identified in the cover pleading, herein, or as disclosed in Defendants’ Invalidity Contentions and accompanying charts and appendices. A person of ordinary skill would have been motivated to combine Zhang and any other prior art references, including but not limited to the other prior art identified in the cover pleading or herein, with a reasonable expectation of success because each of these references contains familiar elements within the same field of endeavor to address the same known problems, according to known methods which would yield predictable results.

Defendants reserve the right to amend or supplement this invalidity chart at a later date.

1. Claim 1

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Claim Language		Exemplary Citations to Zhang
1[pre]	A method of transmitting response information of downlink data of a Machine Type Communication (MTC) terminal, the method comprising:	To the extent the preamble is limiting, at least under Pegasus's apparent infringement theory, Zhang discloses a method for transmitting response information of downlink data of a Machine Type Communication (MTC) terminal. For example, Zhang discloses this limitation based on the following exemplary citations: An aspect of the invention relates to a method for resource allocation in a communications system, the method comprising determining, in a network apparatus, PUCCH format 1a/1b resources for HARQ-ACK for time division duplex signaling based on an index of the first enhanced control channel element used for transmission of a corresponding EPDCCH downlink assignment in an uplink subframe, the index of the downlink subframe in which the EPDCCH downlink assignment is transmitted, and one or more configured parameters. Zhang at Para. [0006]. Thus, according to an exemplary embodiment, there is provided a method for resource allocation in a communications system, comprising determining, in a network apparatus, PUCCH format 1a/1b resources for HARQ-ACK for time division duplex signaling based on an index of the first enhanced control channel element used for transmission of a corresponding EPDCCH downlink assignment in an uplink subframe, the index of the downlink subframe in which the EPDCCH downlink assignment is transmitted, and one or more configured parameters. Zhang at Para. [0080]. The present invention is applicable to any user terminal, network node, server, corresponding component, and/or to any communication system or any combination of different communication systems that support PUCCH resource allocation for HARQ-ACK corresponding to PDSCH scheduled via EPDCCH. Other use cases related to EPDCCH may be considered as well, e.g. signaling related to semi-persistent scheduling. The communication system may be a fixed communication system or a wireless communication system or a communication system utilizing both fixed networks and wireless networks.

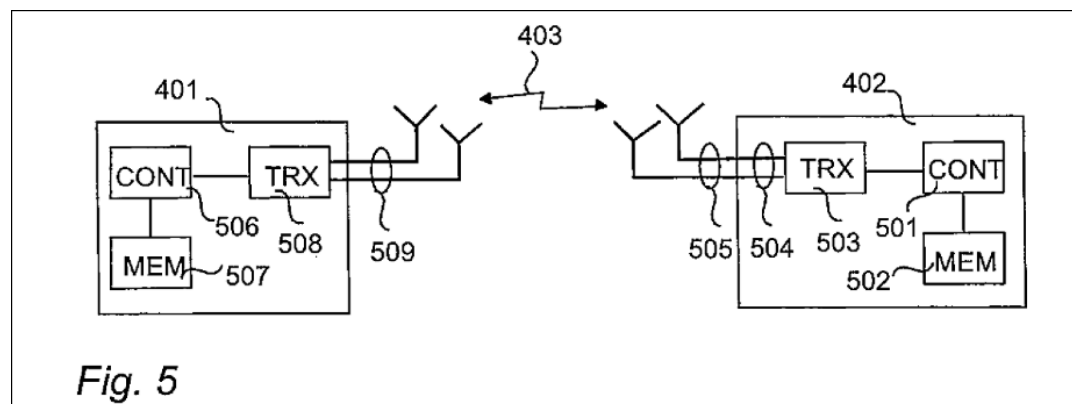
Invalidity of U.S. Patent 10,181,931 in view of Zhang		
Claim Language		Exemplary Citations to Zhang
		The protocols used, the specifications of communication systems, servers and user terminals, especially in wireless communication, develop rapidly. Such development may require extra changes to an embodiment. Therefore, all words and expressions should be interpreted broadly and they are intended to illustrate, not to restrict, the embodiment. Zhang at Para. [0067]. FIG. 5 is a block diagram of an apparatus according to an embodiment of the invention. FIG. 5 shows a user equipment 402 located in the area of a radio network node 401. The user equipment 402 is configured to be in connection with the radio network node 401. The user equipment or UE 402 comprises a controller 501 operationally connected to a memory 502 and a transceiver 503. The controller 501 controls the operation of the user equipment 402. The memory 502 is configured to store software and data. The transceiver 503 is configured to set up and maintain a wireless connection 403 to the radio network node 401. The transceiver 503 is operationally connected to a set of antenna ports 504 connected to an antenna arrangement 505. The antenna arrangement 505 may comprise a set of antennas. The number of antennas may be one to four, for example. The number of antennas is not limited to any particular number. The user equipment 402 may also comprise various other components, such as a user interface, camera, and media player. They are not displayed in the figure due to simplicity. The radio network node 401, such as an LTE base station (eNode-B, eNB) comprises a controller 506 operationally connected to a memory 507, and a transceiver 508. The controller 506 controls the operation of the radio network node 401. The memory 507 is configured to store software and data. The transceiver 508 is configured to set up and maintain a wireless connection to the user equipment 402 within the service area of the radio network node 401. The transceiver 508 is operationally connected to an antenna arrangement 509. The antenna arrangement 509 may comprise a set of antennas. The number of antennas may be two to four, for example. The number of antennas is not limited to any particular number. The radio network node 401 may be operationally connected (directly or indirectly) to another network element (not shown in FIG. 6) of the communication system, such as a radio network controller (RNC), a mobility management entity (MME), an MSC server (MSS), a mobile switching centre (MSC), a radio resource management (RRM) node, a gateway GPRS support node, an

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Claim Language

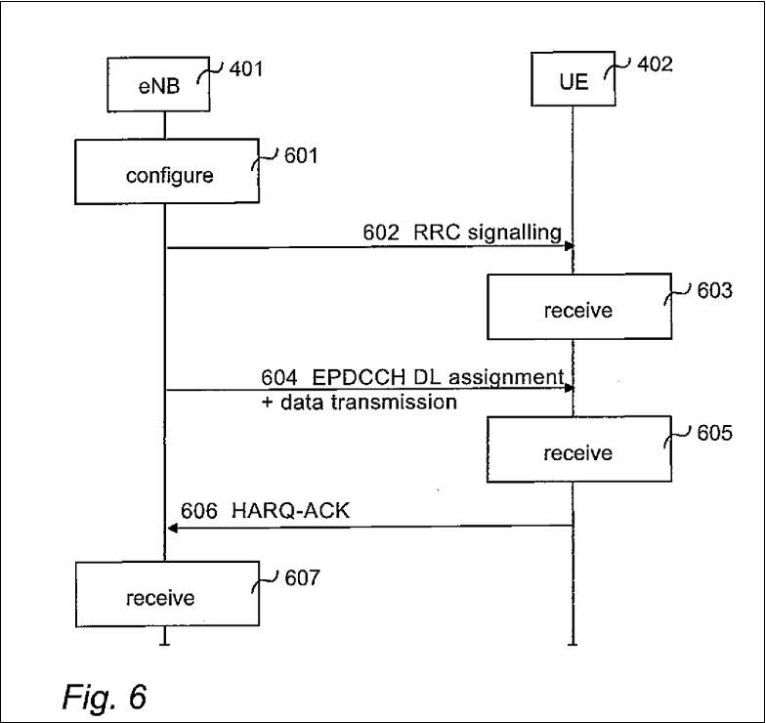
Exemplary Citations to Zhang

operations, administrations and maintenance (OAM) node, a home location register (HLR), a visitor location register (VLR), a serving GPRS support node, a gateway, and/or a server, via an interface. The embodiments are not, however, restricted to the network given above as an example, but a person skilled in the art may apply the solution to other communication networks provided with the necessary properties. For example, the connections between different network elements may be realized with internet protocol (IP) connections. Zhang at Para. [0071]



Zhang at Fig. 5.

The signaling chart of FIG. 6 illustrates the required signaling. In the example of FIG. 6, a network node 401 (which may comprise e.g. a LTE-capable base station (eNode-B, eNB)) may transmit a configuration signal 602 to a user terminal 402 (UE), for configuring UE 402 to transmit a HARQ-ACK signal 606 by utilizing a PUCCH format 1a/b resource for EPDCCH signaling in TDD. This signaling 602 may be e.g. dedicated higher layer (i.e. higher than L1) signaling (e.g. RRC signaling). Before transmitting the signaling 602, eNB 401 may configure the resources in item 601. In item 603, UE 402 may receive the configuration signal 602. In item 604, a EPDCCH DL assignment and data is transmitted from eNB 401 to UE 402. In item 605, UE 402 receives the EPDCCH DL assignment which schedules DL data, wherein UE 402 detects EPDCCH eCCE and uses the index of the first eCCE in determining the HARQ-ACK resource. In step 605, UE 402 applies the

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		resource allocation formula based on the configured parameters and the eCCE index. The formula gives as an output an UL (PUCCH) resource by which the HARQ-ACK 606 is transmitted from UE 402 to eNB 401. In item 606, UE 402 may transmit the HARQ-ACK signal 606 by utilizing the determined PUCCH format 1a/b resource for EPDCCH signaling in TDD. In item 607, eNB 401 may receive the HARQ-ACK signaling 606 from UE 402. Zhang at Para. [0076]  <i>Fig. 6</i> Zhang at Fig. 6. Thus, according to an exemplary embodiment, there is provided a method for resource allocation in a communications system, comprising determining, in a network apparatus, PUCCH format 1a/1b resources for HARQ-ACK for time division duplex signaling based

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		on an index of the first enhanced control channel element used for transmission of a corresponding EPDCCH downlink assignment in an uplink subframe, the index of the downlink subframe in which the EPDCCH downlink assignment is transmitted, and one or more configured parameters. Zhang at Para. [0080]. PCT 193 supports these disclosures. <i>See, e.g.</i>, PCT 193 at 1:16-21; 1:33-2:5; 9:35-10:10; 11:13-12:10; 13:18-34; 14:29-35; To the extent it is found that Zhang does not expressly disclose this limitation, the limitation is inherent. Moreover, to the extent it is found that Zhang does not anticipate this claim, Zhang renders it obvious, either alone, in combination with the knowledge of a person of ordinary skill in the art, and/or in combination with other prior art references identified in the cover pleading or herein. A person of ordinary skill in the art would have been motivated to combine Zhang with any of the other prior art references identified in the cover pleading or herein with a reasonable expectation of success because each of these references contains familiar elements within the same field of endeavor to address the same known problems, according to known methods which would yield predictable results.
1[a]	receiving structural information that contains at least one of i) information on a resource allocated to an uplink control channel for transmitting the response information and ii) start offset information on the resource allocated to the uplink control channel;	At least under Pegasus's apparent infringement theory, Zhang discloses receiving structural information that contains at least one of i) information on a resource allocated to an uplink control channel for transmitting the response information and ii) start offset information on the resource allocated to the uplink control channel. For example, Zhang discloses this limitation based on the following exemplary citations: A further aspect of the invention relates to an apparatus comprising at least one processor; and at least one memory including a computer program code, wherein the at least one memory and the computer program code are configured to, with the at least one processor, cause the apparatus to determine PUCCH format 1a/1b resources for HARQ-ACK for time division duplex signaling based on an index of the first enhanced control channel element used for transmission of a corresponding EPDCCH downlink assignment in an uplink subframe, the index of the downlink subframe in which the EPDCCH downlink assignment is transmitted, and one or more configured parameters.

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		Zhang at Para. [0007] The lowest eCCE index of the EPDCCH DL assignment scheduling the PDSCH data is used as a resource index in implicit PUCCH resource allocation. Additionally, a semi-static resource starting offset is configurable for each EPDCCH set (configuration of an EPDCCH set is UE specific), which may be used e.g. to avoid PUCCH resource collision between EPDCCH and PDCCH as well as different EPDCCH sets. Zhang at Para. [0029] Considering the efficiency of PUCCH resource utilization (or total PUCCH overhead in UL), the resource region for HARQ-ACK corresponding to PDSCH scheduled via PDCCH and/or different EPDCCH sets may be configured to be overlapped. To avoid collisions, a dynamic resource offset that is signaled in DL DCIs via EPDCCH (i.e. the same DCI the schedules the PDSCH) might additionally be adopted. It should be noted that this dynamic offset may be viewed as a selection among multiple resources, and each resource should be linked to the implicitly derived resource (instead of explicitly configured resource, like format 1a/1b resource for SCell in CA). Zhang at Para. [0030] In the case of FDD, the PUCCH format 1a/1b HARQ-ACK resource in response to EPDCCH scheduled PDSCH may be described with the following formula (RAN1#70 agreement): $n_{PUCCH}^{(1)} = n_{eCCE} + N_{UE-PUCCH}^{(1)} + k$ Zhang at Para. [0047]. where $n_{PUCCH}^{(1)}$ is the PUCCH format 1a/b resource for the HARQ-ACK, n_{eCCE} is the index of the lowest eCCE of the detected EPDCCH carrying the DL assignment, $N_{UE-PUCCH}^{(1)}$ is UE- and EPDCCH-set-specific PUCCH resources offset configured by higher layers (via a protocol layer higher than the physical layer), and k is a dynamic offset modifier such as an antenna port-specific offset associated with antenna port p, where p is the antenna port allocated to the first CCE of corresponding EPDCCH or other explicitly signaled or

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		implicitly derived parameter. It should be noted that according to the decisions in RAN1#70, it has not yet been confirmed whether k is needed or not. Zhang at Para. [0048]. In an exemplary embodiment, regarding extended definition of semi-static resource starting offset for each EPDCCH set, resource collisions may be avoided by providing a mechanism to adjust the implicit resource allocation so that it adapts to the number of DL subframes mapping to a single UL subframe. EPDCCH scheduling restrictions may be minimized by allowing for a possibility of having fully orthogonal PUCCH format 1a/b resources for a given UE and/or EPDCCH set. Zhang at Para. [0050]. In an exemplary embodiment, a single semi-static UE-specific resource starting offset $N_{UE-PUCCH}^{(1)}$ may be configured for each EPDCCH set assuming $M=1$. Additionally, for the case of TDD, another parameter, $N_{UE-PUCCH-TDD}^{(1)}$ may be introduced impacting the resource allocation formula when $M>1$, i.e. when PUCCH HARQ-ACK resources for multiple DL subframes map into a single UL subframe. Zhang at Para. [0051]. In an exemplary embodiment, when $M>1$, the offset applied in each DL subframe is dependent on $N_{UE-PUCCH}^{(1)}$, $N_{UE-PUCCH-TDD}^{(1)}$ and m, where m (0 . . . M-1) is the relative index of the DL subframe. Compared with the prior art FDD formula, this means that an additional TDD-specific adjustment based on $N_{UE-PUCCH-TDD}^{(1)}$ is applied. This allows for avoiding the problem depicted in FIG. 1, by fully separating the PUCCH resources related to EPDCCH Set1 and Set2, as in FIG. 2, FIG. 2 being an illustration of a multi-SF PUCCH resource arrangement with a fully orthogonal PUCCH region. Zhang at Para. [0052]. In an exemplary embodiment, the resource allocation formula for TDD may be described using the notation from a 3GPP specification as: $n_{PUCCH}^{(1)} = N_{UE-PUCCH-TDD}^{(1)} * m + n_{eCCE} + N_{UE-PUCCH}^{(1)} + k,$

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		where $N_{\text{UE-PUCCH-TDD}}^{(1)}$ is a parameter specific for a TDD operation. $N_{\text{UE-PUCCH-TDD}}^{(1)}$ may be configured semi-statically and signaled via RRC signaling, or it may be e.g. equal to or a multiple of the number eCCEs in the given EPDCCH set. A resulting PUCCH resource arrangement is shown in FIG. 2. n_{eCCE} is the number of the first eCCE used for transmission of the corresponding EPDCCH in subframe $n-k_m$. UE selects the corresponding m, where $m(0 \dots M-1)$ is the relative index of the DL subframe of PDSCH scheduled by EPDCCH derived from Table 1. k is a dynamic offset modifier such as an antenna port-specific offset associated with antenna port p, where p is the antenna port allocated to the first eCCE of a corresponding EPDCCH or other explicitly signaled or implicitly derived parameter. Zhang at Para. [0056]-[0057]. An exemplary embodiment enables maximizing the similarity between FDD and TDD modes. If $M=1$ ($N_{\text{UE-PUCCH-TDD}}^{(1)}$ is not in use), then the resource allocation corresponds to that of an FDD solution. Zhang at Para. [0062]. The signaling chart of FIG. 6 illustrates the required signaling. In the example of FIG. 6, a network node 401 (which may comprise e.g. a LTE-capable base station (eNode-B, eNB)) may transmit a configuration signal 602 to a user terminal 402 (UE), for configuring UE 402 to transmit a HARQ-ACK signal 606 by utilizing a PUCCH format 1a/b resource for EPDCCH signaling in TDD. This signaling 602 may be e.g. dedicated higher layer (i.e. higher than L1) signaling (e.g. RRC signaling). Before transmitting the signaling 602, eNB 401 may configure the resources in item 601. In item 603, UE 402 may receive the configuration signal 602. In item 604, a EPDCCH DL assignment and data is transmitted from eNB 401 to UE 402. In item 605, UE 402 receives the EPDCCH DL assignment which schedules DL data, wherein UE 402 detects EPDCCH eCCE and uses the index of the first eCCE in determining the HARQ-ACK resource. In step 605, UE 402 applies the resource allocation formula based on the configured parameters and the eCCE index. The formula gives as an output an UL (PUCCH) resource by which the HARQ-ACK 606 is transmitted from UE 402 to eNB 401. In item 606, UE 402 may transmit the HARQ-ACK signal 606 by utilizing the determined PUCCH format 1a/b resource for EPDCCH

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		signaling in TDD. In item 607, eNB 401 may receive the HARQ-ACK signaling 606 from UE 402. Zhang at Para. [0076] <pre> sequenceDiagram participant eNB as eNB 401 participant UE as UE 402 eNB->>UE: configure 601 UE->>UE: receive 603 eNB->>UE: 604 EPDCCH DL assignment + data transmission UE->>UE: receive 605 UE->>eNB: 606 HARQ-ACK eNB->>eNB: receive 607 </pre> <i>Fig. 6</i> Zhang at Fig. 6. FIG. 7 is a flow chart illustrating an exemplary embodiment. The apparatus 402, which may comprise e.g. a network element (network node, e.g. a user terminal, UE) receives, in item 701, from a network apparatus 401 (which may comprise e.g. a LTE base station eNB 401) a configuration signal for configuring UE 402 to transmit a HARQ-ACK signal by utilizing a PUCCH format 1a/b resource for EPDCCH signaling in TDD. The received configuration signaling may be e.g. dedicated higher layer signaling, e.g. RRC signaling. In

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		item 702, UE 402 transmits a HARQ-ACK signal to eNB 401 by utilizing the configured PUCCH format 1a/b resource for EPDCCH signaling in TDD. Zhang at Para. [0077] <pre> graph TD Start([start]) --> Receive[receive 701] Receive --> Transmit[transmit 702] Transmit --> End([end]) </pre> <i>Fig. 7</i> Zhang at Fig. 7. Thus, according to an exemplary embodiment, there is provided a method for resource allocation in a communications system, comprising determining, in a network apparatus, PUCCH format 1a/1b resources for HARQ-ACK for time division duplex signaling based on an index of the first enhanced control channel element used for transmission of a

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		corresponding EPDCCH downlink assignment in an uplink subframe, the index of the downlink subframe in which the EPDCCH downlink assignment is transmitted, and one or more configured parameters. Zhang at Para. [0080]. According to yet another exemplary embodiment, a multi-subframe PUCCH format 1a/1b resource allocation is carried out for HARQ-ACK corresponding to PDSCH scheduled via EPDCCH. Zhang at [0082]. According to yet another exemplary embodiment, the dynamic offset modifier is applied such that it is independent on a subframe index m, wherein the dynamic offset modifier is derived based on downlink control information DCI that EPDCCH is carrying. Zhang at [0087]. According to yet another exemplary embodiment, the dynamic offset modifier is applied such that the dynamic offset modifier depends on a subframe index m, wherein multiple sets of dynamic offset modifiers are defined to be a matrix C with $(M-1)$ columns and N rows, N corresponding to the number of options to perform dynamic switching, M being the number of downlink subframes associated with an uplink subframe for HARQ-ACK feedback, and the subframe index m is used as one factor to determine the value of the dynamic offset modifier $k(n, m)$, where n is an index of dynamic switching option signaled as downlink control information DCI via EPDCCH. Zhang at Para. [0088]. According to yet another exemplary embodiment, the resource index of the ACK/NACK resource corresponding to the m-th subframe X_m is derived from the resource index of the first subframe X_0 as $X_0 + C(m)$, where $C(m)$ is a predefined constant number. Zhang at Para. [0089]. According to yet another exemplary embodiment, the method comprises scheduling the PUCCH format 1a/1b resources for EPDCCH for time division duplex signaling based on formula I:

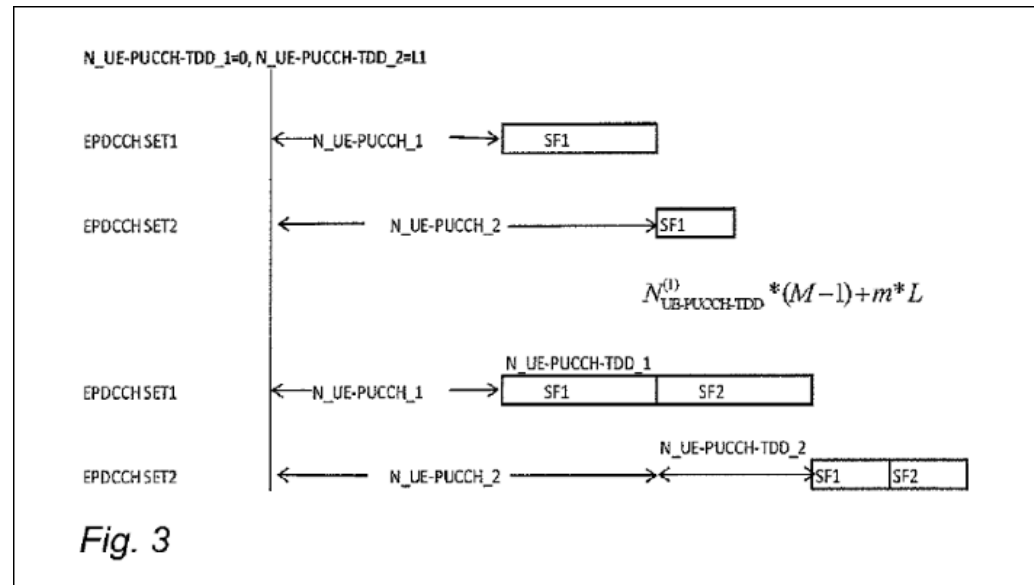
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		$n_{PUCCH}^{(1)} = N_{UE-PUCCH-TDD}^{(1)} * m + n_{eCCE} + N_{UE-PUCCH}^{(1)} + k, \quad (I)$ where $n_{PUCCH}^{(1)}$ is a PUCCH format 1a/1b resource to be allocated for a HARQ-ACK signal; $N_{UE-PUCCH}^{(1)}$ is the first semi-static user terminal-specific resource starting offset defined for an EPDCCH set; $N_{UE-PUCCH-TDD}^{(1)}$ is the second user terminal-specific resource offset defined for EPDCCH sets when $M > 1$, M being the number of downlink subframes associated with an uplink subframe for HARQ-ACK feedback, m being a relative index of a downlink subframe, wherein $0 \leq m \leq M-1$; n_{eCCE} is an index of the first enhanced control channel element eCCE used for transmission of a corresponding EPDCCH downlink assignment in a downlink subframe $n-k_m$, where m is the relative index of the downlink subframes and $0 \leq m \leq M-1$; k is the dynamic offset modifier. Zhang at Paras. [0092]-[0093]. According to yet another exemplary embodiment, the at least one memory and the computer program code are configured to, with the at least one processor, cause the apparatus to schedule the PUCCH format 1a/1b resources for EPDCCH for time division duplex signaling based on formula I: $n_{PUCCH}^{(1)} = N_{UE-PUCCH-TDD}^{(1)} * m + n_{eCCE} + N_{UE-PUCCH}^{(1)} + k, \quad (II)$ $n_{PUCCH}^{(1)}$ is a PUCCH format 1a/1b resource to be allocated for a HARQ-ACK signal; $N_{UE-PUCCH}^{(1)}$ is the first semi-static user terminal-specific resource starting offset defined for an EPDCCH set; $N_{UE-PUCCH-TDD}^{(1)}$ is the second user terminal-specific resource offset defined for EPDCCH sets when $M > 1$, M being the number of downlink subframes associated with an uplink subframe for HARQ-ACK feedback, m being a relative index of a downlink subframe, wherein $0 \leq m \leq M-1$; n_{eCCE} is an index of the first enhanced control channel element eCCE used for transmission of a corresponding EPDCCH downlink assignment in

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a downlink subframe $n-k_m$, where m is the relative index of the downlink subframes and $0 \leq m \leq M-1$; k is a dynamic offset modifier. Zhang at Paras. [0101]-[0103].



Zhang at Fig. 3.

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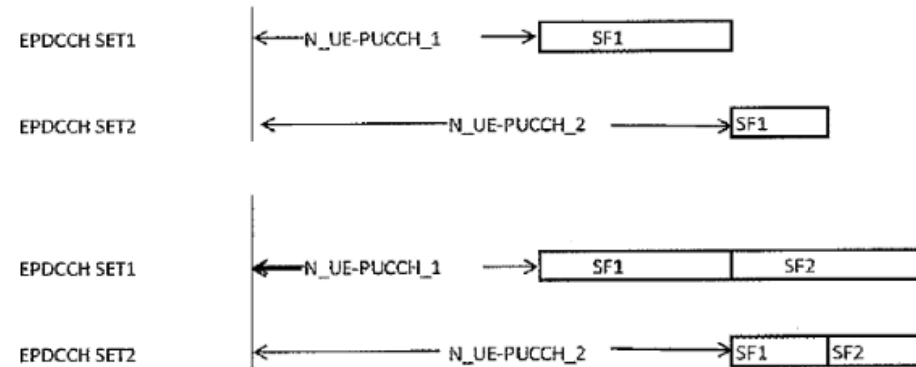


Fig. 1

Zhang at Fig. 1.

TABLE 1

Downlink association set index K: $K: \{k_0, k_1, \dots, k_{K-1}\}$ for TDD

UL-DL Config- uration	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	—

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		Zhang at Table 1. PCT 193 supports these disclosures. <i>See, e.g.</i>, PCT 193 at 3:15-31; 3:32-4:2; 4:3-11; 4:18-25; Table 1; 6:3-20; 6:21-35, 7:6-11; 7:12-16; 7:16-24; 7:33-8:1; 8:2-24; 8:25-31; 13:18-34; 13:35-14:8; 14:29-35; 16:23-31. In To the extent it is found that Zhang does not expressly disclose this limitation, the limitation is inherent. Moreover, to the extent it is found that Zhang does not anticipate this claim, Zhang renders it obvious, either alone, in combination with the knowledge of a person of ordinary skill in the art, and/or in combination with other prior art references identified in the cover pleading or herein. A person of ordinary skill in the art would have been motivated to combine Zhang with any of the other prior art references identified in the cover pleading or herein with a reasonable expectation of success because each of these references contains familiar elements within the same field of endeavor to address the same known problems, according to known methods which would yield predictable results.
1[b]	receiving downlink control information for scheduling the downlink data;	At least under Pegasus's apparent infringement theory, Zhang discloses receiving downlink control information for scheduling the downlink data. For example, Zhang discloses this limitation based on the following exemplary citations: A further aspect of the invention relates to an apparatus comprising at least one processor; and at least one memory including a computer program code, wherein the at least one memory and the computer program code are configured to, with the at least one processor, cause the apparatus to determine PUCCH format 1a/1b resources for HARQ-ACK for time division duplex signaling based on an index of the first enhanced control channel element used for transmission of a corresponding EPDCCH downlink assignment in an uplink subframe, the index of the downlink subframe in which the EPDCCH downlink assignment is transmitted, and one or more configured parameters. Zhang at Para. [0007]. In an exemplary embodiment, regarding enhancement of dynamic offset mechanism to solve multi-SF resource collision, besides the semi-static offset, it is proposed to apply an

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		alternative/complementary dynamic offset modifier k for TDD on top of semi-static (+subframe specific) offset parameters. A starting point is to apply dynamic offset modifier which does not depend on the parameter m. In other words, dynamic offset modifier (if available) is derived from the content downlink control information which EPDCCH is carrying. Zhang at Para. [0053]. The signaling chart of FIG. 6 illustrates the required signaling. In the example of FIG. 6, a network node 401 (which may comprise e.g. a LTE-capable base station (eNode-B, eNB)) may transmit a configuration signal 602 to a user terminal 402 (UE), for configuring UE 402 to transmit a HARQ-ACK signal 606 by utilizing a PUCCH format 1a/b resource for EPDCCH signaling in TDD. This signaling 602 may be e.g. dedicated higher layer (i.e. higher than L1) signaling (e.g. RRC signaling). Before transmitting the signaling 602, eNB 401 may configure the resources in item 601. In item 603, UE 402 may receive the configuration signal 602. In item 604, a EPDCCH DL assignment and data is transmitted from eNB 401 to UE 402. In item 605, UE 402 receives the EPDCCH DL assignment which schedules DL data, wherein UE 402 detects EPDCCH eCCE and uses the index of the first eCCE in determining the HARQ-ACK resource. In step 605, UE 402 applies the resource allocation formula based on the configured parameters and the eCCE index. The formula gives as an output an UL (PUCCH) resource by which the HARQ-ACK 606 is transmitted from UE 402 to eNB 401. In item 606, UE 402 may transmit the HARQ-ACK signal 606 by utilizing the determined PUCCH format 1a/b resource for EPDCCH signaling in TDD. In item 607, eNB 401 may receive the HARQ-ACK signaling 606 from UE 402. Zhang at Para. [0076] Considering the efficiency of PUCCH resource utilization (or total PUCCH overhead in UL), the resource region for HARQ-ACK corresponding to PDSCH scheduled via PDCCH and/or different EPDCCH sets may be configured to be overlapped. To avoid collisions, a dynamic resource offset that is signaled in DL DCIs via EPDCCH (i.e. the same DCI the schedules the PDSCH) might additionally be adopted. It should be noted that this dynamic offset may be viewed as a selection among multiple resources, and each resource should be

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		linked to the implicitly derived resource (instead of explicitly configured resource, like format 1a/1b resource for SCell in CA). Zhang at Para. [0030] In an exemplary embodiment, regarding enhancement of dynamic offset mechanism to solve multi-SF resource collision, besides the semi-static offset, it is proposed to apply an alternative/complementary dynamic offset modifier k for TDD on top of semi-static (+subframe specific) offset parameters. A starting point is to apply dynamic offset modifier which does not depend on the parameter m. In other words, dynamic offset modifier (if available) is derived from the content downlink control information which EPDCCH is carrying. Zhang at Para. [0053]. In an exemplary embodiment, it may also be possible to define an enhanced version of dynamic offset which depends on the subframe index m. In that case multiple (typically M) sets of dynamic offset modifiers may be specified or configured, and the subframe index m may be used as one factor to determine the value of the dynamic offset modifier k (Res_i, m), where Res_i is the resource index signaled in DL DCI via EPDCCH. Zhang at [0054]. An exemplary embodiment of dynamic offset is where k (Res_i, m) is defined to be C(m) with $m \geq 1$. For example, when a predefined condition such as when m=1, the index of the A/N resource corresponding to the 2nd subframe is derived from the resource index of the first subframe $X_m=0$ as $(X_m=0)+C$, where C is a predefined number (e.g. 1 or 3). In more generic terms, there may be a matrix C with (M-1) columns and n rows (n corresponds to number of options behind the dynamic switching). The matrix C may be configured via higher layers (via a protocol layer higher than the physical layer). Zhang at Para. [0055]. The signaling chart of FIG. 6 illustrates the required signaling. In the example of FIG. 6, a network node 401 (which may comprise e.g. a LTE-capable base station (eNode-B, eNB)) may transmit a configuration signal 602 to a user terminal 402 (UE), for configuring UE 402 to transmit a HARQ-ACK signal 606 by utilizing a PUCCH format 1a/b resource for EPDCCH signaling in TDD. This signaling 602 may be e.g. dedicated higher layer (i.e. higher than L1) signaling (e.g. RRC signaling). Before transmitting the signaling 602, eNB

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		401 may configure the resources in item 601. In item 603, UE 402 may receive the configuration signal 602. In item 604, a EPDCCH DL assignment and data is transmitted from eNB 401 to UE 402. In item 605, UE 402 receives the EPDCCH DL assignment which schedules DL data, wherein UE 402 detects EPDCCH eCCE and uses the index of the first eCCE in determining the HARQ-ACK resource. In step 605, UE 402 applies the resource allocation formula based on the configured parameters and the eCCE index. The formula gives as an output an UL (PUCCH) resource by which the HARQ-ACK 606 is transmitted from UE 402 to eNB 401. In item 606, UE 402 may transmit the HARQ-ACK signal 606 by utilizing the determined PUCCH format 1a/b resource for EPDCCH signaling in TDD. In item 607, eNB 401 may receive the HARQ-ACK signaling 606 from UE 402. Zhang at Para. [0076] <pre> sequenceDiagram participant eNB as eNB 401 participant UE as UE 402 eNB->>UE: 601 configure UE->>UE: 602 RRC signalling eNB->>UE: 604 EPDCCH DL assignment + data transmission UE->>UE: 605 receive UE->>eNB: 606 HARQ-ACK eNB->>eNB: 607 receive </pre> Fig. 6

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		Zhang at Fig. 6. FIG. 7 is a flow chart illustrating an exemplary embodiment. The apparatus 402, which may comprise e.g. a network element (network node, e.g. a user terminal, UE) receives, in item 701, from a network apparatus 401 (which may comprise e.g. a LTE base station eNB 401) a configuration signal for configuring UE 402 to transmit a HARQ-ACK signal by utilizing a PUCCH format 1a/b resource for EPDCCH signaling in TDD. The received configuration signaling may be e.g. dedicated higher layer signaling, e.g. RRC signaling. In item 702, UE 402 transmits a HARQ-ACK signal to eNB 401 by utilizing the configured PUCCH format 1a/b resource for EPDCCH signaling in TDD. Zhang at Para. [0077]

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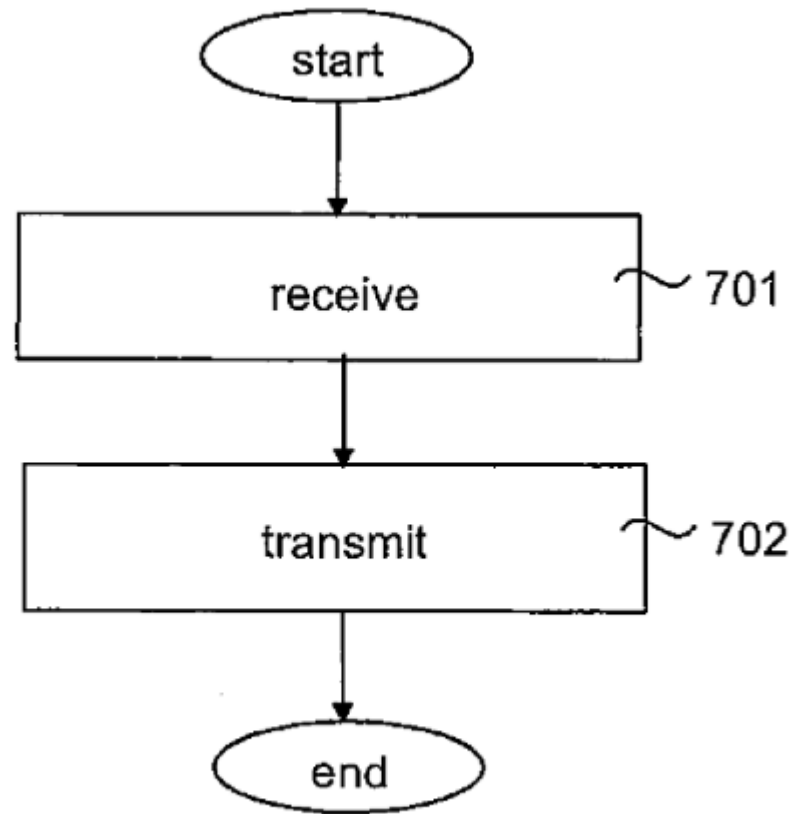
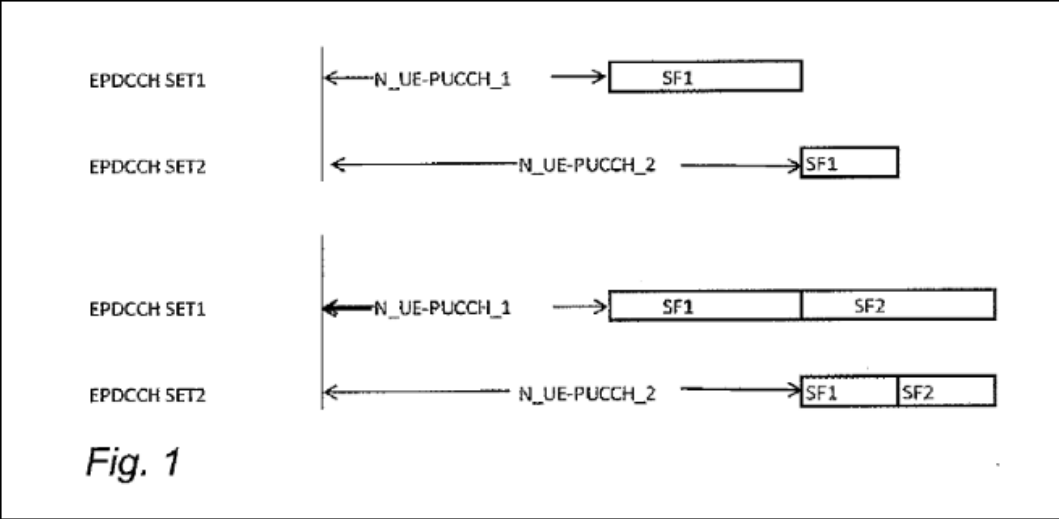


Fig. 7

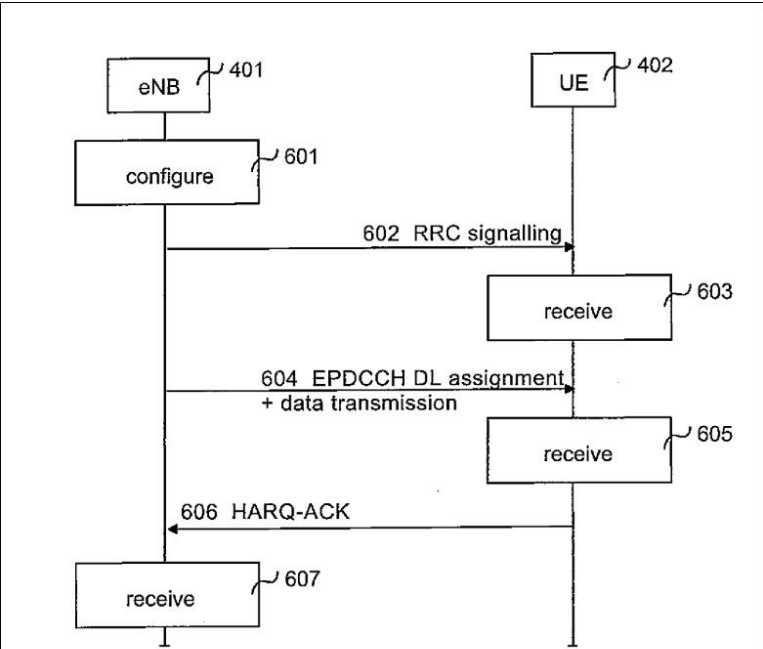
Zhang at Fig. 7.

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		According to yet another exemplary embodiment, a multi-subframe PUCCH format 1a/1b resource allocation is carried out for HARQ-ACK corresponding to PDSCH scheduled via EPDCCH. Zhang at [0082]. According to yet another exemplary embodiment, the dynamic offset modifier is applied such that it is independent on a subframe index m, wherein the dynamic offset modifier is derived based on downlink control information DCI that EPDCCH is carrying. Zhang at [0087]. According to yet another exemplary embodiment, the at least one memory and the computer program code are configured to, with the at least one processor, cause the apparatus to apply the dynamic offset modifier such that it is independent on a subframe index m, wherein the dynamic offset modifier is derived based on downlink control information DCI that EPDCCH is carrying. Zhang at Para. [0097]. The diagram illustrates PUCCH resource allocation for two EPDCCH sets (EPDCCH SET1 and EPDCCH SET2) across multiple subframes. A vertical line represents the timeline. At the top, parameters are given: $N_{UE-PUCCH-TDD_1}=0, N_{UE-PUCCH-TDD_2}=1$. For EPDCCH SET1, a horizontal arrow labeled $N_{UE-PUCCH_1}$ points to a box labeled SF1. For EPDCCH SET2, a horizontal arrow labeled $N_{UE-PUCCH_2}$ points to a box labeled SF1. Below these, a formula is shown: $N_{UE-PUCCH-TDD}^{(1)} * (M-1) + m * L$. Further down, for EPDCCH SET1, a horizontal arrow labeled $N_{UE-PUCCH_1}$ points to a box containing SF1 and SF2, with the label $N_{UE-PUCCH-TDD_1}$ above it. For EPDCCH SET2, a horizontal arrow labeled $N_{UE-PUCCH_2}$ points to a box containing SF1 and SF2, with the label $N_{UE-PUCCH-TDD_2}$ above it. The caption 'Fig. 3' is at the bottom left of the diagram area. Zhang at Fig. 3.

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		 The diagram, labeled Fig. 1, illustrates the allocation of subframes (SF) to two sets of EPDCCH (EPDCCH SET1 and EPDCCH SET2) across two different scenarios. In the top scenario, EPDCCH SET1 is associated with N_UE-PUCCH_1 and points to a single subframe SF1. EPDCCH SET2 is associated with N_UE-PUCCH_2 and also points to a single subframe SF1. In the bottom scenario, EPDCCH SET1 is associated with N_UE-PUCCH_1 and points to a block of two subframes, SF1 and SF2. EPDCCH SET2 is associated with N_UE-PUCCH_2 and also points to a block of two subframes, SF1 and SF2. <i>Fig. 1</i> Zhang at Fig. 1. PCT 193 supports these disclosures. <i>See, e.g.</i>, PCT 193 at 4:3-11; 7:33-8:1; 13:18-34; 13:35-14:8; 17:4-8; 17:22-27. To the extent it is found that Zhang does not expressly disclose this limitation, the limitation is inherent. Moreover, to the extent it is found that Zhang does not anticipate this claim, Zhang renders it obvious, either alone, in combination with the knowledge of a person of ordinary skill in the art, and/or in combination with other prior art references identified in the cover pleading or herein. A person of ordinary skill in the art would have been motivated to combine Zhang with any of the other prior art references identified in the cover pleading or herein with a reasonable expectation of success because each of these references contains familiar elements within the same field of endeavor to address the same known problems, according to known methods which would yield predictable results.

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1[c]	receiving the downlink data; and	At least under Pegasus's apparent infringement theory, Zhang discloses receiving the downlink data. For example, Zhang discloses this limitation based on the following exemplary citations: In an exemplary embodiment, regarding enhancement of dynamic offset mechanism to solve multi-SF resource collision, besides the semi-static offset, it is proposed to apply an alternative/complementary dynamic offset modifier k for TDD on top of semi-static (+subframe specific) offset parameters. A starting point is to apply dynamic offset modifier which does not depend on the parameter m. In other words, dynamic offset modifier (if available) is derived from the content downlink control information which EPDCCH is carrying. Zhang at Para. [0053]. A further aspect of the invention relates to an apparatus comprising at least one processor; and at least one memory including a computer program code, wherein the at least one memory and the computer program code are configured to, with the at least one processor, cause the apparatus to determine PUCCH format 1a/1b resources for HARQ-ACK for time division duplex signaling based on an index of the first enhanced control channel element used for transmission of a corresponding EPDCCH downlink assignment in an uplink subframe, the index of the downlink subframe in which the EPDCCH downlink assignment is transmitted, and one or more configured parameters. Zhang at Para. [0007] The signaling chart of FIG. 6 illustrates the required signaling. In the example of FIG. 6, a network node 401 (which may comprise e.g. a LTE-capable base station (eNode-B, eNB)) may transmit a configuration signal 602 to a user terminal 402 (UE), for configuring UE 402 to transmit a HARQ-ACK signal 606 by utilizing a PUCCH format 1a/b resource for EPDCCH signaling in TDD. This signaling 602 may be e.g. dedicated higher layer (i.e. higher than L1) signaling (e.g. RRC signaling). Before transmitting the signaling 602, eNB 401 may configure the resources in item 601. In item 603, UE 402 may receive the configuration signal 602. In item 604, a EPDCCH DL assignment and data is transmitted

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		from eNB 401 to UE 402. In item 605, UE 402 receives the EPDCCH DL assignment which schedules DL data, wherein UE 402 detects EPDCCH eCCE and uses the index of the first eCCE in determining the HARQ-ACK resource. In step 605, UE 402 applies the resource allocation formula based on the configured parameters and the eCCE index. The formula gives as an output an UL (PUCCH) resource by which the HARQ-ACK 606 is transmitted from UE 402 to eNB 401. In item 606, UE 402 may transmit the HARQ-ACK signal 606 by utilizing the determined PUCCH format 1a/b resource for EPDCCH signaling in TDD. In item 607, eNB 401 may receive the HARQ-ACK signaling 606 from UE 402. Para. [0076]. The signaling chart of FIG. 6 illustrates the required signaling. In the example of FIG. 6, a network node 401 (which may comprise e.g. a LTE-capable base station (eNode-B, eNB)) may transmit a configuration signal 602 to a user terminal 402 (UE), for configuring UE 402 to transmit a HARQ-ACK signal 606 by utilizing a PUCCH format 1a/b resource for EPDCCH signaling in TDD. This signaling 602 may be e.g. dedicated higher layer (i.e. higher than L1) signaling (e.g. RRC signaling). Before transmitting the signaling 602, eNB 401 may configure the resources in item 601. In item 603, UE 402 may receive the configuration signal 602. In item 604, a EPDCCH DL assignment and data is transmitted from eNB 401 to UE 402. In item 605, UE 402 receives the EPDCCH DL assignment which schedules DL data, wherein UE 402 detects EPDCCH eCCE and uses the index of the first eCCE in determining the HARQ-ACK resource. In step 605, UE 402 applies the resource allocation formula based on the configured parameters and the eCCE index. The formula gives as an output an UL (PUCCH) resource by which the HARQ-ACK 606 is transmitted from UE 402 to eNB 401. In item 606, UE 402 may transmit the HARQ-ACK signal 606 by utilizing the determined PUCCH format 1a/b resource for EPDCCH signaling in TDD. In item 607, eNB 401 may receive the HARQ-ACK signaling 606 from UE 402. Zhang at Para. [0076]

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		 <i>Fig. 6</i>
		Zhang at Fig. 6. PCT 193 supports these disclosures. See PCT Application at 13:18-34. To the extent it is found that Zhang does not expressly disclose this limitation, the limitation is inherent. Moreover, to the extent it is found that Zhang does not anticipate this claim, Zhang renders it obvious, either alone, in combination with the knowledge of a person of ordinary skill in the art, and/or in combination with other prior art references identified in the cover pleading or herein. A person of ordinary skill in the art would have been motivated to combine Zhang with any of the other prior art references identified in the cover pleading or herein with a reasonable expectation of success because each of these

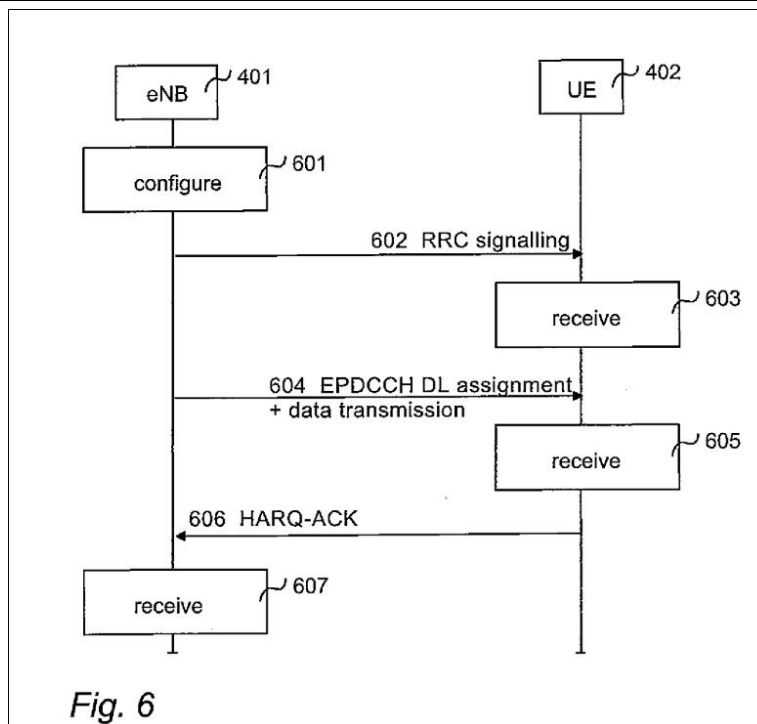
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		references contains familiar elements within the same field of endeavor to address the same known problems, according to known methods which would yield predictable results.
1[d]	transmitting the response information on the downlink data by using the resource allocated to the uplink control channel,	At least under Pegasus's apparent infringement theory, Zhang discloses transmitting the response information on the downlink data by using the resource allocated to the uplink control channel. For example, Zhang discloses this limitation based on the following exemplary citations: A further aspect of the invention relates to an apparatus comprising at least one processor; and at least one memory including a computer program code, wherein the at least one memory and the computer program code are configured to, with the at least one processor, cause the apparatus to determine PUCCH format 1a/1b resources for HARQ-ACK for time division duplex signaling based on an index of the first enhanced control channel element used for transmission of a corresponding EPDCCH downlink assignment in an uplink subframe, the index of the downlink subframe in which the EPDCCH downlink assignment is transmitted, and one or more configured parameters. Zhang at Para. [0007] The signaling chart of FIG. 6 illustrates the required signaling. In the example of FIG. 6, a network node 401 (which may comprise e.g. a LTE-capable base station (eNode-B, eNB)) may transmit a configuration signal 602 to a user terminal 402 (UE), for configuring UE 402 to transmit a HARQ-ACK signal 606 by utilizing a PUCCH format 1a/b resource for EPDCCH signaling in TDD. This signaling 602 may be e.g. dedicated higher layer (i.e. higher than L1) signaling (e.g. RRC signaling). Before transmitting the signaling 602, eNB 401 may configure the resources in item 601. In item 603, UE 402 may receive the configuration signal 602. In item 604, a EPDCCH DL assignment and data is transmitted from eNB 401 to UE 402. In item 605, UE 402 receives the EPDCCH DL assignment which schedules DL data, wherein UE 402 detects EPDCCH eCCE and uses the index of the first eCCE in determining the HARQ-ACK resource. In step 605, UE 402 applies the resource allocation formula based on the configured parameters and the eCCE index. The formula gives as an output an UL (PUCCH) resource by which the HARQ-ACK 606 is transmitted from UE 402 to eNB 401. In item 606, UE 402 may transmit the HARQ-ACK

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		signal 606 by utilizing the determined PUCCH format 1a/b resource for EPDCCH signaling in TDD. In item 607, eNB 401 may receive the HARQ-ACK signaling 606 from UE 402. Zhang at Para. [0076]. PUCCH (physical uplink control channel) carries uplink control information, and supports multiple formats, such as 1, 1a, 1b, 2, 2a, 2b, and 3. If PUCCH is enabled, there is at least one resource block in a frequency domain reserved for PUCCH. In a time domain, each slot has a PUCCH resource block in an FDD mode, and each uplink slot has a PUCCH RB in a TDD mode. PUCCH format 1/1a/1b resources are identified by a resource index. Zhang at Para. [0003] The signaling chart of FIG. 6 illustrates the required signaling. In the example of FIG. 6, a network node 401 (which may comprise e.g. a LTE-capable base station (eNode-B, eNB)) may transmit a configuration signal 602 to a user terminal 402 (UE), for configuring UE 402 to transmit a HARQ-ACK signal 606 by utilizing a PUCCH format 1a/b resource for EPDCCH signaling in TDD. This signaling 602 may be e.g. dedicated higher layer (i.e. higher than L1) signaling (e.g. RRC signaling). Before transmitting the signaling 602, eNB 401 may configure the resources in item 601. In item 603, UE 402 may receive the configuration signal 602. In item 604, a EPDCCH DL assignment and data is transmitted from eNB 401 to UE 402. In item 605, UE 402 receives the EPDCCH DL assignment which schedules DL data, wherein UE 402 detects EPDCCH eCCE and uses the index of the first eCCE in determining the HARQ-ACK resource. In step 605, UE 402 applies the resource allocation formula based on the configured parameters and the eCCE index. The formula gives as an output an UL (PUCCH) resource by which the HARQ-ACK 606 is transmitted from UE 402 to eNB 401. In item 606, UE 402 may transmit the HARQ-ACK signal 606 by utilizing the determined PUCCH format 1a/b resource for EPDCCH signaling in TDD. In item 607, eNB 401 may receive the HARQ-ACK signaling 606 from UE 402. Zhang at Para. [0076]

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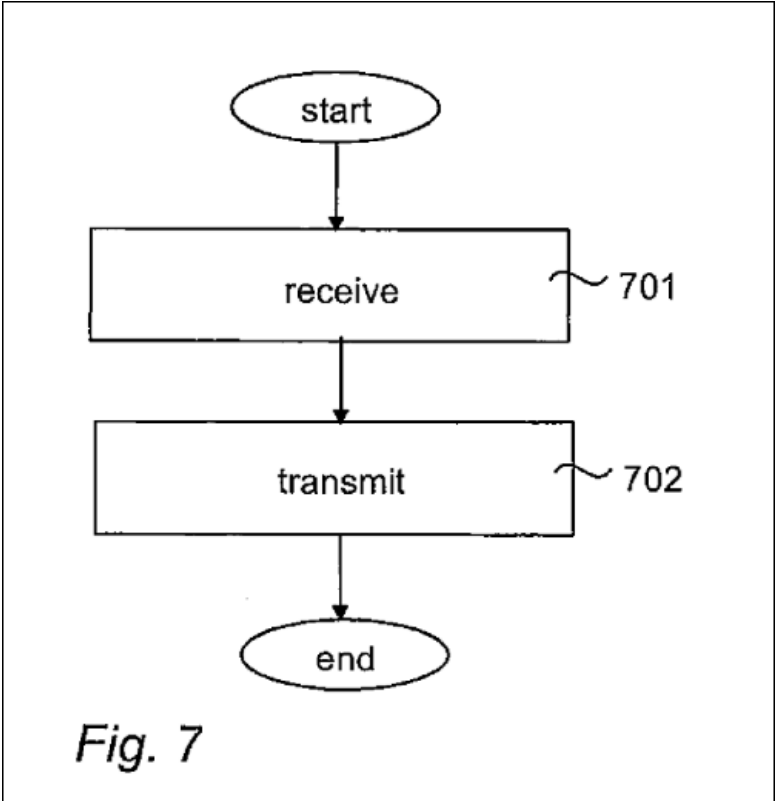
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Zhang at Fig. 6.

FIG. 7 is a flow chart illustrating an exemplary embodiment. The apparatus 402, which may comprise e.g. a network element (network node, e.g. a user terminal, UE) receives, in item 701, from a network apparatus 401 (which may comprise e.g. a LTE base station eNB 401) a configuration signal for configuring UE 402 to transmit a HARQ-ACK signal by utilizing a PUCCH format la/b resource for EPDCCH signaling in TDD. The received configuration signaling may be e.g. dedicated higher layer signaling, e.g. RRC signaling. In item 702, UE 402 transmits a HARQ-ACK signal to eNB 401 by utilizing the configured PUCCH format la/b resource for EPDCCH signaling in TDD. Zhang at Para. [0077]

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		 <i>Fig. 7</i> Zhang at Fig. 7. PCT 193 supports these disclosures. See PCT 193 at 7:33-8:1; 13:18-34; 13:35-14:8 To the extent it is found that Zhang does not expressly disclose this limitation, the limitation is inherent. Moreover, to the extent it is found that Zhang does not anticipate this claim, Zhang renders it obvious, either alone, in combination with the knowledge of a person of ordinary skill in the art, and/or in combination with other prior art references identified in the cover pleading or herein. A person of ordinary skill in the art would have been motivated to combine Zhang with any of the other prior art references identified in the

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		cover pleading or herein with a reasonable expectation of success because each of these references contains familiar elements within the same field of endeavor to address the same known problems, according to known methods which would yield predictable results.
1[e]	wherein the resource allocated to the uplink control channel is determined based on at least one of: i) information on a resource of a downlink control channel for scheduling the downlink data; ii) the information on the resource allocated to the uplink control channel; and iii) the start offset information on the resource allocated to the uplink control channel;	At least under Pegasus's apparent infringement theory, Zhang discloses the resource allocated to the uplink control channel is determined based on at least one of: i) information on a resource of a downlink control channel for scheduling the downlink data; ii) the information on the resource allocated to the uplink control channel; and iii) the start offset information on the resource allocated to the uplink control channel. For example, Zhang discloses this limitation based on the following exemplary citations: A further aspect of the invention relates to an apparatus comprising at least one processor; and at least one memory including a computer program code, wherein the at least one memory and the computer program code are configured to, with the at least one processor, cause the apparatus to determine PUCCH format 1a/1b resources for HARQ-ACK for time division duplex signaling based on an index of the first enhanced control channel element used for transmission of a corresponding EPDCCH downlink assignment in an uplink subframe, the index of the downlink subframe in which the EPDCCH downlink assignment is transmitted, and one or more configured parameters. Zhang at Para. [0007] The lowest eCCE index of the EPDCCH DL assignment scheduling the PDSCH data is used as a resource index in implicit PUCCH resource allocation. Additionally, a semi-static resource starting offset is configurable for each EPDCCH set (configuration of an EPDCCH set is UE specific), which may be used e.g. to avoid PUCCH resource collision between EPDCCH and PDCCH as well as different EPDCCH sets. Zhang at Para. [0029] Considering the efficiency of PUCCH resource utilization (or total PUCCH overhead in UL), the resource region for HARQ-ACK corresponding to PDSCH scheduled via PDCCH and/or different EPDCCH sets may be configured to be overlapped. To avoid collisions, a dynamic resource offset that is signaled in DL DCIs via EPDCCH (i.e. the same DCI the

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		schedules the PDSCH) might additionally be adopted. It should be noted that this dynamic offset may be viewed as a selection among multiple resources, and each resource should be linked to the implicitly derived resource (instead of explicitly configured resource, like format 1a/1b resource for SCell in CA). Zhang at Para. [0030] PUCCH (physical uplink control channel) carries uplink control information, and supports multiple formats, such as 1, 1a, 1b, 2, 2a, 2b, and 3. If PUCCH is enabled, there is at least one resource block in a frequency domain reserved for PUCCH. In a time domain, each slot has a PUCCH resource block in an FDD mode, and each uplink slot has a PUCCH RB in a TDD mode. PUCCH format 1/1a/1b resources are identified by a resource index. Zhang at Para. [0003] PUCCH format 1a/1b resource allocation for HARQ-ACKs corresponding to PDSCH transport block scheduled via EPDCCH was discussed in the 3GPP RAN1#70 meeting. It was agreed that: the lowest eCCE index of the corresponding EPDCCH is a component of PUCCH resource determination; UE is configured with a semi-static PUCCH resource starting offset for each EPDCCH set (eCCE is indexed per EPDCCH set); for further study until RAN1#70bis between: - option A) not to use dynamically signaled PUCCH resource offset by EPDCCH, - option B) dynamically signaled PUCCH resource offset by EPDCCH, whichever of options A and B is chosen, RRC signaling is not introduced; FFS until RAN1#70bis for localized EPDCCH among: - option X) not to use antenna port index, - option Y) to use antenna port index of EPDCCH, - option Z) to use antenna port index of PDSCH; TDD aspects are FFS—if solutions are needed, aim for solutions without RRC impact. Zhang at Paras. [0020]-[0027]

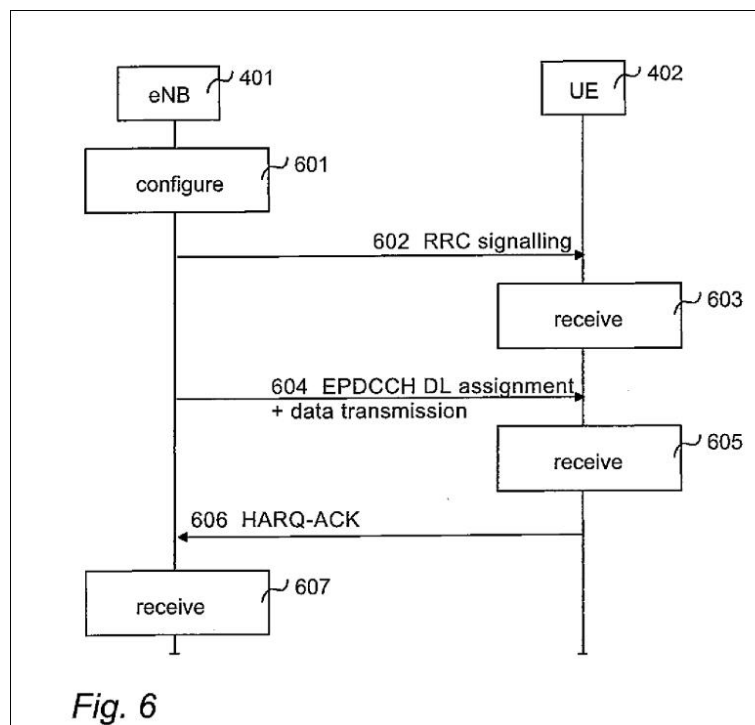
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		In an exemplary embodiment, the resource allocation formula for TDD may be described using the notation from a 3GPP specification as: $n_{PUCCH}^{(1)} = N_{UE-PUCCH-TDD}^{(1)} * m + n_{eCCE} + N_{UE-PUCCH}^{(1)} + k,$ where $N_{UE-PUCCH-TDD}^{(1)}$ is a parameter specific for a TDD operation. $N_{UE-PUCCH-TDD}^{(1)}$ may be configured semi-statically and signaled via RRC signaling, or it may be e.g. equal to or a multiple of the number eCCEs in the given EPDCCH set. A resulting PUCCH resource arrangement is shown in FIG. 2. n_{eCCE} is the number of the first eCCE used for transmission of the corresponding EPDCCH in subframe $n-k_m$. UE selects the corresponding m, where $m(0 \dots M-1)$ is the relative index of the DL subframe of PDSCH scheduled by EPDCCH derived from Table 1. k is a dynamic offset modifier such as an antenna port-specific offset associated with antenna port p, where p is the antenna port allocated to the first eCCE of a corresponding EPDCCH or other explicitly signaled or implicitly derived parameter. Zhang at Para. [0056]-[0057]. The signaling chart of FIG. 6 illustrates the required signaling. In the example of FIG. 6, a network node 401 (which may comprise e.g. a LTE-capable base station (eNode-B, eNB)) may transmit a configuration signal 602 to a user terminal 402 (UE), for configuring UE 402 to transmit a HARQ-ACK signal 606 by utilizing a PUCCH format 1a/b resource for EPDCCH signaling in TDD. This signaling 602 may be e.g. dedicated higher layer (i.e. higher than L1) signaling (e.g. RRC signaling). Before transmitting the signaling 602, eNB 401 may configure the resources in item 601. In item 603, UE 402 may receive the configuration signal 602. In item 604, a EPDCCH DL assignment and data is transmitted from eNB 401 to UE 402. In item 605, UE 402 receives the EPDCCH DL assignment which schedules DL data, wherein UE 402 detects EPDCCH eCCE and uses the index of the first eCCE in determining the HARQ-ACK resource. In step 605, UE 402 applies the resource allocation formula based on the configured parameters and the eCCE index. The formula gives as an output an UL (PUCCH) resource by which the HARQ-ACK 606 is

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transmitted from UE 402 to eNB 401. In item 606, UE 402 may transmit the HARQ-ACK signal 606 by utilizing the determined PUCCH format 1a/b resource for EPDCCH signaling in TDD. In item 607, eNB 401 may receive the HARQ-ACK signaling 606 from UE 402. Zhang at Para. [0076]



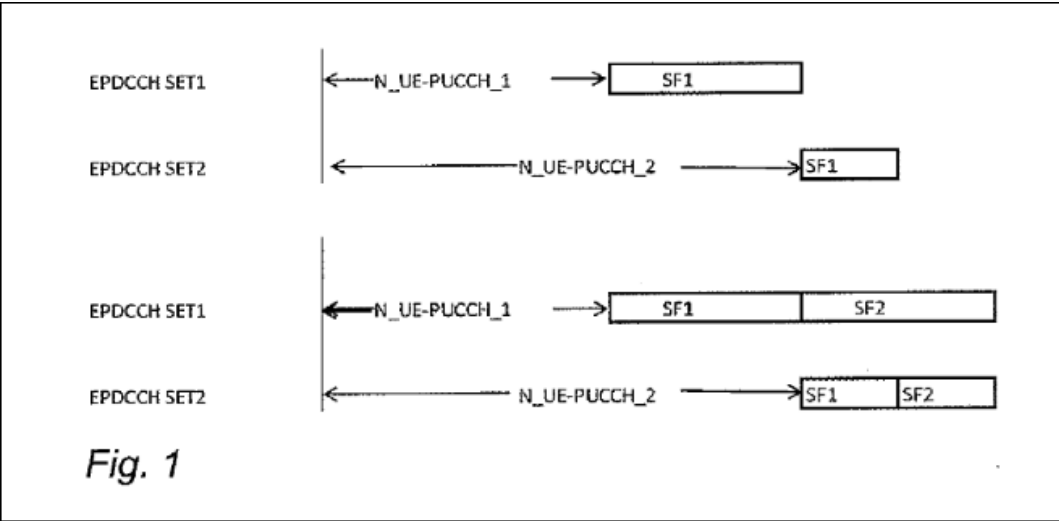
Zhang at Fig. 6.

Thus, according to an exemplary embodiment, there is provided a method for resource allocation in a communications system, comprising determining, in a network apparatus, PUCCH format 1a/1b resources for HARQ-ACK for time division duplex signaling based on an index of the first enhanced control channel element used for transmission of a corresponding EPDCCH downlink assignment in an uplink subframe, the index of the

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		downlink subframe in which the EPDCCH downlink assignment is transmitted, and one or more configured parameters. Zhang at Para. [0080]. According to yet another exemplary embodiment, a multi-subframe PUCCH format 1a/1b resource allocation is carried out for HARQ-ACK corresponding to PDSCH scheduled via EPDCCH. Zhang at [0082]. According to yet another exemplary embodiment, the dynamic offset modifier is applied such that it is independent on a subframe index m, wherein the dynamic offset modifier is derived based on downlink control information DCI that EPDCCH is carrying. Zhang at [0087]. According to yet another exemplary embodiment, the dynamic offset modifier is applied such that the dynamic offset modifier depends on a subframe index m, wherein multiple sets of dynamic offset modifiers are defined to be a matrix C with $(M-1)$ columns and N rows, N corresponding to the number of options to perform dynamic switching, M being the number of downlink subframes associated with an uplink subframe for HARQ-ACK feedback, and the subframe index m is used as one factor to determine the value of the dynamic offset modifier $k(n, m)$, where n is an index of dynamic switching option signaled as downlink control information DCI via EPDCCH. Zhang at Para. [0088]. According to yet another exemplary embodiment, the resource index of the ACK/NACK resource corresponding to the m-th subframe X_m is derived from the resource index of the first subframe X_0 as $X_0 + C(m)$, where $C(m)$ is a predefined constant number. Zhang at Para. [0089]. According to yet another exemplary embodiment, the at least one memory and the computer program code are configured to, with the at least one processor, cause the apparatus to apply the dynamic offset modifier such that it is independent on a subframe index m, wherein the dynamic offset modifier is derived based on downlink control information DCI that EPDCCH is carrying. Zhang at Para. [0097].

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		According to yet another exemplary embodiment, the at least one memory and the computer program code are configured to, with the at least one processor, cause the apparatus to schedule the PUCCH format 1a/1b resources for EPDCCH for time division duplex signaling based on formula I: $n_{PUCCH}^{(1)} = N_{UE-PUCCH-TDD}^{(1)} * m + n_{eCCE} + N_{UE-PUCCH}^{(1)} + k, \quad (II)$ $n_{PUCCH}^{(1)}$ is a PUCCH format 1a/1b resource to be allocated for a HARQ-ACK signal; $N_{UE-PUCCH}^{(1)}$ is the first semi-static user terminal-specific resource starting offset defined for an EPDCCH set; $N_{UE-PUCCH-TDD}^{(1)}$ is the second user terminal-specific resource offset defined for EPDCCH sets when $M > 1$, M being the number of downlink subframes associated with an uplink subframe for HARQ-ACK feedback, m being a relative index of a downlink subframe, wherein $0 \leq m \leq M-1$; n_{eCCE} is an index of the first enhanced control channel element eCCE used for transmission of a corresponding EPDCCH downlink assignment in a downlink subframe $n-k_m$, where m is the relative index of the downlink subframes and $0 \leq m \leq M-1$; k is a dynamic offset modifier. Zhang at Paras. [0101]-[0103].

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		$N_{\text{UE-PUCCH-TDD}_1}=0, N_{\text{UE-PUCCH-TDD}_2}=1$ $N_{\text{UE-PUCCH-TDD}}^{(1)} * (M-1) + m * L$ $N_{\text{UE-PUCCH-TDD}_1}$ $N_{\text{UE-PUCCH-TDD}_2}$ <i>Fig. 3</i> Zhang at Fig. 3.

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		 <i>Fig. 1</i> Zhang at Fig. 1. PCT 193 supports these disclosures. <i>See, e.g.</i>, PCT 193 at 3:15-31; 3:32-4:2; 4:3-11; 6:21-35; 7:12-16; 7:16-24; 7:33-8:1; 8:2-24; 8:25-31; 13:18-24; 14:29-35 To the extent it is found that Zhang does not expressly disclose this limitation, the limitation is inherent. Moreover, to the extent it is found that Zhang does not anticipate this claim, Zhang renders it obvious, either alone, in combination with the knowledge of a person of ordinary skill in the art, and/or in combination with other prior art references identified in the cover pleading or herein. A person of ordinary skill in the art would have been motivated to combine Zhang with any of the other prior art references identified in the cover pleading or herein with a reasonable expectation of success because each of these references contains familiar elements within the same field of endeavor to address the same known problems, according to known methods which would yield predictable results.
1[f]	wherein the start offset information of the resource allocated to the uplink control channel is	At least under Pegasus's apparent infringement theory, Zhang discloses the start offset information of the resource allocated to the uplink control channel is configured separated

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	configured separated from start offset information for a terminal different from the MTC terminal;	from start offset information for a terminal different from the MTC terminal. For example, Zhang discloses this limitation based on the following exemplary citations: The lowest eCCE index of the EPDCCH DL assignment scheduling the PDSCH data is used as a resource index in implicit PUCCH resource allocation. Additionally, a semi-static resource starting offset is configurable for each EPDCCH set (configuration of an EPDCCH set is UE specific), which may be used e.g. to avoid PUCCH resource collision between EPDCCH and PDCCH as well as different EPDCCH sets. Zhang at Para. [0029]. According to another exemplary embodiment, the one or more configured parameters comprising one or more of a first semi-static user terminal-specific resource starting offset defined for an EPDCCH set, a second user terminal-specific resource offset defined for each EPDCCH set, a dynamic offset modifier. Zhang at Para. [0081]. According to yet another exemplary embodiment, when $M=1$, the resource determination is independent of the second user terminal-specific resource offset. Zhang at Para. [0083]. According to yet another exemplary embodiment, for time division duplex signaling when $M>1$, the second user terminal-specific resource offset impacts resource allocation when PUCCH HARQ-ACK resources for multiple downlink subframes map into a single uplink subframe. Zhang at Para. [0084]. According to yet another exemplary embodiment, the offset for each EPDCCH set applied in each downlink subframe is dependent on the first semi-static user terminal-specific resource starting offset, the second user terminal-specific resource offset, and m, where $m(0 \dots M-1)$ is a relative index of the downlink subframe, M being the number of downlink subframes associated with an uplink subframe for HARQ-ACK feedback. Zhang at Para. [0085].

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		According to yet another exemplary embodiment, the dynamic offset modifier k is an antenna port-specific offset associated with antenna port p, where p is the antenna port allocated to the first control channel element CCE of corresponding EPDCCH or other explicitly signaled or implicitly derived parameter. Zhang at Para. [0091] PCT 193 supports these disclosures. <i>See, e.g.</i>, PCT 193 at 3:32-4:2; 4:12-13; 7:12-16; 7:33-8:1 To the extent it is found that Zhang does not expressly disclose this limitation, the limitation is inherent. Moreover, to the extent it is found that Zhang does not anticipate this claim, Zhang renders it obvious, either alone, in combination with the knowledge of a person of ordinary skill in the art, and/or in combination with other prior art references identified in the cover pleading or herein. A person of ordinary skill in the art would have been motivated to combine Zhang with any of the other prior art references identified in the cover pleading or herein with a reasonable expectation of success because each of these references contains familiar elements within the same field of endeavor to address the same known problems, according to known methods which would yield predictable results.
1[g]	wherein a plurality of pieces of start offset information of the resource allocated to the uplink control channel are provided, and the plurality of pieces of start offset information are received through cell-specific high layer signaling for the MTC terminal from a base station;	At least under Pegasus's apparent infringement theory, Zhang discloses a plurality of pieces of start offset information of the resource allocated to the uplink control channel are provided, and the plurality of pieces of start offset information are received through cell-specific high layer signaling for the MTC terminal from a base station. For example, Zhang discloses this limitation based on the following exemplary citations: The lowest eCCE index of the EPDCCH DL assignment scheduling the PDSCH data is used as a resource index in implicit PUCCH resource allocation. Additionally, a semi-static resource starting offset is configurable for each EPDCCH set (configuration of an EPDCCH set is UE specific), which may be used e.g. to avoid PUCCH resource collision between EPDCCH and PDCCH as well as different EPDCCH sets. Zhang at Para. [0029]

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		In the case of FDD, the PUCCH format 1a/1b HARQ-ACK resource in response to EPDCCH scheduled PDSCH may be described with the following formula (RAN1#70 agreement): $n_{PUCCH}^{(1)} = n_{eCCE} + N_{UE-PUCCH}^{(1)} + k$ where $n_{PUCCH}^{(1)}$ is the PUCCH format 1a/b resource for the HARQ-ACK, n_{eCCE} is the index of the lowest eCCE of the detected EPDCCH carrying the DL assignment, $N_{UE-PUCCH}^{(1)}$ is UE- and EPDCCH-set-specific PUCCH resources offset configured by higher layers (via a protocol layer higher than the physical layer), and k is a dynamic offset modifier such as an antenna port-specific offset associated with antenna port p, where p is the antenna port allocated to the first CCE of corresponding EPDCCH or other explicitly signaled or implicitly derived parameter. It should be noted that according to the decisions in RAN1#70, it has not yet been confirmed whether k is needed or not. Zhang at Paras. [0047]-[0048]. The signaling chart of FIG. 6 illustrates the required signaling. In the example of FIG. 6, a network node 401 (which may comprise e.g. a LTE-capable base station (eNode-B, eNB)) may transmit a configuration signal 602 to a user terminal 402 (UE), for configuring UE 402 to transmit a HARQ-ACK signal 606 by utilizing a PUCCH format 1a/b resource for EPDCCH signaling in TDD. This signaling 602 may be e.g. dedicated higher layer (i.e. higher than L1) signaling (e.g. RRC signaling). Before transmitting the signaling 602, eNB 401 may configure the resources in item 601. In item 603, UE 402 may receive the configuration signal 602. In item 604, a EPDCCH DL assignment and data is transmitted from eNB 401 to UE 402. In item 605, UE 402 receives the EPDCCH DL assignment which schedules DL data, wherein UE 402 detects EPDCCH eCCE and uses the index of the first eCCE in determining the HARQ-ACK resource. In step 605, UE 402 applies the resource allocation formula based on the configured parameters and the eCCE index. The formula gives as an output an UL (PUCCH) resource by which the HARQ-ACK 606 is

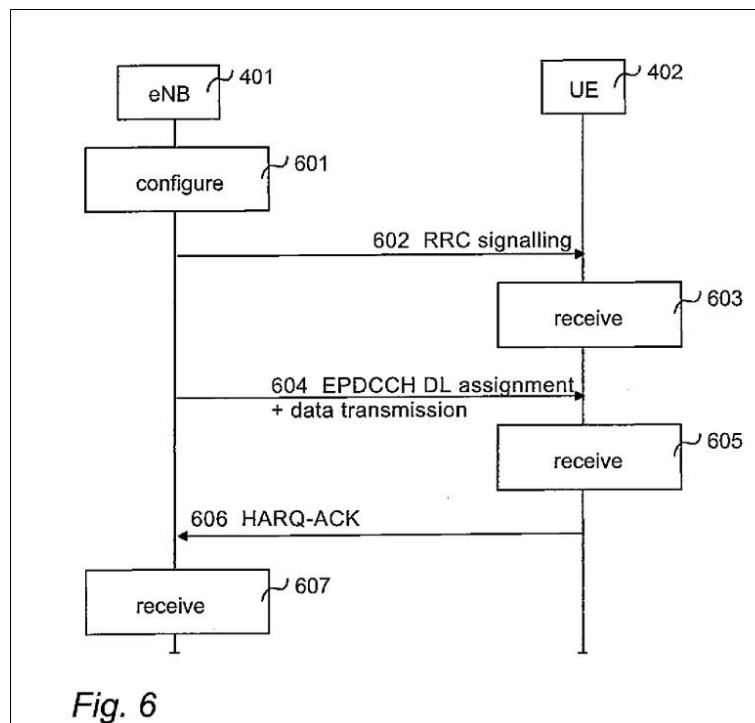
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		transmitted from UE 402 to eNB 401. In item 606, UE 402 may transmit the HARQ-ACK signal 606 by utilizing the determined PUCCH format 1a/b resource for EPDCCH signaling in TDD. In item 607, eNB 401 may receive the HARQ-ACK signaling 606 from UE 402. Zhang at Para. [0076]. FIG. 7 is a flow chart illustrating an exemplary embodiment. The apparatus 402, which may comprise e.g. a network element (network node, e.g. a user terminal, UE) receives, in item 701, from a network apparatus 401 (which may comprise e.g. a LTE base station eNB 401) a configuration signal for configuring UE 402 to transmit a HARQ-ACK signal by utilizing a PUCCH format 1a/b resource for EPDCCH signaling in TDD. The received configuration signaling may be e.g. dedicated higher layer signaling, e.g. RRC signaling. In item 702, UE 402 transmits a HARQ-ACK signal to eNB 401 by utilizing the configured PUCCH format 1a/b resource for EPDCCH signaling in TDD. Zhang at Para. [0077]. An exemplary embodiment of dynamic offset is where $k(\text{Res_i}, m)$ is defined to be $C(m)$ with $m \geq 1$. For example, when a predefined condition such as when $m=1$, the index of the A/N resource corresponding to the 2nd subframe is derived from the resource index of the first subframe $X_m=0$ as $(X_m=0)+C$, where C is a predefined number (e.g. 1 or 3). In more generic terms, there may be a matrix C with $(M-1)$ columns and n rows (n corresponds to number of options behind the dynamic switching). The matrix C may be configured via higher layers (via a protocol layer higher than the physical layer). Zhang at Para. [0055]. The signaling chart of FIG. 6 illustrates the required signaling. In the example of FIG. 6, a network node 401 (which may comprise e.g. a LTE-capable base station (eNode-B, eNB)) may transmit a configuration signal 602 to a user terminal 402 (UE), for configuring UE 402 to transmit a HARQ-ACK signal 606 by utilizing a PUCCH format 1a/b resource for EPDCCH signaling in TDD. This signaling 602 may be e.g. dedicated higher layer (i.e. higher than L1) signaling (e.g. RRC signaling). Before transmitting the signaling 602, eNB 401 may configure the resources in item 601. In item 603, UE 402 may receive the configuration signal 602. In item 604, a EPDCCH DL assignment and data is transmitted

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from eNB 401 to UE 402. In item 605, UE 402 receives the EPDCCH DL assignment which schedules DL data, wherein UE 402 detects EPDCCH eCCE and uses the index of the first eCCE in determining the HARQ-ACK resource. In step 605, UE 402 applies the resource allocation formula based on the configured parameters and the eCCE index. The formula gives as an output an UL (PUCCH) resource by which the HARQ-ACK 606 is transmitted from UE 402 to eNB 401. In item 606, UE 402 may transmit the HARQ-ACK signal 606 by utilizing the determined PUCCH format 1a/b resource for EPDCCH signaling in TDD. In item 607, eNB 401 may receive the HARQ-ACK signaling 606 from UE 402. Zhang at Para. [0076]



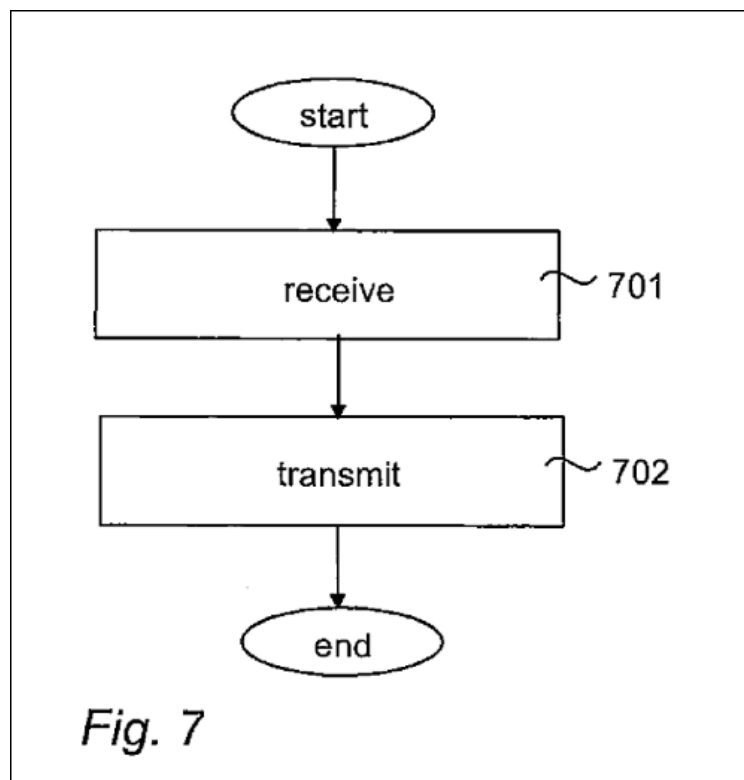
Zhang at Fig. 6.

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FIG. 7 is a flow chart illustrating an exemplary embodiment. The apparatus 402, which may comprise e.g. a network element (network node, e.g. a user terminal, UE) receives, in item 701, from a network apparatus 401 (which may comprise e.g. a LTE base station eNB 401) a configuration signal for configuring UE 402 to transmit a HARQ-ACK signal by utilizing a PUCCH format la/b resource for EPDCCH signaling in TDD. The received configuration signaling may be e.g. dedicated higher layer signaling, e.g. RRC signaling. In item 702, UE 402 transmits a HARQ-ACK signal to eNB 401 by utilizing the configured PUCCH format la/b resource for EPDCCH signaling in TDD. Zhang at Para. [0077]



Zhang at Fig. 7.

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		According to another exemplary embodiment, the one or more configured parameters comprising one or more of a first semi-static user terminal-specific resource starting offset defined for an EPDCCH set, a second user terminal-specific resource offset defined for each EPDCCH set, a dynamic offset modifier. Zhang at Para. [0081]. According to yet another exemplary embodiment, the matrix C is configured via a protocol layer higher than the physical layer. Zhang at Para. [0090]. PCT 193 supports these disclosures. <i>See, e.g.</i>, PCT 193 at 3:15-31; 3:32-4:2; 4:12-13, 6:21-35; 7:12-16; 7:33-8:1; 13:18-24; 13:35-14:8 To the extent it is found that Zhang does not expressly disclose this limitation, the limitation is inherent. Moreover, to the extent it is found that Zhang does not anticipate this claim, Zhang renders it obvious, either alone, in combination with the knowledge of a person of ordinary skill in the art, and/or in combination with other prior art references identified in the cover pleading or herein. A person of ordinary skill in the art would have been motivated to combine Zhang with any of the other prior art references identified in the cover pleading or herein with a reasonable expectation of success because each of these references contains familiar elements within the same field of endeavor to address the same known problems, according to known methods which would yield predictable results.
1[h]	wherein the start offset information on the resource allocated to the uplink control channel is determined based on a coverage level; and	At least under Pegasus's apparent infringement theory, Zhang discloses the start offset information on the resource allocated to the uplink control channel is determined based on a coverage level. For example, Zhang discloses this limitation based on the following exemplary citations: The lowest eCCE index of the EPDCCH DL assignment scheduling the PDSCH data is used as a resource index in implicit PUCCH resource allocation. Additionally, a semi-static resource starting offset is configurable for each EPDCCH set (configuration of an EPDCCH set is UE specific), which may be used e.g. to avoid PUCCH resource collision between EPDCCH and PDCCH as well as different EPDCCH sets.

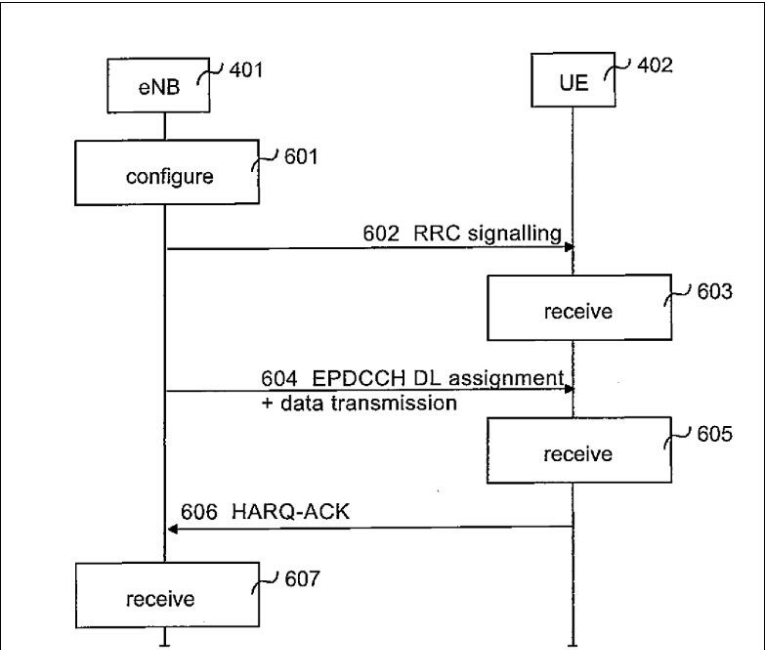
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		Zhang at Para. [0029]. In an exemplary embodiment, regarding enhancement of dynamic offset mechanism to solve multi-SF resource collision, besides the semi-static offset, it is proposed to apply an alternative/complementary dynamic offset modifier k for TDD on top of semi-static (+subframe specific) offset parameters. A starting point is to apply dynamic offset modifier which does not depend on the parameter m. In other words, dynamic offset modifier (if available) is derived from the content downlink control information which EPDCCH is carrying. Zhang at Para. [0053]. An exemplary embodiment relates to PUCCH format 1a/1b resource allocation for EPDCCH in TDD. An exemplary embodiment is handling the multi-SF PUCCH resource arrangement format 1a/1b resource allocation for EPDCCH in TDD. The definition of semi-static offset for each EPDCCH set is extended by considering multiple DL subframes, and dynamic offset mechanism is enhanced to solve the resource collision between multiple DL subframes. Zhang at Para. [0049]. According to yet another exemplary embodiment, the dynamic offset modifier is dependent on an antenna port or a power control command. Zhang at Para. [0086]. According to yet another exemplary embodiment, the dynamic offset modifier k is an antenna port-specific offset associated with antenna port p, where p is the antenna port allocated to the first control channel element CCE of corresponding EPDCCH or other explicitly signaled or implicitly derived parameter. Zhang at Para. [0091] According to yet another exemplary embodiment, the at least one memory and the computer program code are configured to, with the at least one processor, cause the apparatus to apply the dynamic offset modifier k dependent on an antenna port or a power control command. Zhang at Para. [0096] PCT 193 supports these disclosures. PCT 193 at 4:12-13; 6:36-7:5; 7:12-16; 7:33-8:1

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		To the extent it is found that Zhang does not expressly disclose this limitation, the limitation is inherent. Moreover, to the extent it is found that Zhang does not anticipate this claim, Zhang renders it obvious, either alone, in combination with the knowledge of a person of ordinary skill in the art, and/or in combination with other prior art references identified in the cover pleading or herein. A person of ordinary skill in the art would have been motivated to combine Zhang with any of the other prior art references identified in the cover pleading or herein with a reasonable expectation of success because each of these references contains familiar elements within the same field of endeavor to address the same known problems, according to known methods which would yield predictable results.
1[i]	wherein when the response information of the downlink data of the MTC terminal is repeatedly transmitted, the repeated transmission is performed using a same uplink control channel resource in each uplink subframe in which the uplink control channel is repeatedly transmitted.	At least under Pegasus's apparent infringement theory, Zhang discloses when the response information of the downlink data of the MTC terminal is repeatedly transmitted, the repeated transmission is performed using a same uplink control channel resource in each uplink subframe in which the uplink control channel is repeatedly transmitted. For example, Zhang discloses this limitation based on the following exemplary citations: An aspect of the invention relates to a method for resource allocation in a communications system, the method comprising determining, in a network apparatus, PUCCH format 1a/1b resources for HARQ-ACK for time division duplex signaling based on an index of the first enhanced control channel element used for transmission of a corresponding EPDCCH downlink assignment in an uplink subframe, the index of the downlink subframe in which the EPDCCH downlink assignment is transmitted, and one or more configured parameters. Zhang at Para. [0006]. The present invention is applicable to any user terminal, network node, server, corresponding component, and/or to any communication system or any combination of different communication systems that support PUCCH resource allocation for HARQ-ACK corresponding to PDSCH scheduled via EPDCCH. Other use cases related to EPDCCH may be considered as well, e.g. signaling related to semi-persistent scheduling. The communication system may be a fixed communication system or a wireless communication system or a communication system utilizing both fixed networks and wireless networks.

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		The protocols used, the specifications of communication systems, servers and user terminals, especially in wireless communication, develop rapidly. Such development may require extra changes to an embodiment. Therefore, all words and expressions should be interpreted broadly and they are intended to illustrate, not to restrict, the embodiment. Zhang at Para. [0067]. The signaling chart of FIG. 6 illustrates the required signaling. In the example of FIG. 6, a network node 401 (which may comprise e.g. a LTE-capable base station (eNode-B, eNB)) may transmit a configuration signal 602 to a user terminal 402 (UE), for configuring UE 402 to transmit a HARQ-ACK signal 606 by utilizing a PUCCH format 1a/b resource for EPDCCH signaling in TDD. This signaling 602 may be e.g. dedicated higher layer (i.e. higher than L1) signaling (e.g. RRC signaling). Before transmitting the signaling 602, eNB 401 may configure the resources in item 601. In item 603, UE 402 may receive the configuration signal 602. In item 604, a EPDCCH DL assignment and data is transmitted from eNB 401 to UE 402. In item 605, UE 402 receives the EPDCCH DL assignment which schedules DL data, wherein UE 402 detects EPDCCH eCCE and uses the index of the first eCCE in determining the HARQ-ACK resource. In step 605, UE 402 applies the resource allocation formula based on the configured parameters and the eCCE index. The formula gives as an output an UL (PUCCH) resource by which the HARQ-ACK 606 is transmitted from UE 402 to eNB 401. In item 606, UE 402 may transmit the HARQ-ACK signal 606 by utilizing the determined PUCCH format 1a/b resource for EPDCCH signaling in TDD. In item 607, eNB 401 may receive the HARQ-ACK signaling 606 from UE 402. Para. [0076]. FIG. 8 is a flow chart illustrating an exemplary embodiment. The apparatus 401, which may comprise e.g. a network element (network node 401, e.g. a LTE base station, eNB) transmits, in item 802, to another network element (network node 402, e.g. a user terminal, UE) a configuration signal for configuring UE 402 to transmit a HARQ-ACK signal by utilizing a PUCCH format 1a/b resource for EPDCCH signaling in TDD. The configuration signaling transmitted in item 802 may be e.g. dedicated higher layer signaling. Before

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		transmitting the signaling in item 802, eNB 401 may configure the resources in item 801. In item 803, eNB 401 may receive the HARQ-ACK signaling transmitted from UE 401 by utilizing the configured PUCCH format 1a/b resource for EPDCCH signaling in TDD. Zhang at Para. [0078]. Thus, according to an exemplary embodiment, there is provided a method for resource allocation in a communications system, comprising determining, in a network apparatus, PUCCH format 1a/1b resources for HARQ-ACK for time division duplex signaling based on an index of the first enhanced control channel element used for transmission of a corresponding EPDCCH downlink assignment in an uplink subframe, the index of the downlink subframe in which the EPDCCH downlink assignment is transmitted, and one or more configured parameters. Zhang at Para. [0080]. According to yet another exemplary embodiment, a multi-subframe PUCCH format 1a/1b resource allocation is carried out for HARQ-ACK corresponding to PDSCH scheduled via EPDCCH. Zhang at Para. [0082]. According to yet another exemplary embodiment, the method comprises scheduling the PUCCH format 1a/1b resources for EPDCCH for time division duplex signaling based on formula I: $n_{PUCCH(1)+k}^{(1)} = N_{UE-PUCCH-TDD}^{(1)} * m + n_{eCCE} + N_{UE-PUCCH}^{(1)} \quad (I)$ where nPUCCH (1) is a PUCCH format 1a/1b resource to be allocated for a HARQ-ACK signal; N_{UE-PUCCH} (1) is the first semi-static user terminal-specific resource starting offset defined for an EPDCCH set; N_{UE-PUCCH-TDD} (1) is the second user terminal-specific resource offset defined for EPDCCH sets when M>1, M being the number of downlink subframes associated with an uplink subframe for HARQ-ACK feedback, m

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		being a relative index of a downlink subframe, wherein $0 \leq m \leq M-1$; n_{eCCE} is an index of the first enhanced control channel element $eCCE$ used for transmission of a corresponding EPDCCH downlink assignment in a downlink subframe $n-km$, where m is the relative index of the downlink subframes and $0 \leq m \leq M-1$; k is the dynamic offset modifier. Zhang at Paras. [0092]-[0093]. According to yet another exemplary embodiment, there is provided an apparatus comprising at least one processor; and at least one memory including a computer program code, wherein the at least one memory and the computer program code are configured to, with the at least one processor, cause the apparatus to determine PUCCH format 1a/1b resources for HARQ-ACK for time division duplex signaling based on an index of the first enhanced control channel element used for transmission of a corresponding EPDCCH downlink assignment in an uplink subframe, the index of the downlink subframe in which the EPDCCH downlink assignment is transmitted, and one or more configured parameters. Zhang at Para. [0094]. In an exemplary embodiment, a single semi-static UE-specific resource starting offset $N_{UE-PUCCH}^{(1)}$ may be configured for each EPDCCH set assuming $M=1$. Additionally, for the case of TDD, another parameter, $N_{UE-PUCCH-TDD}^{(1)}$ may be introduced impacting the resource allocation formula when $M>1$, i.e. when PUCCH HARQ-ACK resources for multiple DL subframes map into a single UL subframe. Zhang at Para. [0051]. The signaling chart of FIG. 6 illustrates the required signaling. In the example of FIG. 6, a network node 401 (which may comprise e.g. a LTE-capable base station (eNode-B, eNB)) may transmit a configuration signal 602 to a user terminal 402 (UE), for configuring UE 402 to transmit a HARQ-ACK signal 606 by utilizing a PUCCH format 1a/b resource for EPDCCH signaling in TDD. This signaling 602 may be e.g. dedicated higher layer (i.e. higher than L1) signaling (e.g. RRC signaling). Before transmitting the signaling 602, eNB 401 may configure the resources in item 601. In item 603, UE 402 may receive the configuration signal 602. In item 604, a EPDCCH DL assignment and data is transmitted from eNB 401 to UE 402. In item 605, UE 402 receives the EPDCCH DL assignment

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		which schedules DL data, wherein UE 402 detects EPDCCH eCCE and uses the index of the first eCCE in determining the HARQ-ACK resource. In step 605, UE 402 applies the resource allocation formula based on the configured parameters and the eCCE index. The formula gives as an output an UL (PUCCH) resource by which the HARQ-ACK 606 is transmitted from UE 402 to eNB 401. In item 606, UE 402 may transmit the HARQ-ACK signal 606 by utilizing the determined PUCCH format 1a/b resource for EPDCCH signaling in TDD. In item 607, eNB 401 may receive the HARQ-ACK signaling 606 from UE 402. Zhang at Para. [0076]  <pre> sequenceDiagram participant eNB as eNB 401 participant UE as UE 402 eNB->>UE: 602 RRC signalling Note over UE: receive 603 eNB->>UE: 604 EPDCCH DL assignment + data transmission Note over UE: receive 605 UE->>eNB: 606 HARQ-ACK Note over eNB: receive 607 </pre> <i>Fig. 6</i> Zhang at Fig. 6.

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		FIG. 7 is a flow chart illustrating an exemplary embodiment. The apparatus 402, which may comprise e.g. a network element (network node, e.g. a user terminal, UE) receives, in item 701, from a network apparatus 401 (which may comprise e.g. a LTE base station eNB 401) a configuration signal for configuring UE 402 to transmit a HARQ-ACK signal by utilizing a PUCCH format la/b resource for EPDCCH signaling in TDD. The received configuration signaling may be e.g. dedicated higher layer signaling, e.g. RRC signaling. In item 702, UE 402 transmits a HARQ-ACK signal to eNB 401 by utilizing the configured PUCCH format la/b resource for EPDCCH signaling in TDD. Zhang at Para. [0077] <pre> graph TD Start([start]) --> Receive[receive 701] Receive --> Transmit[transmit 702] Transmit --> End([end]) </pre> <i>Fig. 7</i> Zhang at Fig. 7. According to yet another exemplary embodiment, for time division duplex signaling when $M > 1$, the second user terminal-specific resource offset impacts resource allocation when

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		PUCCH HARQ-ACK resources for multiple downlink subframes map into a single uplink subframe. Zhang at Para. [0084]. PCT 193 supports these disclosures. <i>See, e.g.</i>, PCT 193 at 3:15-31; 3:32-4:2; 6:36-7:5; 7:6-11; 7:12-16; 7:16-24; 13:18-24; 13:35-14:8; 14:8-17 To the extent it is found that Zhang does not expressly disclose this limitation, the limitation is inherent. Moreover, to the extent it is found that Zhang does not anticipate this claim, Zhang renders it obvious, either alone, in combination with the knowledge of a person of ordinary skill in the art, and/or in combination with other prior art references identified in the cover pleading or herein. A person of ordinary skill in the art would have been motivated to combine Zhang with any of the other prior art references identified in the cover pleading or herein with a reasonable expectation of success because each of these references contains familiar elements within the same field of endeavor to address the same known problems, according to known methods which would yield predictable results.

2. Claim 2

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2	The method of claim 1, wherein: at least one of the plurality of pieces of start offset information is applied according to a corresponding coverage level of the MTC terminal.	At least under Pegasus's apparent infringement theory, Zhang discloses at least one of the plurality of pieces of start offset information is applied according to a corresponding coverage level of the MTC terminal. For example, Zhang discloses this limitation based on the following exemplary citations: <i>See</i> limitation 1[h]. To the extent it is found that Zhang does not expressly disclose this limitation, the limitation is inherent. Moreover, to the extent it is found that Zhang does not anticipate this claim, Zhang renders it obvious, either alone, in combination with the knowledge of a person of ordinary skill in the art, and/or in combination with other prior art references

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		identified in the cover pleading or herein. A person of ordinary skill in the art would have been motivated to combine Zhang with any of the other prior art references identified in the cover pleading or herein with a reasonable expectation of success because each of these references contains familiar elements within the same field of endeavor to address the same known problems, according to known methods which would yield predictable results.

3. Claim 3

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Claim Language		Exemplary Citations to Zhang
3[pre]	A method of configuring a resource of response information of downlink data for a Machine Type Communication (MTC) terminal in a base station, the method comprising:	To the extent the preamble is limiting, at least under Pegasus's apparent infringement theory, Zhang discloses a method of configuring a resource of response information of downlink data for a Machine Type Communication (MTC) terminal in a base station. For example, Zhang discloses this limitation based on the following exemplary citations: See limitation 1[pre]. A further aspect of the invention relates to an apparatus comprising at least one processor; and at least one memory including a computer program code, wherein the at least one memory and the computer program code are configured to, with the at least one processor, cause the apparatus to determine PUCCH format 1a/1b resources for HARQ-ACK for time division duplex signaling based on an index of the first enhanced control channel element used for transmission of a corresponding EPDCCH downlink assignment in an uplink subframe, the index of the downlink subframe in which the EPDCCH downlink assignment is transmitted, and one or more configured parameters. Zhang at Para. [0007] The present invention is applicable to any user terminal, network node, server, corresponding component, and/or to any communication system or any combination of different communication systems that support PUCCH resource allocation for HARQ-ACK corresponding to PDSCH scheduled via EPDCCH. Other use cases related to

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Claim Language		Exemplary Citations to Zhang
		EPDCCH may be considered as well, e.g. signaling related to semi-persistent scheduling. The communication system may be a fixed communication system or a wireless communication system or a communication system utilizing both fixed networks and wireless networks. The protocols used, the specifications of communication systems, servers and user terminals, especially in wireless communication, develop rapidly. Such development may require extra changes to an embodiment. Therefore, all words and expressions should be interpreted broadly and they are intended to illustrate, not to restrict, the embodiment. Zhang at Para. [0067]. The exemplary radio system of FIG. 4 comprises a network node 401 of a network operator. The network node 401 may include e.g. an LTE base station (eNB), radio network controller (RNC), or any other network element, or a combination of network elements. The network node 401 may be connected to one or more core network (CN) elements (not shown in FIG. 4) such as a mobile switching centre (MSC), MSC server (MSS), mobility management entity (MME), gateway GPRS support node (GGSN), serving GPRS support node (SGSN), home location register (HLR), home subscriber server (HSS), visitor location register (VLR). In FIG. 4, the radio network node 401 that may also be called eNB (enhanced node-B, evolved node-B) or network apparatus of the radio system, hosts the functions for radio resource management in a public land mobile network. FIG. 4 shows one or more user equipment 402 located in the service area of the radio network node 401. The user equipment refers to a portable computing device, and it may also be referred to as a user terminal. Such computing devices include wireless mobile communication devices operating with or without a subscriber identification module (SIM) in hardware or in software, including, but not limited to, the following types of devices: mobile phone, smart-phone, personal digital assistant (PDA), handset, laptop computer. In the example situation of FIG. 4, the user equipment 402 is capable of connecting to the radio network node 401 via a connection 403. Zhang at Para. [0070].

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Claim Language

Exemplary Citations to Zhang

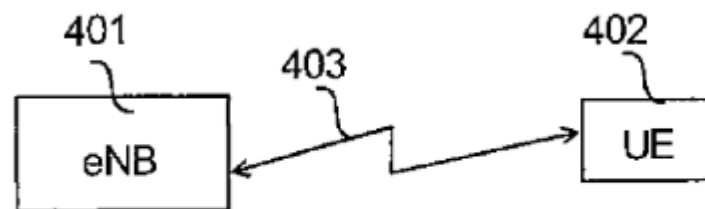


Fig. 4

Zhang at Fig. 4.

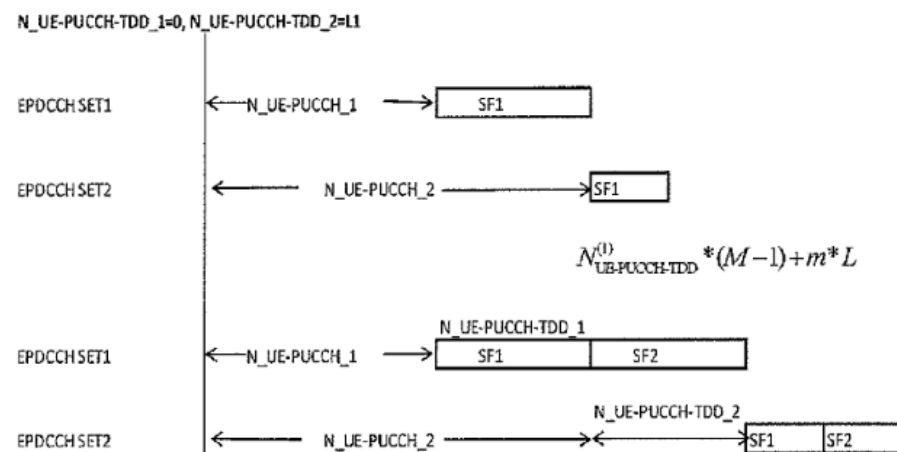
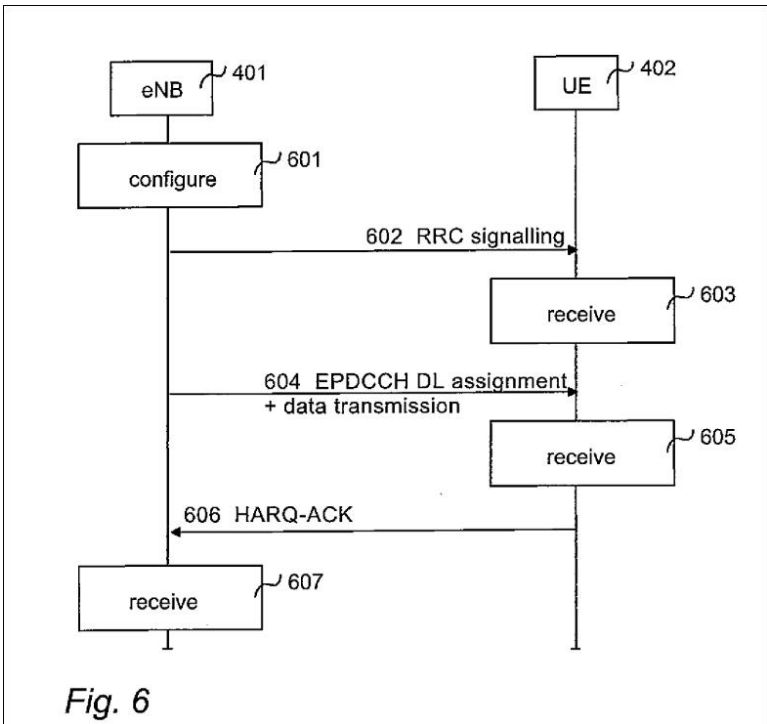


Fig. 3

Zhang at Fig. 3.

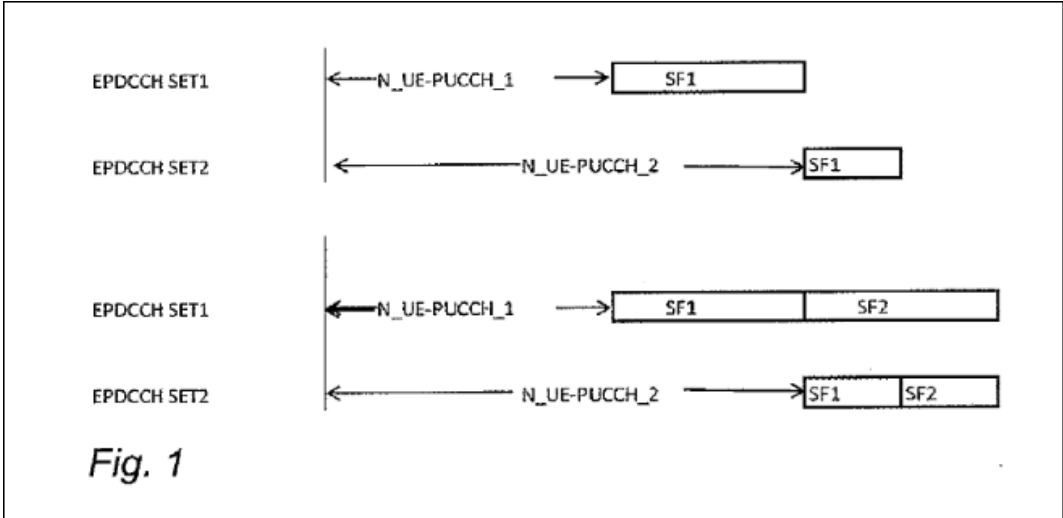
Invalidity of U.S. Patent 10,181,931 in view of Zhang		
Claim Language		Exemplary Citations to Zhang
		<i>Fig. 1</i> Zhang at Fig. 1. The signaling chart of FIG. 6 illustrates the required signaling. In the example of FIG. 6, a network node 401 (which may comprise e.g. a LTE-capable base station (eNode-B, eNB)) may transmit a configuration signal 602 to a user terminal 402 (UE), for configuring UE 402 to transmit a HARQ-ACK signal 606 by utilizing a PUCCH format 1a/b resource for EPDCCH signaling in TDD. This signaling 602 may be e.g. dedicated higher layer (i.e. higher than L1) signaling (e.g. RRC signaling). Before transmitting the signaling 602, eNB 401 may configure the resources in item 601. In item 603, UE 402 may receive the configuration signal 602. In item 604, a EPDCCH DL assignment and data is transmitted from eNB 401 to UE 402. In item 605, UE 402 receives the EPDCCH DL assignment which schedules DL data, wherein UE 402 detects EPDCCH eCCE and uses the index of the first eCCE in determining the HARQ-ACK resource. In step 605, UE 402 applies the resource allocation formula based on the configured parameters and the eCCE index. The formula gives as an output an UL (PUCCH) resource by which the HARQ-ACK 606 is

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		transmitted from UE 402 to eNB 401. In item 606, UE 402 may transmit the HARQ-ACK signal 606 by utilizing the determined PUCCH format 1a/b resource for EPDCCH signaling in TDD. In item 607, eNB 401 may receive the HARQ-ACK signaling 606 from UE 402. Zhang at Para. [0076]  <i>Fig. 6</i> Zhang at Fig. 6. FIG. 8 is a flow chart illustrating an exemplary embodiment. The apparatus 401, which may comprise e.g. a network element (network node 401, e.g. a LTE base station, eNB) transmits, in item 802, to another network element (network node 402, e.g. a user terminal, UE) a configuration signal for configuring UE 402 to transmit a HARQ-ACK signal by utilizing a PUCCH format 1a/b resource for EPDCCH signaling in TDD. The configuration

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		signaling transmitted in item 802 may be e.g. dedicated higher layer signaling. Before transmitting the signaling in item 802, eNB 401 may configure the resources in item 801. In item 803, eNB 401 may receive the HARQ-ACK signaling transmitted from UE 401 by utilizing the configured PUCCH format 1a/b resource for EPDCCH signaling in TDD. Zhang at Para. [0078]. <pre> graph TD Start([start]) --> Configure[configure 801] Configure --> Transmit[transmit 802] Transmit --> Receive[receive 803] Receive --> End([end]) </pre> <i>Fig. 8</i> Zhang at Fig. 8. PCT 193 supports these disclosures. <i>See, e.g.</i>, PCT 193 at 10:30-11:13; 13:18-24; 14:8-17 To the extent it is found that Zhang does not expressly disclose this limitation, the limitation is inherent. Moreover, to the extent it is found that Zhang does not anticipate this

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		claim, Zhang renders it obvious, either alone, in combination with the knowledge of a person of ordinary skill in the art, and/or in combination with other prior art references identified in the cover pleading or herein. A person of ordinary skill in the art would have been motivated to combine Zhang with any of the other prior art references identified in the cover pleading or herein with a reasonable expectation of success because each of these references contains familiar elements within the same field of endeavor to address the same known problems, according to known methods which would yield predictable results.
3[a]	transmitting structural information that contains at least one of i) information on a resource allocated to an uplink control channel for transmitting the response information and ii) start offset information on the resource allocated to the uplink control channel;	At least under Pegasus's apparent infringement theory, Zhang discloses transmitting structural information that contains at least one of i) information on a resource allocated to an uplink control channel for transmitting the response information and ii) start offset information on the resource allocated to the uplink control channel. For example, Zhang discloses this limitation based on the following exemplary citations: <i>See limitation 1[a].</i>

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		$N_{\text{UE-PUCCH-TDD}_1}=0, N_{\text{UE-PUCCH-TDD}_2}=L1$ $N_{\text{UE-PUCCH-TDD}}^{(1)} * (M-1) + m * L$ <i>Fig. 3</i> Zhang at Fig. 3.

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Claim Language		Exemplary Citations to Zhang
		 <i>Fig. 1</i> Zhang at Fig. 1. To the extent it is found that Zhang does not expressly disclose this limitation, the limitation is inherent. Moreover, to the extent it is found that Zhang does not anticipate this claim, Zhang renders it obvious, either alone, in combination with the knowledge of a person of ordinary skill in the art, and/or in combination with other prior art references identified in the cover pleading or herein. A person of ordinary skill in the art would have been motivated to combine Zhang with any of the other prior art references identified in the cover pleading or herein with a reasonable expectation of success because each of these references contains familiar elements within the same field of endeavor to address the same known problems, according to known methods which would yield predictable results.
3[b]	transmitting downlink control information for scheduling the downlink data; and	At least under Pegasus's apparent infringement theory, Zhang discloses transmitting downlink control information for scheduling the downlink data. For example, Zhang discloses this limitation based on the following exemplary citations: See limitation 1[b].

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Claim Language		Exemplary Citations to Zhang
		To the extent it is found that Zhang does not expressly disclose this limitation, the limitation is inherent. Moreover, to the extent it is found that Zhang does not anticipate this claim, Zhang renders it obvious, either alone, in combination with the knowledge of a person of ordinary skill in the art, and/or in combination with other prior art references identified in the cover pleading or herein. A person of ordinary skill in the art would have been motivated to combine Zhang with any of the other prior art references identified in the cover pleading or herein with a reasonable expectation of success because each of these references contains familiar elements within the same field of endeavor to address the same known problems, according to known methods which would yield predictable results.
3[c]	transmitting the downlink data,	At least under Pegasus's apparent infringement theory, Zhang discloses transmitting the downlink data. For example, Zhang discloses this limitation based on the following exemplary citations: <i>See</i> limitation 1[c]. To the extent it is found that Zhang does not expressly disclose this limitation, the limitation is inherent. Moreover, to the extent it is found that Zhang does not anticipate this claim, Zhang renders it obvious, either alone, in combination with the knowledge of a person of ordinary skill in the art, and/or in combination with other prior art references identified in the cover pleading or herein. A person of ordinary skill in the art would have been motivated to combine Zhang with any of the other prior art references identified in the cover pleading or herein with a reasonable expectation of success because each of these references contains familiar elements within the same field of endeavor to address the same known problems, according to known methods which would yield predictable results.
3[d]	wherein the resource of the uplink control channel for transmitting the response	At least under Pegasus's apparent infringement theory, Zhang discloses the resource of the uplink control channel for transmitting the response information of the downlink data is determined based on at least one piece of information on i) a resource of a downlink

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information of the downlink data is determined based on at least one piece of information on i) a resource of a downlink control channel for scheduling the downlink data; ii) the information on the resource allocated to the uplink control channel; and iii) the start offset information on the resource allocated to the uplink control channel;

Exemplary Citations to Zhang

control channel for scheduling the downlink data; ii) the information on the resource allocated to the uplink control channel; and iii) the start offset information on the resource allocated to the uplink control channel. For example, Zhang discloses this limitation based on the following exemplary citations:

See limitation 1[e].

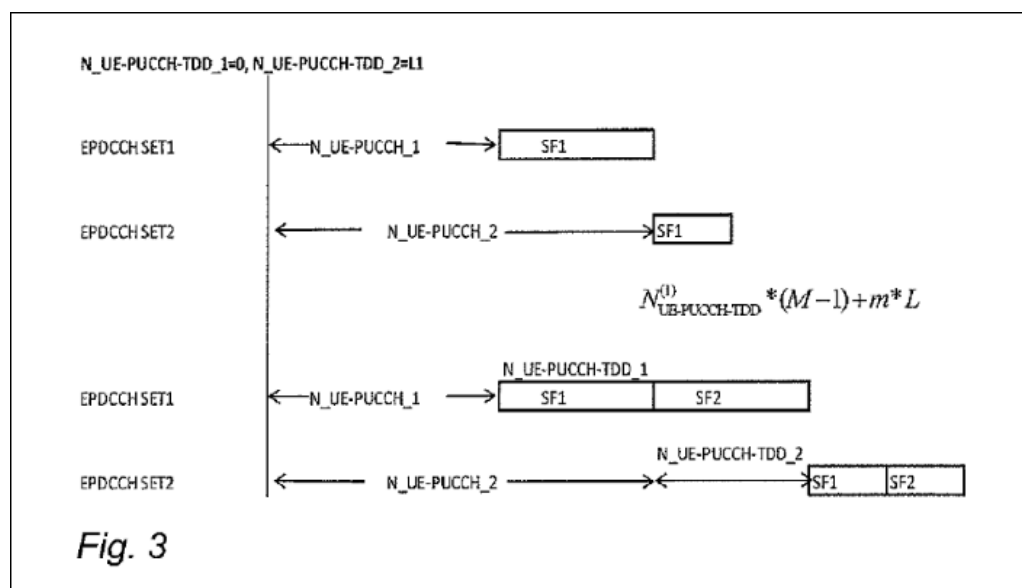
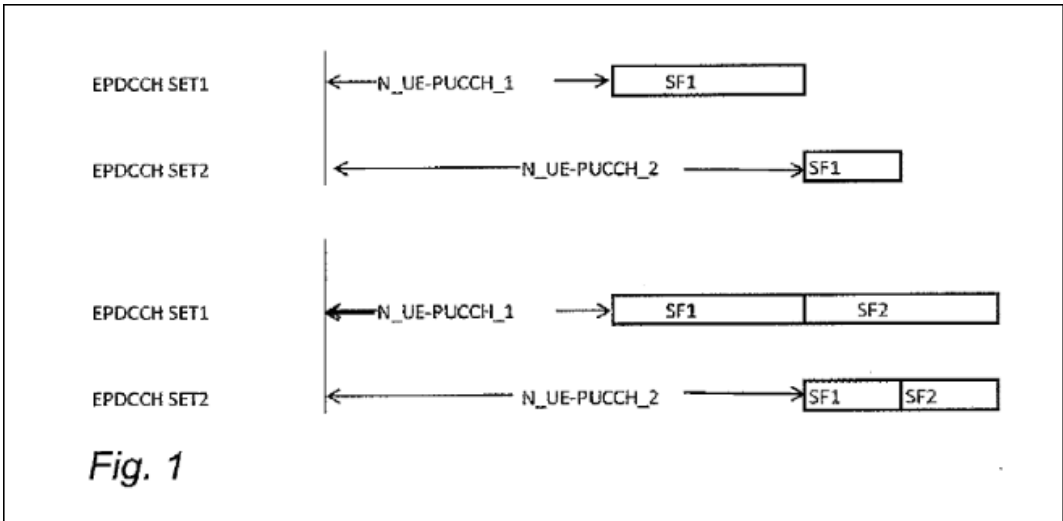


Fig. 3

Zhang at Fig. 3.

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Claim Language		Exemplary Citations to Zhang
		 The diagram, labeled Fig. 1, illustrates two scenarios for EPDCCH sets. In the top scenario, EPDCCH SET1 is associated with N_UE-PUCCH_1 and contains SF1. EPDCCH SET2 is associated with N_UE-PUCCH_2 and contains SF1. In the bottom scenario, EPDCCH SET1 is associated with N_UE-PUCCH_1 and contains SF1 and SF2. EPDCCH SET2 is associated with N_UE-PUCCH_2 and contains SF1 and SF2. The label 'Fig. 1' is positioned below the diagram. Zhang at Fig. 1. To the extent it is found that Zhang does not expressly disclose this limitation, the limitation is inherent. Moreover, to the extent it is found that Zhang does not anticipate this claim, Zhang renders it obvious, either alone, in combination with the knowledge of a person of ordinary skill in the art, and/or in combination with other prior art references identified in the cover pleading or herein. A person of ordinary skill in the art would have been motivated to combine Zhang with any of the other prior art references identified in the cover pleading or herein with a reasonable expectation of success because each of these references contains familiar elements within the same field of endeavor to address the same known problems, according to known methods which would yield predictable results.
3[e]	wherein the start offset information of the resource allocated to the uplink control channel is configured separated from offset	At least under Pegasus's apparent infringement theory, Zhang discloses the start offset information of the resource allocated to the uplink control channel is configured separated from offset information on a terminal different from the MTC terminal. For example, Zhang discloses this limitation based on the following exemplary citations:

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Claim Language		Exemplary Citations to Zhang
	information on a terminal different from the MTC terminal;	See limitation 1[f]. To the extent it is found that Zhang does not expressly disclose this limitation, the limitation is inherent. Moreover, to the extent it is found that Zhang does not anticipate this claim, Zhang renders it obvious, either alone, in combination with the knowledge of a person of ordinary skill in the art, and/or in combination with other prior art references identified in the cover pleading or herein. A person of ordinary skill in the art would have been motivated to combine Zhang with any of the other prior art references identified in the cover pleading or herein with a reasonable expectation of success because each of these references contains familiar elements within the same field of endeavor to address the same known problems, according to known methods which would yield predictable results.
3[f]	wherein a plurality of pieces of start offset information on the resource allocated to the uplink control channel are provided, and the plurality of pieces of start offset information are transmitted through cell-specific high layer signaling for the MTC terminal to the MTC terminal;	At least under Pegasus's apparent infringement theory, Zhang discloses a plurality of pieces of start offset information on the resource allocated to the uplink control channel are provided, and the plurality of pieces of start offset information are transmitted through cell-specific high layer signaling for the MTC terminal to the MTC terminal. For example, Zhang discloses this limitation based on the following exemplary citations: See limitation 1[g]. To the extent it is found that Zhang does not expressly disclose this limitation, the limitation is inherent. Moreover, to the extent it is found that Zhang does not anticipate this claim, Zhang renders it obvious, either alone, in combination with the knowledge of a person of ordinary skill in the art, and/or in combination with other prior art references identified in the cover pleading or herein. A person of ordinary skill in the art would have been motivated to combine Zhang with any of the other prior art references identified in the cover pleading or herein with a reasonable expectation of success because each of these references contains familiar elements within the same field of endeavor to address the same known problems, according to known methods which would yield predictable results.

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Claim Language		Exemplary Citations to Zhang
3[g]	wherein the start offset information on the resource allocated to the uplink control channel is determined based on a coverage level; and	At least under Pegasus's apparent infringement theory, Zhang discloses the start offset information on the resource allocated to the uplink control channel is determined based on a coverage level. For example, Zhang discloses this limitation based on the following exemplary citations: <i>See</i> limitation 1[h]. To the extent it is found that Zhang does not expressly disclose this limitation, the limitation is inherent. Moreover, to the extent it is found that Zhang does not anticipate this claim, Zhang renders it obvious, either alone, in combination with the knowledge of a person of ordinary skill in the art, and/or in combination with other prior art references identified in the cover pleading or herein. A person of ordinary skill in the art would have been motivated to combine Zhang with any of the other prior art references identified in the cover pleading or herein with a reasonable expectation of success because each of these references contains familiar elements within the same field of endeavor to address the same known problems, according to known methods which would yield predictable results.
3[h]	wherein when the response information of the downlink data of the MTC terminal is repeatedly transmitted, the repeated transmission is performed using a same uplink control channel resource in each uplink subframe in which the uplink control channel is repeatedly transmitted.	At least under Pegasus's apparent infringement theory, Zhang discloses when the response information of the downlink data of the MTC terminal is repeatedly transmitted, the repeated transmission is performed using a same uplink control channel resource in each uplink subframe in which the uplink control channel is repeatedly transmitted. For example, Zhang discloses this limitation based on the following exemplary citations: <i>See</i> limitation 1[i]. To the extent it is found that Zhang does not expressly disclose this limitation, the limitation is inherent. Moreover, to the extent it is found that Zhang does not anticipate this claim, Zhang renders it obvious, either alone, in combination with the knowledge of a person of ordinary skill in the art, and/or in combination with other prior art references identified in the cover pleading or herein. A person of ordinary skill in the art would have been motivated to combine Zhang with any of the other prior art references identified in

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Claim Language		Exemplary Citations to Zhang
		the cover pleading or herein with a reasonable expectation of success because each of these references contains familiar elements within the same field of endeavor to address the same known problems, according to known methods which would yield predictable results.

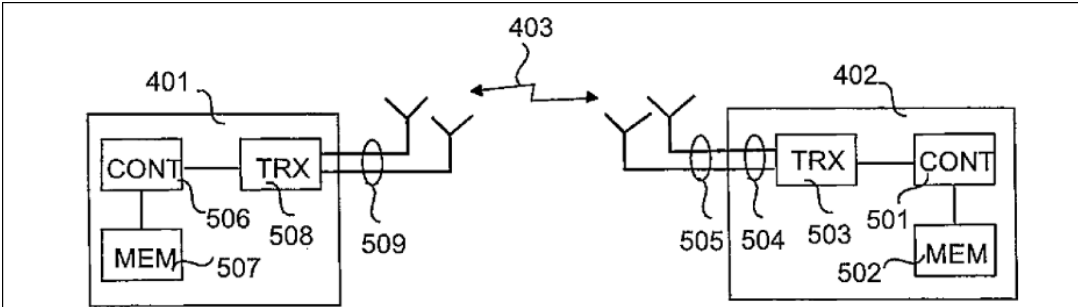
4. Claim 4

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Claim Language		Exemplary Citations to Zhang
4	The method of claim 3, wherein: at least one of the plurality of pieces of start offset information is applied according to a corresponding coverage level of the MTC terminal.	At least under Pegasus's apparent infringement theory, Zhang discloses at least one of the plurality of pieces of start offset information is applied according to a corresponding coverage level of the MTC terminal. For example, Zhang discloses this limitation based on the following exemplary citations: <i>See every limitation of claim 3, claim 2, limitation 1[h].</i> To the extent it is found that Zhang does not expressly disclose this limitation, the limitation is inherent. Moreover, to the extent it is found that Zhang does not anticipate this claim, Zhang renders it obvious, either alone, in combination with the knowledge of a person of ordinary skill in the art, and/or in combination with other prior art references identified in the cover pleading or herein. A person of ordinary skill in the art would have been motivated to combine Zhang with any of the other prior art references identified in the cover pleading or herein with a reasonable expectation of success because each of these references contains familiar elements within the same field of endeavor to address the same known problems, according to known methods which would yield predictable results.

5. Claim 5

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Claim Language		Exemplary Citations to Zhang
5[pre]	A Machine Type Communication (MTC) terminal for transmitting response information of downlink data to a base station, the terminal comprising:	To the extent the preamble is limiting, at least under Pegasus's apparent infringement theory, Zhang discloses a Machine Type Communication (MTC) terminal for transmitting response information of downlink data to a base station. For example, Zhang discloses this limitation based on the following exemplary citations: See limitation 1[pre]. A still further aspect of the invention relates to a user terminal comprising at least one processor; and at least one memory including a computer program code, wherein the at least one memory and the computer program code are configured to, with the at least one processor, cause the user terminal to apply PUCCH format 1a/1b resource mapping for EPDCCH scheduled PDSCH for time division duplex signaling based on an index of the first enhanced control channel element used for transmission of a corresponding EPDCCH downlink assignment in an uplink subframe, the index of the downlink subframe in which the EPDCCH downlink assignment is transmitted, and one or more configured parameters. Zhang at Para. [0008] According to yet another exemplary embodiment, there is provided a user terminal comprising at least one processor; and at least one memory including a computer program code, wherein the at least one memory and the computer program code are configured to, with the at least one processor, cause the user terminal to apply PUCCH format 1a/1b resource mapping for EPDCCH scheduled PDSCH for time division duplex signaling based on an index of the first enhanced control channel element used for transmission of a corresponding EPDCCH downlink assignment in an uplink subframe, the index of the downlink subframe in which the EPDCCH downlink assignment is transmitted, and one or more configured parameters. Zhang at Para. [0104] The present invention is applicable to any user terminal, network node, server, corresponding component, and/or to any communication system or any combination of

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Claim Language		Exemplary Citations to Zhang
		different communication systems that support PUCCH resource allocation for HARQ-ACK corresponding to PDSCH scheduled via EPDCCH. Other use cases related to EPDCCH may be considered as well, e.g. signaling related to semi-persistent scheduling. The communication system may be a fixed communication system or a wireless communication system or a communication system utilizing both fixed networks and wireless networks. The protocols used, the specifications of communication systems, servers and user terminals, especially in wireless communication, develop rapidly. Such development may require extra changes to an embodiment. Therefore, all words and expressions should be interpreted broadly and they are intended to illustrate, not to restrict, the embodiment. Zhang at Para. [0067]. FIG. 5 is a block diagram of an apparatus according to an embodiment of the invention. FIG. 5 shows a user equipment 402 located in the area of a radio network node 401. The user equipment 402 is configured to be in connection with the radio network node 401. The user equipment or UE 402 comprises a controller 501 operationally connected to a memory 502 and a transceiver 503. The controller 501 controls the operation of the user equipment 402. The memory 502 is configured to store software and data. The transceiver 503 is configured to set up and maintain a wireless connection 403 to the radio network node 401. The transceiver 503 is operationally connected to a set of antenna ports 504 connected to an antenna arrangement 505. The antenna arrangement 505 may comprise a set of antennas. The number of antennas may be one to four, for example. The number of antennas is not limited to any particular number. The user equipment 402 may also comprise various other components, such as a user interface, camera, and media player. They are not displayed in the figure due to simplicity. The radio network node 401, such as an LTE base station (eNode-B, eNB) comprises a controller 506 operationally connected to a memory 507, and a transceiver 508. The controller 506 controls the operation of the radio network node 401. The memory 507 is configured to store software and data. The transceiver 508 is configured to set up and maintain a wireless connection to the user equipment 402 within the service area of the radio network node 401. The transceiver 508 is operationally connected to an antenna arrangement 509. The antenna arrangement 509 may comprise a set of antennas. The number of antennas may be two to

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Claim Language		Exemplary Citations to Zhang
		four, for example. The number of antennas is not limited to any particular number. The radio network node 401 may be operationally connected (directly or indirectly) to another network element (not shown in FIG. 6) of the communication system, such as a radio network controller (RNC), a mobility management entity (MME), an MSC server (MSS), a mobile switching centre (MSC), a radio resource management (RRM) node, a gateway GPRS support node, an operations, administrations and maintenance (OAM) node, a home location register (HLR), a visitor location register (VLR), a serving GPRS support node, a gateway, and/or a server, via an interface. The embodiments are not, however, restricted to the network given above as an example, but a person skilled in the art may apply the solution to other communication networks provided with the necessary properties. For example, the connections between different network elements may be realized with internet protocol (IP) connections. Zhang at Para. [0071]  Fig. 5 Zhang at Fig. 5. The signaling chart of FIG. 6 illustrates the required signaling. In the example of FIG. 6, a network node 401 (which may comprise e.g. a LTE-capable base station (eNode-B, eNB)) may transmit a configuration signal 602 to a user terminal 402 (UE), for configuring UE 402 to transmit a HARQ-ACK signal 606 by utilizing a PUCCH format 1a/b resource for EPDCCH signaling in TDD. This signaling 602 may be e.g. dedicated higher layer (i.e. higher than L1) signaling (e.g. RRC signaling). Before transmitting the signaling 602,

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Claim Language		Exemplary Citations to Zhang
		eNB 401 may configure the resources in item 601. In item 603, UE 402 may receive the configuration signal 602. In item 604, a EPDCCH DL assignment and data is transmitted from eNB 401 to UE 402. In item 605, UE 402 receives the EPDCCH DL assignment which schedules DL data, wherein UE 402 detects EPDCCH eCCE and uses the index of the first eCCE in determining the HARQ-ACK resource. In step 605, UE 402 applies the resource allocation formula based on the configured parameters and the eCCE index. The formula gives as an output an UL (PUCCH) resource by which the HARQ-ACK 606 is transmitted from UE 402 to eNB 401. In item 606, UE 402 may transmit the HARQ-ACK signal 606 by utilizing the determined PUCCH format 1a/b resource for EPDCCH signaling in TDD. In item 607, eNB 401 may receive the HARQ-ACK signaling 606 from UE 402. Zhang at Para. [0076] <pre> sequenceDiagram participant eNB as eNB 401 participant UE as UE 402 eNB->>UE: 601 configure eNB->>UE: 602 RRC signalling eNB->>UE: 604 EPDCCH DL assignment + data transmission UE->>eNB: 606 HARQ-ACK eNB->>UE: 607 receive </pre> <i>Fig. 6</i>

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Claim Language		Exemplary Citations to Zhang
		Zhang at Fig. 6. According to yet another exemplary embodiment, there is provided a user terminal comprising at least one processor; and at least one memory including a computer program code, wherein the at least one memory and the computer program code are configured to, with the at least one processor, cause the user terminal to apply PUCCH format 1a/1b resource mapping for EPDCCH scheduled PDSCH for time division duplex signaling based on an index of the first enhanced control channel element used for transmission of a corresponding EPDCCH downlink assignment in an uplink subframe, the index of the downlink subframe in which the EPDCCH downlink assignment is transmitted, and one or more configured parameters. Zhang at Para. [0104]. PCT 193 supports these disclosures. See PCT 193 at 2:15-23; 4:12-13; 11:13-12:10; 13:18-34; To the extent it is found that Zhang does not expressly disclose this limitation, the limitation is inherent. Moreover, to the extent it is found that Zhang does not anticipate this claim, Zhang renders it obvious, either alone, in combination with the knowledge of a person of ordinary skill in the art, and/or in combination with other prior art references identified in the cover pleading or herein. A person of ordinary skill in the art would have been motivated to combine Zhang with any of the other prior art references identified in the cover pleading or herein with a reasonable expectation of success because each of these references contains familiar elements within the same field of endeavor to address the same known problems, according to known methods which would yield predictable results.
5[a]	a receiving unit configured to receive structural information that contains at least one piece of i) information on a resource allocated to an uplink control channel for transmitting the	At least under Pegasus's apparent infringement theory, Zhang discloses a receiving unit configured to receive structural information that contains at least one piece of i) information on a resource allocated to an uplink control channel for transmitting the response information and ii) start offset information on the resource to which the uplink control channel is allocated, configured to receive downlink control information for

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Claim Language		Exemplary Citations to Zhang
	response information and ii) start offset information on the resource to which the uplink control channel is allocated, configured to receive downlink control information for scheduling the downlink data, and configured to receive the downlink data;	scheduling the downlink data, and configured to receive the downlink data. For example, Zhang discloses this limitation based on the following exemplary citations: See limitations 1[a], 1[b], and 1[c]. To the extent it is found that Zhang does not expressly disclose this limitation, the limitation is inherent. Moreover, to the extent it is found that Zhang does not anticipate this claim, Zhang renders it obvious, either alone, in combination with the knowledge of a person of ordinary skill in the art, and/or in combination with other prior art references identified in the cover pleading or herein. A person of ordinary skill in the art would have been motivated to combine Zhang with any of the other prior art references identified in the cover pleading or herein with a reasonable expectation of success because each of these references contains familiar elements within the same field of endeavor to address the same known problems, according to known methods which would yield predictable results.
5[b]	a controller configured to determine a resource allocated to the uplink control channel for transmitting the response information of the downlink data based on at least one of i) information on a resource of a downlink control channel for scheduling the downlink data, ii) the information on the resource allocated to the uplink control channel, and iii) the start offset information on the resource allocated to the uplink control channel; and	At least under Pegasus's apparent infringement theory, Zhang discloses a controller configured to determine a resource allocated to the uplink control channel for transmitting the response information of the downlink data based on at least one of i) information on a resource of a downlink control channel for scheduling the downlink data, ii) the information on the resource allocated to the uplink control channel, and iii) the start offset information on the resource allocated to the uplink control channel. For example, Zhang discloses this limitation based on the following exemplary citations: See limitation 1[e]. To the extent it is found that Zhang does not expressly disclose this limitation, the limitation is inherent. Moreover, to the extent it is found that Zhang does not anticipate this claim, Zhang renders it obvious, either alone, in combination with the knowledge of a person of ordinary skill in the art, and/or in combination with other prior art references identified in the cover pleading or herein. A person of ordinary skill in the art would have been motivated to combine Zhang with any of the other prior art references identified in

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		the cover pleading or herein with a reasonable expectation of success because each of these references contains familiar elements within the same field of endeavor to address the same known problems, according to known methods which would yield predictable results.
5[c]	a transmitting unit configured to transmit the response information of the downlink data by using the determined resource of the uplink control channel,	At least under Pegasus's apparent infringement theory, Zhang discloses a transmitting unit configured to transmit the response information of the downlink data by using the determined resource of the uplink control channel. For example, Zhang discloses this limitation based on the following exemplary citations: See limitation 1[d]. To the extent it is found that Zhang does not expressly disclose this limitation, the limitation is inherent. Moreover, to the extent it is found that Zhang does not anticipate this claim, Zhang renders it obvious, either alone, in combination with the knowledge of a person of ordinary skill in the art, and/or in combination with other prior art references identified in the cover pleading or herein. A person of ordinary skill in the art would have been motivated to combine Zhang with any of the other prior art references identified in the cover pleading or herein with a reasonable expectation of success because each of these references contains familiar elements within the same field of endeavor to address the same known problems, according to known methods which would yield predictable results.
5[d]	wherein the start offset information of the resource allocated to the uplink control channel is configured separated from offset information on a terminal different from the MTC terminal;	At least under Pegasus's apparent infringement theory, Zhang discloses the start offset information of the resource allocated to the uplink control channel is configured separated from offset information on a terminal different from the MTC terminal. For example, Zhang discloses this limitation based on the following exemplary citations: See limitation 1[f]. To the extent it is found that Zhang does not expressly disclose this limitation, the limitation is inherent. Moreover, to the extent it is found that Zhang does not anticipate

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		this claim, Zhang renders it obvious, either alone, in combination with the knowledge of a person of ordinary skill in the art, and/or in combination with other prior art references identified in the cover pleading or herein. A person of ordinary skill in the art would have been motivated to combine Zhang with any of the other prior art references identified in the cover pleading or herein with a reasonable expectation of success because each of these references contains familiar elements within the same field of endeavor to address the same known problems, according to known methods which would yield predictable results.
5[e]	wherein a plurality of pieces of start offset information on the resource allocated to the uplink control channel are provided, and the plurality of pieces of start offset information are received through cell-specific high layer signaling for the MTC terminal from the base station;	At least under Pegasus's apparent infringement theory, Zhang discloses a plurality of pieces of start offset information on the resource allocated to the uplink control channel are provided, and the plurality of pieces of start offset information are received through cell-specific high layer signaling for the MTC terminal from the base station. For example, Zhang discloses this limitation based on the following exemplary citations: See limitation 1[g]. To the extent it is found that Zhang does not expressly disclose this limitation, the limitation is inherent. Moreover, to the extent it is found that Zhang does not anticipate this claim, Zhang renders it obvious, either alone, in combination with the knowledge of a person of ordinary skill in the art, and/or in combination with other prior art references identified in the cover pleading or herein. A person of ordinary skill in the art would have been motivated to combine Zhang with any of the other prior art references identified in the cover pleading or herein with a reasonable expectation of success because each of these references contains familiar elements within the same field of endeavor to address the same known problems, according to known methods which would yield predictable results.
5[f]	wherein the start offset information on the resource allocated to the uplink control	At least under Pegasus's apparent infringement theory, Zhang discloses the start offset information on the resource allocated to the uplink control channel is determined based on a coverage level. For example, Zhang discloses this limitation based on the following exemplary citations:

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	channel is determined based on a coverage level; and	See limitation 1[h]. To the extent it is found that Zhang does not expressly disclose this limitation, the limitation is inherent. Moreover, to the extent it is found that Zhang does not anticipate this claim, Zhang renders it obvious, either alone, in combination with the knowledge of a person of ordinary skill in the art, and/or in combination with other prior art references identified in the cover pleading or herein. A person of ordinary skill in the art would have been motivated to combine Zhang with any of the other prior art references identified in the cover pleading or herein with a reasonable expectation of success because each of these references contains familiar elements within the same field of endeavor to address the same known problems, according to known methods which would yield predictable results.
5[g]	wherein when the response information of the downlink data of the MTC terminal is repeatedly transmitted, the repeated transmission is performed using a same uplink control channel resource in each uplink subframe in which the uplink control channel is repeatedly transmitted.	At least under Pegasus's apparent infringement theory, Zhang discloses when the response information of the downlink data of the MTC terminal is repeatedly transmitted, the repeated transmission is performed using a same uplink control channel resource in each uplink subframe in which the uplink control channel is repeatedly transmitted. For example, Zhang discloses this limitation based on the following exemplary citations: See limitation 1[i]. To the extent it is found that Zhang does not expressly disclose this limitation, the limitation is inherent. Moreover, to the extent it is found that Zhang does not anticipate this claim, Zhang renders it obvious, either alone, in combination with the knowledge of a person of ordinary skill in the art, and/or in combination with other prior art references identified in the cover pleading or herein. A person of ordinary skill in the art would have been motivated to combine Zhang with any of the other prior art references identified in the cover pleading or herein with a reasonable expectation of success because each of these references contains familiar elements within the same field of endeavor to address the same known problems, according to known methods which would yield predictable results.

6. Claim 6

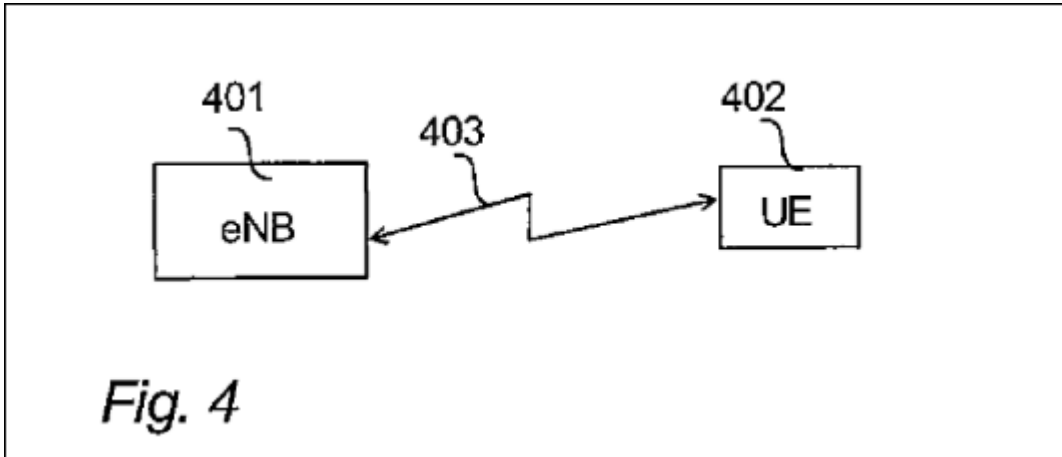
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6	The MTC terminal of claim 5, wherein: at least one of the plurality of pieces of start offset information is applied according to a corresponding coverage level of the MTC terminal.	At least under Pegasus’s apparent infringement theory, Zhang discloses at least one of the plurality of pieces of start offset information is applied according to a corresponding coverage level of the MTC terminal. For example, Zhang discloses this limitation based on the following exemplary citations: <i>See every limitation of claim 5, claim 2, limitation 1[h].</i> To the extent it is found that Zhang does not expressly disclose this limitation, the limitation is inherent. Moreover, to the extent it is found that Zhang does not anticipate this claim, Zhang renders it obvious, either alone, in combination with the knowledge of a person of ordinary skill in the art, and/or in combination with other prior art references identified in the cover pleading or herein. A person of ordinary skill in the art would have been motivated to combine Zhang with any of the other prior art references identified in the cover pleading or herein with a reasonable expectation of success because each of these references contains familiar elements within the same field of endeavor to address the same known problems, according to known methods which would yield predictable results.

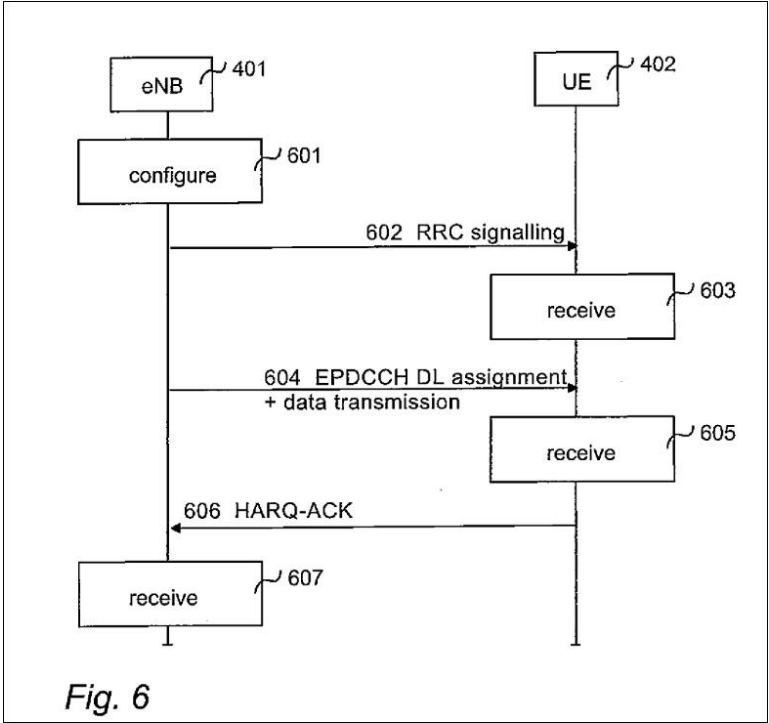
7. Claim 7

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7[pre]	A base station for configuring a resource of response information of downlink data for a Machine Type Communication (MTC)	To the extent the preamble is limiting, at least under Pegasus’s apparent infringement theory, Zhang discloses A base station for configuring a resource of response information of downlink data for a Machine Type Communication (MTC) terminal. For example, Zhang discloses this limitation based on the following exemplary citations: <i>See limitations 1[pre] and 3[pre].</i>

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	terminal, the base station comprising:	The present invention is applicable to any user terminal, network node, server, corresponding component, and/or to any communication system or any combination of different communication systems that support PUCCH resource allocation for HARQ-ACK corresponding to PDSCH scheduled via EPDCCH. Other use cases related to EPDCCH may be considered as well, e.g. signaling related to semi-persistent scheduling. The communication system may be a fixed communication system or a wireless communication system or a communication system utilizing both fixed networks and wireless networks. The protocols used, the specifications of communication systems, servers and user terminals, especially in wireless communication, develop rapidly. Such development may require extra changes to an embodiment. Therefore, all words and expressions should be interpreted broadly and they are intended to illustrate, not to restrict, the embodiment. Zhang at Para. [0067]. A further aspect of the invention relates to an apparatus comprising at least one processor; and at least one memory including a computer program code, wherein the at least one memory and the computer program code are configured to, with the at least one processor, cause the apparatus to determine PUCCH format 1a/1b resources for HARQ-ACK for time division duplex signaling based on an index of the first enhanced control channel element used for transmission of a corresponding EPDCCH downlink assignment in an uplink subframe, the index of the downlink subframe in which the EPDCCH downlink assignment is transmitted, and one or more configured parameters. Zhang at Para. [0007] In accordance with another aspect of the present invention, there is provided an evolved Node B (eNB) servicing a Long Term Evolution (LTE) communication system, the eNB configured to: receive Physical Random Access Channel (PRACH) preamble messages from a plurality of Terminal Equipments (TEs) of the LTE system, said TEs including a Limited Capability Terminal Equipment (LTE), at least one PRACH preamble from a predetermined subset of PRACH preambles, said subset being strictly smaller than a set of all PRACH preambles used by the plurality of TEs, the at least one PRACH preamble

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		included in a corresponding PRACH preamble message; and upon receipt of the at least one PRACH preamble belonging to said subset, schedule transmission of an associated random access response (RAR) on a restricted set of physical resource blocks (PRBs) which is predictable and accessible to said LCTE, the restricted set of PRBs being strictly smaller than a set of all PRBs used in the LTE communication system, wherein the restricted set of PRBs is identified by a function commonly known to both the eNB and the LCTE or the eNB is configured to communicate the restricted set of PRBs to the LCTE via a System Information Block, SIB; monitor one or more indicators of system performance indicative of a usage distribution of the set of all PRACH preambles and to adjust a size of the predetermined subset of PRACH preambles based on said one or more indicators of system performance and to facilitate an increased evenness in said usage distribution. Zhang at Para. [0010] The exemplary radio system of FIG. 4 comprises a network node 401 of a network operator. The network node 401 may include e.g. an LTE base station (eNB), radio network controller (RNC), or any other network element, or a combination of network elements. The network node 401 may be connected to one or more core network (CN) elements (not shown in FIG. 4) such as a mobile switching centre (MSC), MSC server (MSS), mobility management entity (MME), gateway GPRS support node (GGSN), serving GPRS support node (SGSN), home location register (HLR), home subscriber server (HSS), visitor location register (VLR). In FIG. 4, the radio network node 401 that may also be called eNB (enhanced node-B, evolved node-B) or network apparatus of the radio system, hosts the functions for radio resource management in a public land mobile network. FIG. 4 shows one or more user equipment 402 located in the service area of the radio network node 401. The user equipment refers to a portable computing device, and it may also be referred to as a user terminal. Such computing devices include wireless mobile communication devices operating with or without a subscriber identification module (SIM) in hardware or in software, including, but not limited to, the following types of devices: mobile phone, smart-phone, personal digital assistant (PDA), handset, laptop computer. In the example situation of FIG. 4, the user equipment 402 is capable of connecting to the radio network node 401 via a connection 403. Zhang at Para. [0070].

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		 Fig. 4 Zhang at Fig. 4. The signaling chart of FIG. 6 illustrates the required signaling. In the example of FIG. 6, a network node 401 (which may comprise e.g. a LTE-capable base station (eNode-B, eNB)) may transmit a configuration signal 602 to a user terminal 402 (UE), for configuring UE 402 to transmit a HARQ-ACK signal 606 by utilizing a PUCCH format 1a/b resource for EPDCCH signaling in TDD. This signaling 602 may be e.g. dedicated higher layer (i.e. higher than L1) signaling (e.g. RRC signaling). Before transmitting the signaling 602, eNB 401 may configure the resources in item 601. In item 603, UE 402 may receive the configuration signal 602. In item 604, a EPDCCH DL assignment and data is transmitted from eNB 401 to UE 402. In item 605, UE 402 receives the EPDCCH DL assignment which schedules DL data, wherein UE 402 detects EPDCCH eCCE and uses the index of the first eCCE in determining the HARQ-ACK resource. In step 605, UE 402 applies the resource allocation formula based on the configured parameters and the eCCE index. The formula gives as an output an UL (PUCCH) resource by which the HARQ-ACK 606 is transmitted from UE 402 to eNB 401. In item 606, UE 402 may transmit the HARQ-ACK signal 606 by utilizing the determined PUCCH format 1a/b resource for EPDCCH

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		signaling in TDD. In item 607, eNB 401 may receive the HARQ-ACK signaling 606 from UE 402. Zhang at Para. [0076]  <i>Fig. 6</i> Zhang at Fig. 6. FIG. 8 is a flow chart illustrating an exemplary embodiment. The apparatus 401, which may comprise e.g. a network element (network node 401, e.g. a LTE base station, eNB) transmits, in item 802, to another network element (network node 402, e.g. a user terminal, UE) a configuration signal for configuring UE 402 to transmit a HARQ-ACK signal by utilizing a PUCCH format 1a/b resource for EPDCCH signaling in TDD. The configuration signaling transmitted in item 802 may be e.g. dedicated higher layer signaling. Before transmitting the signaling in item 802, eNB 401 may configure the

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		resources in item 801. In item 803, eNB 401 may receive the HARQ-ACK signaling transmitted from UE 401 by utilizing the configured PUCCH format 1a/b resource for EPDCCH signaling in TDD. Zhang at Para. [0078]. <pre> graph TD start([start]) --> configure[configure 801] configure --> transmit[transmit 802] transmit --> receive[receive 803] receive --> end([end]) </pre> <i>Fig. 8</i> Zhang at Fig. 8. According to yet another exemplary embodiment, there is provided an apparatus comprising at least one processor; and at least one memory including a computer program code, wherein the at least one memory and the computer program code are configured to, with the at least one processor, cause the apparatus to determine PUCCH format 1a/1b resources for HARQ-ACK for time division duplex signaling based on an index of the first enhanced control channel element used for transmission of a corresponding

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		EPDCCH downlink assignment in an uplink subframe, the index of the downlink subframe in which the EPDCCH downlink assignment is transmitted, and one or more configured parameters. Zhang at [0094] PCT 193 supports these disclosures. See PCT 193 at 2:6-14; 10:30-11:13; 13:18-24; 14:8-17 To the extent it is found that Zhang does not expressly disclose this limitation, the limitation is inherent. Moreover, to the extent it is found that Zhang does not anticipate this claim, Zhang renders it obvious, either alone, in combination with the knowledge of a person of ordinary skill in the art, and/or in combination with other prior art references identified in the cover pleading or herein. A person of ordinary skill in the art would have been motivated to combine Zhang with any of the other prior art references identified in the cover pleading or herein with a reasonable expectation of success because each of these references contains familiar elements within the same field of endeavor to address the same known problems, according to known methods which would yield predictable results.
7[a]	a transmitting unit configured to transmit structural information, downlink control information for scheduling the downlink data, and the downlink data,	At least under Pegasus's apparent infringement theory, Zhang discloses a transmitting unit configured to transmit structural information, downlink control information for scheduling the downlink data, and the downlink data. For example, Zhang discloses this limitation based on the following exemplary citations: See limitations 1[a], 3[a], 1[b], 3[b], 1[c], 3[c]. According to yet another exemplary embodiment, the at least one memory and the computer program code are configured to, with the at least one processor, cause the apparatus to carry out a multi-subframe PUCCH format 1a/1b resource allocation for HARQ-ACK corresponding to PDSCH scheduled via EPDCCH. Zhang at Para. [0095]. According to yet another exemplary embodiment, the at least one memory and the computer program code are configured to, with the at least one processor, cause the

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		apparatus to apply the dynamic offset modifier such that it is independent on a subframe index m, wherein the dynamic offset modifier is derived based on downlink control information DCI that EPDCCH is carrying. Zhang at Para. [0097]. To the extent it is found that Zhang does not expressly disclose this limitation, the limitation is inherent. Moreover, to the extent it is found that Zhang does not anticipate this claim, Zhang renders it obvious, either alone, in combination with the knowledge of a person of ordinary skill in the art, and/or in combination with other prior art references identified in the cover pleading or herein. A person of ordinary skill in the art would have been motivated to combine Zhang with any of the other prior art references identified in the cover pleading or herein with a reasonable expectation of success because each of these references contains familiar elements within the same field of endeavor to address the same known problems, according to known methods which would yield predictable results.
7[b]	wherein the structural information contains at least one piece of i) information on a resource allocated to an uplink control channel for transmitting the response information and ii) start offset information on the resource allocated to the uplink control channel;	At least under Pegasus's apparent infringement theory, Zhang discloses a the structural information contains at least one piece of i) information on a resource allocated to an uplink control channel for transmitting the response information and ii) start offset information on the resource allocated to the uplink control channel. For example, Zhang discloses this limitation based on the following exemplary citations: See limitations 1[a] and 3[a]. According to yet another exemplary embodiment, the at least one memory and the computer program code are configured to, with the at least one processor, cause the apparatus to schedule the PUCCH format 1a/1b resources for EPDCCH for time division duplex signaling based on formula I: $n_{PUCCH}^{(1)} = N_{UE-PUCCH-TDD}^{(1)} * m + n_{eCCE} + N_{UE-PUCCH}^{(1)} + k, \quad (II)$

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		$n_{\text{PUCCH}}^{(1)}$ is a PUCCH format 1a/1b resource to be allocated for a HARQ-ACK signal; $N_{\text{UE-PUCCH}}^{(1)}$ is the first semi-static user terminal-specific resource starting offset defined for an EPDCCH set; $N_{\text{UE-PUCCH-TDD}}^{(1)}$ is the second user terminal-specific resource offset defined for EPDCCH sets when $M > 1$, M being the number of downlink subframes associated with an uplink subframe for HARQ-ACK feedback, m being a relative index of a downlink subframe, wherein $0 \leq m \leq M-1$; n_{eCCE} is an index of the first enhanced control channel element eCCE used for transmission of a corresponding EPDCCH downlink assignment in a downlink subframe $n-k_m$, where m is the relative index of the downlink subframes and $0 \leq m \leq M-1$; k is a dynamic offset modifier. Zhang at Paras. [0101]-[0103]. According to yet another exemplary embodiment, the at least one memory and the computer program code are configured to, with the at least one processor, cause the apparatus to set the second user terminal-specific resource offset as the number of PUCCH resources corresponding to a first EPDCCH set+the number of PUCCH resources corresponding to a second EPDCCH set; or the number of eCCEs in the first EPDCCH set+the number of eCCEs in the second EPDCCH set. To the extent it is found that Zhang does not expressly disclose this limitation, the limitation is inherent. Zhang at Para. [0100]. According to yet another exemplary embodiment, the at least one memory and the computer program code are configured to, with the at least one processor, cause the apparatus to apply the dynamic offset modifier such that the dynamic offset modifier depends on a subframe index m, wherein multiple sets of dynamic offset modifiers are defined to be a matrix C with $(M-1)$ columns and N rows, N corresponding to the number of options to perform dynamic switching, M being the number of downlink subframes associated with an uplink subframe for HARQ-ACK feedback, and the subframe index m is used as one factor to determine the value of the dynamic offset modifier $k(n, m)$, where n is an index of dynamic switching option. Zhang at Para. [0098]. PCT 193 supports these disclosures. See PCT 193 at 7:12-24; 8:25-31

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		To the extent it is found that Zhang does not expressly disclose this limitation, the limitation is inherent. Moreover, to the extent it is found that Zhang does not anticipate this claim, Zhang renders it obvious, either alone, in combination with the knowledge of a person of ordinary skill in the art, and/or in combination with other prior art references identified in the cover pleading or herein. A person of ordinary skill in the art would have been motivated to combine Zhang with any of the other prior art references identified in the cover pleading or herein with a reasonable expectation of success because each of these references contains familiar elements within the same field of endeavor to address the same known problems, according to known methods which would yield predictable results.
7[c]	wherein the resource of the uplink control channel for transmitting the response information of the downlink data is determined based on at least one piece of i) information on a resource of a downlink control channel for scheduling the downlink data, ii) the information on the resource allocated to the uplink control channel, and iii) the start offset information of the resource allocated to the uplink control channel;	At least under Pegasus's apparent infringement theory, Zhang discloses the resource of the uplink control channel for transmitting the response information of the downlink data is determined based on at least one piece of i) information on a resource of a downlink control channel for scheduling the downlink data, ii) the information on the resource allocated to the uplink control channel, and iii) the start offset information of the resource allocated to the uplink control channel. For example, Zhang discloses this limitation based on the following exemplary citations: See limitation 1[e]. According to yet another exemplary embodiment, the at least one memory and the computer program code are configured to, with the at least one processor, cause the apparatus to apply the dynamic offset modifier such that it is independent on a subframe index m, wherein the dynamic offset modifier is derived based on downlink control information DCI that EPDCCH is carrying. Zhang at Para. [0097]. According to yet another exemplary embodiment, the at least one memory and the computer program code are configured to, with the at least one processor, cause the apparatus to set the second user terminal-specific resource offset as the number of PUCCH resources corresponding to a first EPDCCH set+the number of PUCCH

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		resources corresponding to a second EPDCCH set; or the number of eCCEs in the first EPDCCH set+the number of eCCEs in the second EPDCCH set. To the extent it is found that Zhang does not expressly disclose this limitation, the limitation is inherent. Zhang at Para. [0100]. According to yet another exemplary embodiment, the at least one memory and the computer program code are configured to, with the at least one processor, cause the apparatus to schedule the PUCCH format 1a/1b resources for EPDCCH for time division duplex signaling based on formula I: $n_{PUCCH}^{(1)} = N_{UE-PUCCH-TDD}^{(1)} * m + n_{eCCE} + N_{UE-PUCCH}^{(1)} + k, \quad (II)$ $n_{PUCCH}^{(1)}$ is a PUCCH format 1a/1b resource to be allocated for a HARQ-ACK signal; $N_{UE-PUCCH}^{(1)}$ is the first semi-static user terminal-specific resource starting offset defined for an EPDCCH set; $N_{UE-PUCCH-TDD}^{(1)}$ is the second user terminal-specific resource offset defined for EPDCCH sets when $M > 1$, M being the number of downlink subframes associated with an uplink subframe for HARQ-ACK feedback, m being a relative index of a downlink subframe, wherein $0 \leq m \leq M-1$; n_{eCCE} is an index of the first enhanced control channel element eCCE used for transmission of a corresponding EPDCCH downlink assignment in a downlink subframe $n-k_m$, where m is the relative index of the downlink subframes and $0 \leq m \leq M-1$; k is a dynamic offset modifier. Zhang at Paras. [0101]-[0103]. PCT 193 supports these disclosures. <i>See, e.g.</i>, PCT 193 at 7:6-24; 8:25-31 Moreover, to the extent it is found that Zhang does not anticipate this claim, Zhang renders it obvious, either alone, in combination with the knowledge of a person of ordinary skill in the art, and/or in combination with other prior art references identified in the cover pleading or herein. A person of ordinary skill in the art would have been

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		motivated to combine Zhang with any of the other prior art references identified in the cover pleading or herein with a reasonable expectation of success because each of these references contains familiar elements within the same field of endeavor to address the same known problems, according to known methods which would yield predictable results.
7[d]	wherein the start offset information of the resource allocated to the uplink control channel is configured separated from offset information on a terminal different from the MTC terminal;	At least under Pegasus's apparent infringement theory, Zhang discloses the start offset information of the resource allocated to the uplink control channel is configured separated from offset information on a terminal different from the MTC terminal. For example, Zhang discloses this limitation based on the following exemplary citations: See limitation 1[f]. To the extent it is found that Zhang does not expressly disclose this limitation, the limitation is inherent. Moreover, to the extent it is found that Zhang does not anticipate this claim, Zhang renders it obvious, either alone, in combination with the knowledge of a person of ordinary skill in the art, and/or in combination with other prior art references identified in the cover pleading or herein. A person of ordinary skill in the art would have been motivated to combine Zhang with any of the other prior art references identified in the cover pleading or herein with a reasonable expectation of success because each of these references contains familiar elements within the same field of endeavor to address the same known problems, according to known methods which would yield predictable results.
7[e]	wherein a plurality of pieces of start offset information on the resource allocated to the uplink control channel are provided, and the plurality of pieces of start offset information are transmitted through cell-specific high layer signaling	At least under Pegasus's apparent infringement theory, Zhang discloses a plurality of pieces of start offset information on the resource allocated to the uplink control channel are provided, and the plurality of pieces of start offset information are transmitted through cell-specific high layer signaling for the MTC terminal to the MTC terminal. For example, Zhang discloses this limitation based on the following exemplary citations: See limitation 1[g].

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	for the MTC terminal to the MTC terminal;	To the extent it is found that Zhang does not expressly disclose this limitation, the limitation is inherent. Moreover, to the extent it is found that Zhang does not anticipate this claim, Zhang renders it obvious, either alone, in combination with the knowledge of a person of ordinary skill in the art, and/or in combination with other prior art references identified in the cover pleading or herein. A person of ordinary skill in the art would have been motivated to combine Zhang with any of the other prior art references identified in the cover pleading or herein with a reasonable expectation of success because each of these references contains familiar elements within the same field of endeavor to address the same known problems, according to known methods which would yield predictable results.
7[f]	wherein the start offset information of the resource allocated to the uplink control channel is determined based on a coverage level; and	At least under Pegasus's apparent infringement theory, Zhang discloses the start offset information of the resource allocated to the uplink control channel is determined based on a coverage level. For example, Zhang discloses this limitation based on the following exemplary citations: <i>See</i> limitation 1[h]. According to yet another exemplary embodiment, the at least one memory and the computer program code are configured to, with the at least one processor, cause the apparatus to apply the dynamic offset modifier k dependent on an antenna port or a power control command. Zhang at Para. [0096]. PCT 193 supports these disclosures. <i>See, e.g.</i>, PCT 193 at 4:12-13. To the extent it is found that Zhang does not expressly disclose this limitation, the limitation is inherent. Moreover, to the extent it is found that Zhang does not anticipate this claim, Zhang renders it obvious, either alone, in combination with the knowledge of a person of ordinary skill in the art, and/or in combination with other prior art references identified in the cover pleading or herein. A person of ordinary skill in the art would have been motivated to combine Zhang with any of the other prior art references identified in

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Claim Language		Exemplary Citations to Zhang
		the cover pleading or herein with a reasonable expectation of success because each of these references contains familiar elements within the same field of endeavor to address the same known problems, according to known methods which would yield predictable results.
7[g]	wherein when the response information of the downlink data of the MTC terminal is repeatedly transmitted, the repeated transmission is performed using a same uplink control channel resource in each uplink subframe in which the uplink control channel is repeatedly transmitted.	At least under Pegasus's apparent infringement theory, Zhang discloses when the response information of the downlink data of the MTC terminal is repeatedly transmitted, the repeated transmission is performed using a same uplink control channel resource in each uplink subframe in which the uplink control channel is repeatedly transmitted. For example, Zhang discloses this limitation based on the following exemplary citations: See limitation 1[i]. To the extent it is found that Zhang does not expressly disclose this limitation, the limitation is inherent. Moreover, to the extent it is found that Zhang does not anticipate this claim, Zhang renders it obvious, either alone, in combination with the knowledge of a person of ordinary skill in the art, and/or in combination with other prior art references identified in the cover pleading or herein. A person of ordinary skill in the art would have been motivated to combine Zhang with any of the other prior art references identified in the cover pleading or herein with a reasonable expectation of success because each of these references contains familiar elements within the same field of endeavor to address the same known problems, according to known methods which would yield predictable results.