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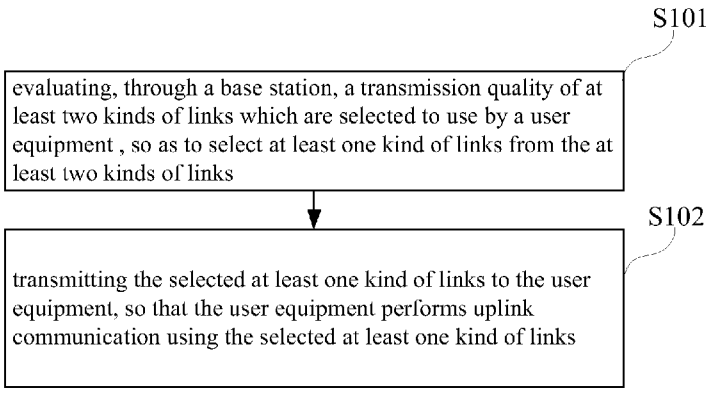


FIG. 1

(57) Abstract: The present disclosure discloses a method, a base station, a UE, and a device with storage function for communication. The method includes: the base station evaluate a transmission quality of at least two kinds of links which are selected to use by a UE, so as to select at least one kind of the links; and transmitting the selected at least one kind of the links to the UE, so that the UE performs uplink communication using the selected at least one kind of the links. The present disclosure transmits the uplink selected by the base station to the UE, so that the UE can perform uplink communication according to the link selected by the base station, thereby improving the reliability of the transmission and reducing the possibility of signal delay while allocating communication resources reasonably.

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COMMUNICATION METHOD, BASE STATION, USER EQUIPMENT, AND DEVICE

TECHNICAL FIELD

[0001] Embodiments of the present disclosure generally relate to communicationtechnology, and in particular relate to a method, a base station, a user equipment, and a device with storage functionfor communication.

BACKGROUND

[0002] With the development of the 5G NR (new radio) network, there will be a situation in which the 4G LTE (long term evolution) network and the 5G NR network are connected to a UE (user equipment) at a same time. At the RAN2 # NR AdHoc conference, a split SRB (signaling radio bearer) structure was agreed, and it was proposed that a RRC (radio resource control) message can be transmitted througheither or bothof the LTE linkand the NR link to increase the transmission reliability while reducing the signal delay.

[0003] DL (downlink) refers to a transmission channel of a base stationto the UE, and UL (uplink) refers to a transmission channel of the UE to the base station. The inventor of the present application has found after a long-term research and development that the base station can select the link by itself when the DL adopts the split SRB structure, while the UE can not complete the selection of the link when theULadopts the split SRB structure.

SUMMARY

[0004] The embodiments of the present disclosure is to provide a method, a base station, a user equipment, and a device with storage function for communication,

whichcan solve the problem of selecting a communication method in the UL using the split SRB structure.

[0005] The embodiments of the present disclosure is to provide a method, a base station, a user equipment, and a device with storage function for communication, which can solve the problem of using PDCP(PDCP) duringthe UL communication.

[0006] receiving a link selection instruction from a base station through a user equipment, the link selection instruction carries at least one kind of links selected by evaluating a transmission quality of at least two kinds of links which areselected to use bythe user equipment; and

[0007] performing uplink communication using the selected at least one kind of links.In order to solve the above-mentioned technical problem, a technical aspect of the present disclosure is to provide a communication method including: a Evaluating, through a base station, a transmission quality of at least two kinds of links which are selected to use bya user equipment , so as to select at least one kind of links from the at least two kinds of links; transmitting the selected at least one kind of links to the user equipment, so that the user equipment performs uplink communication using the selected at least one kind of links.

[0008] receiving a link selection instruction from a base station through a user equipment, the link selection instruction carries at least one kind of links selected by evaluating a transmission quality of at least two kinds of links which areselected to use bythe user equipment; and

[0009] performing uplink communication using the selected at least one kind of links.In order to solve the above technical problem, another aspect of the present disclosure is to provide a communication method including: receiving a link selection instruction from a base station through a user equipment, the link

selection instruction carries at least one kind of links selected by evaluating a transmission quality of at least two kinds of links which areselected to use bythe user equipment; andperforming uplink communication using the selected at least one kind of links.

[0010] In order to solve the above technical problem, another aspect of the present disclosure is to provide A base station comprising a first processing circuit and a first communication circuit electrically coupled to each other, the first processing circuit executing instructions at operation to implementthe above-mentioned method.

[0011] In order to solve the above technical problem, another aspect of the present disclosure is to provideA user equipment comprising a first processing circuit and a first communication circuit electrically coupled to each other, the first processing circuit executing instructions at operation to implementthe above-mentioned method.

[0012] In order to solve the above technical problem, another aspect of the present disclosure is to provide a device with a storage function, wherein the device is stored with instructions, the instructions are executed to implement the above-mentioned method.

In order to solve the above technical problem, another aspect of the present disclosure is to provide a communication method, including:detecting an uplink to be performed bya user equipment through a base station, so as to determine whether the link supports PDCP function; and transmitting an activating / deactivating instruction to the user equipment if the uplink supports PDCP function, so that the user equipment enables / disables PDCP function in an uplink communication.

In order to solve the above technical problem, another aspect of the present disclosure is to provide a communication method, including:receiving an activating / deactivating instruction from a base station through a user equipment, the activating / deactivating instruction is transmitted by the base station based on a detectedPDCP

function supported by an uplink to be performed by the user equipment; andenabling/ disabling the detectedPDCP function in an uplink communication through the user equipment.

[0013] In order to solve the above technical problem, another aspect of the present disclosure is to provide A base station comprising a second processing circuit and a second communication circuit electrically coupled to each other, the second processing circuit executing instructions at operation to implement theabove-mentioned method.

[0014] In order to solve the above technical problem, another aspect of the present disclosure is to provide a user equipment including a second processing circuit and a second communication circuit electrically coupled to each other, the second processing circuit executing instructions at operation to implement the above-mentioned method.

[0015] The disclosure has the advantages that, in contrast to the prior art, the embodiments of the present disclosure are applied to the UL in the split SRB structure, andcan select at least one kind oflink to perform communication, in which the selection result of the base station can be provided tothe user equipment in a reliable manner, thereby reducing the signal delay andadjustingthe linkdynamically basing on the current communication quality to allocate and use communication resources reasonably.

[0016] In addition, the activating instruction is transmitted to the UE in the case of the UL communication supporting the PDCP function, so that the UE enables the PDCP function in the UL communication to enhance the reliability of the communication transmission.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] FIG. 1 is a flow chart of a first embodiment of a communication method of the present disclosure.

[0018] FIG. 2 is a schematic diagram of the structure of a PDU (protocol data unit).

[0019] FIG. 3 is a schematic diagram ofthe structure of a PDU carrying a linkselection instructionaccording to the first embodiment of the present disclosure.

[0020] FIG. 4 is a schematic diagram of a reference table 1 for composing a selection instructionaccording to an embodiment of the present disclosure.

[0021] FIG. 5 is a schematic diagram of a reference table 2 for composing a selection instruction according to an embodiment of the presentdisclosure.

[0022] FIG. 6 is flow chart of a second embodiment of a communication method of the present disclosure.

[0023] FIG. 7 is a schematic diagram of a first embodiment of a base station of the present disclosure.

[0024] FIG. 8 is a schematic diagram of a first embodiment of a user equipment of the present disclosure.

[0025] FIG. 9 is a flow chart of a third embodiment of a communication method of the present disclosure.

[0026] FIG. 10 is a schematic diagram ofthe structure of a PDU carrying an activating instructionaccording to the third embodiment of the present disclosure.

[0027] FIG. 11 is a flow chart of a fourth embodiment of a communication method of the present disclosure.

[0028] FIG. 12 is a schematic diagram of a second embodiment of a base station of the present disclosure.

[0029] FIG. 13 is a schematic diagram of a second embodiment of a user equipment of the present disclosure.

[0030] FIG.14 is a schematic diagram of a protocol stack corresponding to

areplication function of PDCP.

[0031] FIG. 15 is a schematic diagram the structural of a devicewith a storage function according to an embodiment the present disclosure.

DETAILED DESCRIPTION

[0032] The technical schemes in the embodiments of the present disclosure will now be described in conjunction with the accompanying drawings in the embodiments of the present disclosure.It will be apparent that the described embodiments are merely part of the embodiments of the present disclosurerather than all of the embodiments.All other embodiments obtained based on the embodiments in the present disclosure by those skilled in the art without making creative work are within the scope of the present disclosure.

[0033] Referring to FIG. 1, a flow chart of a first embodiment of a communication method of the present disclosure is depicted.The method may include the following blocks.

[0034] AtS101:evaluating, through a base station, a transmission quality of at least two kinds of links which are selected to use bya user equipment , so as to select at least one kind of links from the at least two kinds of links.

[0035] In one embodiment, the base station includes an eNB (4G base station) and a gNB (5G base station).In this embodiment, the UE's uplink transmissionusesplit SRB structure. Different base stations communicate with each other wirelessly, and two base stations evaluateeach other'sparameters of the connecting with UE.Such as signal strength, transmission speed, and transmission signaling reliability. In an application scenario,one of thetwo base stationsis eNBandthe other is gNB, the eNB is specified as the primary base station. The primary base station selects one or both of the LTE linkand the NR link as thelink of the UL basedon the evaluation result.

[0036] AtS102: transmitting the selected at least one kind of links to the user equipment, so that the user equipment performs uplink communication using the selected at least one kind of links.

[0037] Specifically, the eNB acts as the primary base station andtransmit instructionwhich is based on the selection result,such as LTE, to the UE.In an application scenario, a selection instruction is carried in the RRC message for transmission. Since the consumption of transmitting the RRC message is large, it will not be transmitted frequently, and the selection of the linkdepends on the communication quality between the two base stations and the UE, which is time-sensitive,so the valid time of the message has to be limited. Therefore, in addition to carrying the selection instruction, the RRC messagesalso carries the valid time of the selectedlink. In general, the UE has a built-in timer device. After receiving the RRC message carrying the instruction to select the link, the UE reads the valid time periodtherein, and starts the built-in timing function while adopting the selection instruction carried by the RRC message, so as to begin a countdownof the read valid time. After the countdown, the UE no longer uses the selected link, but uses the default prioritized linkin the UE, for example, NR.

[0038] In another application scenario, the instruction of selecting the link is carried bya PDU (protocol data unit) in PDCP layer. Referring to FIG. 2, a schematic diagram of the structure of a PDUis depicted.The D / C field of the PDUis used to indicate whether the PDUis a control PDU (C) or a data PDU (D), and both the data PDU and the control PDU can be used to carry the instruction ofselecting thelink.R represents a reserved field, and the header of the PDU generally has four reserved fields. The present disclosure uses two of the fields 11 and 12 to carry the instruction of selecting the link.Referring to FIG. 3, a schematic diagram of the structure of a PDU carrying a link selection instruction according to the first

embodiment of the present disclosureis depicted.As shown in FIG. 3, the fields 11 and 12 of the PDU are written withthe instruction of selecting the link.The fields 11 and 12 are originally R (reserved field), and become to S (selection instruction) after writing the instruction of selecting the link.

[0039] Since there are idle reserved fields in the header of the PDU, the transmitted data and the transmission reliabilityof the PDUwill not be affected by adding the instruction of selecting the link to these fields,which can saveresources.In addition, since the resources consumed in transmitting the PDU is lesser than that consumed intransmittingtheRRC, and the transmission frequency of the PDUis more frequent than the RRC, the timingcan be performed without carrying the valid time of the instructionwhen the PDU in the PCDP is used to carry the instruction of selecting the link.

[0040] The instruction of selecting the link is carried in the PDU in the PCDP layer.The PDCP layer belongs to the data link layer and is located at the upper layer of the RRC layer which belonging to the upper layer of a network. After the UE receives the PDU carrying the instruction of selecting the link, the PDCP layer will communicate with the RRC layer, and the RRC layer will read the instruction of selecting the link so that the UE can perform the UL communication according to the link selected by the base station.

[0041] Ina further application scenario, the instruction of selecting the link is carried in a MAC (media access control)CE (control element) of MAC layer.Since the resources consumed in the transmission of the MAC CE islesser than that of the RRC, and the transmission frequency is more frequent than the RRC, the valid time period the instruction is not need to be limitedwhen the MAC CE is used to carry the instruction of selecting the link,.

[0042] The instruction of selecting the link is carried in the MAC CE of the MAC

layer.The MAC layer belongs to the data link layer and is located at the upper layer of the RRC layer which belonging to the upper layer of network. After the UE receives the MAC CE carrying the instruction of selecting the link, the MAC layer will communicate with the RRC layer, and the RRC layer will read the instruction of selecting the link so that the UE can perform the UL communication according to the link selected by the base station.

[0043] As can be seen from the above description, this embodiment carries the instruction of selecting the link by using the PDU and the MAC CEin the PDCPor the RRC, transmitsthe instruction to the UE through the DL communication, so as to help the UE to select the appropriate link to perform the UL communication usingthe split SRB structure.The method is simple and feasible, while not waste resources.

[0044] Referring to FIG. 4 andFIG. 5, FIG. 4 is one ofschematic diagramsof composing a selection instruction according to an embodiment of the present disclosure.FIG. 5 is the other one of schematic diagramsof composing a selection instruction according to an embodiment of the present disclosure.In the prior art, since there are three links: LTE, NR, and Both. Aspace of 2 bits is required in binary to represent the selected link, for example, 00 (LTE), 01 (NR), and 10 (Both). This embodiment proposes a new method to represent the selected link, which requires only 1 bit of transmission resource.

[0045] In FIG. 4, L represents LTE, N represents NR, and B represents Both, which are set in a certain order in the UE.When one of the letters is used to represent the current link, the letters on both sides of the letter (i.e., before and after the letter) are thelinks can be selected. For example, if the current link is NR and the selected link is LTE, it means that one bit is retreated from the current selected position.Since "0" indicates that one bit is retracted in this embodiment,the content of the transmitted instructionis "0".If the current link is NR and the selected link is Both, it means that

one bit isforwarded from the current position.Since "1" indicates that one bit is forwarded in this embodiment, the content of the transmitted instructionis "1".

[0046] Similarly, ifthe current link is LTE, the content of the transmitted instruction is "0" while the selected link is Both, and the content of the transmitted instruction is "1" while the selected link is NR; if the current link is Both, the content of the transmitted instruction is "0" while the selected link is NR, and the content of the transmitted instruction is "1" while the selected link is LTE.The specific content can refer to FIG. 5.When the selected link is the same as the current link, the instruction is not transmitted, and the UE maintains the current link for the UL communication.

[0047] In other embodiments, the ordering of L, N, and B is not necessarily coincide with FIG. 4, and the meaning of "0" and "1" is not necessarily coincide with FIG. 5.

[0048] In this embodiment, the base station will arrange the linkcan be selected by the UE into a sequence as shown in FIG. 4and transmits the sequence to the UE in the downlink communication. The UE receives and stores the sequence,and selectthe UL communicationbasing on the current link in the stored sequence and a position direction indicated by the selection instruction when the selection instruction issued by the base station is received. In other embodiments, the arrangingof the sequence of the link may also be set by the UE in advance and notifies the base station, or a unified sequence of links may be set in the base station and the UE.

[0049] In other embodiments, the base station and the UE do not need to sort the three links LTE, NR, and Both, and only need to create a table similar toFIG. 5.When a certain kind of the linksis defined as a current linkin the table,it is only need to select the content of the instructionto be transmitted for the other two kinds of the links respectively.

[0050] As can be seen from the above description, this embodiment composes the

instruction to be transmitted to the UE according to comparing the positional relationship (i.e., advance or backward) ofthe selected link and the current link in the sequence of the tables.In some cases, only 1bit of transmission resourceis needed to represent the selected link, which saves the space for the instructions,thereby savingresources.

[0051] Referring to FIG. 6, a flow chart of a second embodiment of a communication method of the present disclosure is depicted.The method may include the following blocks.

[0052] AtS601: receiving a link selection instruction from a base station through a user equipment, the link selection instruction carries at least one kind of links selected by evaluating a transmission quality of at least two kinds of links which are selected to use bythe user equipment.

[0053] Also referring to FIG. 1, the communication method is obtained by the primary base stationthroughcomparingits transmission quality with thatof the base stations of other links can beselected to connect by the UE. The selection instruction is composed by the primary base station, and is carried using the RRC message, the PDU of the PDCP, the MAC CE, or other messages, so as to facilitate the reception of the UE.

[0054] AtS602: performing uplink communication using the selected at least one kind of links.

[0055] Specifically, the UE reads the content of the selection instruction from the RRC message,the PDU of the PDCP, the MAC CE, or other message carrying the selection instruction after receiving the messages, for example, the RRC layer, the PDCP layer, or the MAC layer performs communications to obtain the instruction for the UL communication. After the UE reads the instruction, it selects the link according to the content of the instruction to perform the UL communication.

[0056] As can be seen from the above description, in the second embodiment of the communication method of the present disclosure, the UE receives the instruction of the link selected by the base station through evaluating, and selects the link to perform the UL communication according to the instruction, which can adjust the UL communicationdynamically and contribute tothe rational allocation of communication resources, and can read the contents of the instructions carried in other messages, therebysavingthe space for transmission and avoid the waste of resources.

[0057] Referring to FIG. 7, a schematic diagram of a first embodiment of a base station of the present disclosure is depicted.The base station 70 includes a first processing circuit 71 and a first communication circuit 72.The first communication circuit 72 is configured to communicate with the communication circuits of other base stations, so as to understand the communication quality of each other. The communication quality of each other is evaluatedby the operation of the first processing circuit 71, thereby selecting a suitable link. The first processing circuit 71 composes the instruction according to the selected link, and carries the instruction in the RRC message, the PDU of thePDCP,or the MAC CE. The first communication circuit 72 transmits the messages carrying the instruction of selecting the link to the UE.

[0058] As can be seen from the above description, the first embodiment of the base station of the present disclosure receives a communication signal from another base station through the first communication circuit, obtains an appropriate UL communication by the operation of the first processing circuit, and composes the linkas an instruction so as to carry in other messages and transmit to the UE through the first communication circuit, thereby allocating the communication resources appropriately without occupying other communication spaces.

[0059] Referring to FIG. 8, a schematic diagram of a first embodiment of a user

equipment of the present disclosure is depicted. The user equipment 80 includes a second processing circuit 81 and a second communication circuit 82. The second communication circuit 82 is configured to receive the message carrying the instruction of selecting the link from the base station.The second processing circuit 81 is configured to read the instruction of selecting the link from the message received by the second communication circuit 82 and perform the UL communication according to the link selected by the instruction.

[0060] As can be seen from the above description, the first embodiment of the user equipment of the present disclosure receives the message carrying the instruction of selecting the linkthrough the second communication circuit, reads the instruction and controls the UE to perform the UL communication using the selected link through the second processing circuit , which can adjust thelink dynamically and contribute tothe rational allocation of communication resources, and can read the instructions carried in other messages to effectively save the resources consumed by transmitting instructions.

[0061] Referring to FIG. 9, a flow chart of a third embodiment of a communication method of the present disclosure is depicted.The method may include the following blocks.

[0062] AtS901:detecting an uplink to be performed by the user equipment UE through the base station, so as to determine whether the link supports PDCP function.

[0063] Specifically, the UE supports the PDCPfunction merelyin the NR link.Therefore, the base station needs to detect the UL communicationto be performed by the UE. If theUL communicationto be performed by the UE is LTE or other link that does not support the PDCP function, an activating instructionwill not transmitted tothe UE so as to avoid the waste of resources.

[0064] AtS902:transmitting an activating / deactivating instruction to the user

equipment if the uplink supports PDCP function, so that the user equipment enables / disables PDCP function in an uplink communication.

[0065] Specifically, if the UL communicationto be performed bythe UE is NR, it means that the PDCP function can be enabled in the UL communicationto be performed by the UE, and the base station also needs to determine that whetherthe UE needs to enable the PDCPfunctionin the UL communicationto be performed by the UE.If necessary, the base station transmits theactivating instruction to the UE; otherwise,the base station transmits thedeactivating instruction to the UE.

[0066] In an application scenario, the activating instruction is carried in the PDU in the PDCP layer. Also referring to FIG. 2, the D / C field of the PDC is used to indicate whether the PDC is a control PDU (C) or a data PDU (D).R represents a reserved field, and the header of the PDU generally has four reserved fields.The present disclosure uses two of the fields 11 and 12 to carry the instruction of selecting the link.Referring to FIG. 10,a schematic diagram of the structure of a PDU carrying an activating instruction according to the third embodiment of the present disclosure is depicted.As shown in FIG. 10, the fields 11 and 12 of the PDU are written with the instruction of selecting the link.The fields 11 and 12 are originally R (reserved field), and becomes to A (activating instruction) after writing the instruction of selecting the link.In other embodiments, it is not necessary to change two fields, but possible to change one, three, or four fields.

[0067] Since there are idle reserved fields in the header of the PDU, the transmitted data and the transmission reliabilityof the PDUwill not be affected by adding the instruction of selecting the link to these fields,which can saveresources.In addition, since the resources consumed in transmitting the PDU is lesser than that consumed intransmitting the RRC, and the transmission frequency of the PDU is more frequent than the RRC, the timingcan be performed without carrying the valid time period the

instructionwhen the PDU in the PCDP is used to carry the instruction of selecting the link.

[0068] After receiving the PDU containing the activating instruction, the UE reads the activating instruction, and enables the PDCP function when performing the UL communication.

[0069] The method of transmitting the deactivating instruction is the same as the method of transmitting the activating instruction, except that the contents of the instructions are different, and will not be described here. After receiving the PDU containing the deactivating instruction, the UE reads the deactivating instruction, and disables (deactivates) the PDCP function when performing the UL communication.

[0070] As can be seen from the above description, the present disclosure can effectively save resources by carrying the activating instruction for enabling the PDCP function in the head of the PDU, and increase the reliability of the communication transmission by enabling the PDCP function.

[0071] Referring to FIG. 11, a flow chart of a fourth embodiment of a communication method of the present disclosureis depicted.The method may include the following blocks.

[0072] AtS1101:receiving the activating / deactivating instruction from the base station through the user equipment UE.The activating / deactivating instruction is transmitted by the base station based on a detected PDCP function supported by the UL communicationto be performed by the UE.

[0073] Also referring to FIG. 9, since the UE can not enable the PDCP function independently in the UL communication, and the PDCP function is currently only supported in the NR link, the base station first needs to detect that whether the NR link is selected as the UL communicationto be performed by the UE, and if so, the base station transmits theactivating instruction for the PDCP function. The activating

instruction may be carried by the data PDU of the PDCP and stored at the head of the PDU.

[0074] AtS1102: enabling / disabling the detectedPDCP function in an uplink communication through the UE.

[0075] In an application scenario, the UE reads the content of the activatinginstructions in the header of the PDU after receiving the PDU carrying the activating instruction, and enables the PDCP function in the UL communication.Referring to FIG. 14, a schematic diagram of a protocol stack corresponding to a replication function of PDCP is depicted.The protocol stack corresponds to the enable of the PDCP function. Two identical data units PDCP PDU are transmitted by the PDCP layer through two different links, and reach the physical layer through the MAC layer.Similarly, the communications between the physical layer and the MAC layer as well asthe physical layer and the PDCP layer are performedthrough two different links. In other embodiments, it is also possible to transmit packets simultaneously on three or more links so as to effectively improve the reliability of transmissions.

[0076] In other application scenarios, the UE reads the content of the deactivating instruction of the header after receiving the PDU carrying the deactivating instruction, and disables the PDCP function in the UL communication.

[0077] As can be seen from the above description, the UE in the fourth embodiment of the present disclosure can receive the activating and the deactivating instructions transmitted by the base station which are carried in the PDU header, so as to enable and disable the PDCP function in the UL communication correspondingly, therebyimproving the transmission reliability and savingthe resources.

[0078] Referring to FIG. 12, a schematic diagram of a second embodiment of a base station of the present disclosureis depicted. The base120 includes a third

processing circuit 121 and a third communication circuit 122.The third communication circuit 122 is configured to communicate with the UE.The third processing circuit 121 detects whether the UL communication to be performed by the UE supports the PDCP function. If supported, it is determined whether need to enable the PDCP function.Ifnecessary, the activating instruction for enabling the PDCP function is carried in the header of the PDU, and the third communication circuit 122 transmits the PDU carrying the activating instruction to the UE.If not necessary, the deactivating instruction for disabling the PDCP function is carried in the header of the PDU, and the third communication circuit 122 transmits the PDU carrying the deactivating instruction to the UE.

[0079] As can be seen from the above description, the second embodiment of the base station detects the UL communicationto be performed by the UE through the third communication circuit 122,and determines whether the link supports the PDCP function through the third processing circuit 121. If supported,it continues to determine whether need to enable the PDCP function, and then transmit the activating / deactivating instruction carried in the PDU to the UE, thereby saving the resources while enhancing the transmission reliability.

[0080] Referring to FIG. 13, a schematic diagram of a second embodiment of a user equipment of the present disclosureis depicted. The user equipment 130 includesa fourth processing circuit 131 and a fourth communication circuit 132.The fourth communication circuit 132 is configuredto receive the PDU carrying the activating / deactivating instruction from the base station. The fourth processing circuit 131 is configured to read the activating / deactivating instruction from the PDU received by the fourth communication circuit 132, and to enable / disable the PDCP function correspondingly in the UL communication.

[0081] As can be seen from the above description, the second embodiment of the

user equipment receives the PDU carrying theactivating / deactivating instruction through the fourth communication circuit, reads the instruction through the fourth processing circuit and enables / disables the PDCP function correspondingly in the UL communication, which can effectively enhance the reliability of transmission.In addition, through reading the instructions carried in other messages, the resources consumed in transmitting the instructions can be saved effectively.

[0082] Referring to FIG. 15, a schematic diagram the structural of a device with a storage function according to an embodiment the present disclosureis depicted.The device 150 with the storage function stores at least one program or instruction 151.The program or instruction 151 is configured to executethe communication method as shown in FIGs. 1, 6, 9, and 11. In one embodiment, the device with storage function may be a storage chip or a hard disk in a terminal, or other storage means such as a removable hard disk, a USB flash drive, and anoptical disc, and may be a server or the like.

[0083] As can be seen from the above description, the program or instructionstored in the device with the storage function can be used to select the UL communication and transmit the result of the selection, so that the UE performs the UL communication according to the result.The program or instructionstored in the device with the storage function can further be used to determine whether the UL communication to be performed by the UE supports the PDCP function, and transmit the activating / deactivating instruction in the case of supported, so that the UEenables / disables the PDCP functioncorrespondingly in the UL communication.

[0084] In contrast to the prior art, this embodiment adopts the split SRB structure, and can select one or both of LTE and NR as the UL communication, which improves the reliability of the UL communication while reducing the delay of signal transmission.In addition,the link can be adjusted dynamically basing on the current

communication quality, and the communication resourcescan be allocated and used reasonably, therebyreducingthe waste of resources. At the same time, the selection instruction takes the minimum data bit of transmission resources, which further saves resources.

[0085] In addition, this embodiment notifies the UE to enable the PDCP function in the UL communication in the case that the UL communication supports the PDCP function, thereby improving the transmission reliability.

[0086] The foregoing is merely embodiments of the present disclosure, and is not intended to limit the scope of the present disclosure. Any equivalent structure or flow transformation made based on the specification and the accompanying drawings of the present disclosure,or any direct or indirect applications of the present disclosure on other related fields, shall all be covered within the protection of the present disclosure.

What is claimed is:

1. A communication method, comprising:

evaluating, through a base station,a transmission quality of at least two kinds of links which are selected to use bya user equipment , so as to select at least one kind of links from the at least two kinds of links; and

transmitting the selected at least one kind of links to the user equipment, so that the user equipment performs uplink communication using the selected at least one kind oflinks.

2. The methodof claim 1, wherein:

the transmitting the selected at least one kind oflinks to the user equipmentcomprises:

transmitting the selected at least one kind oflinks to the user equipment via a radio resource control information.

3. The methodof claim 2, wherein:

before, after, or whilethe transmitting the selected at least one kind oflinks to the user equipment via the radio resource control information further comprises:

transmitting avalid time of the selected at least one kind oflinks to the user equipment, so that the user equipment uses the selected at least one kind oflinksto perform communication onlywithin the valid time.

4. The methodof claim 3, wherein:

the valid time period and the selected at least one kind oflinks are carried by the same radio resource control information.

5. The methodof claim 1, wherein:

the transmitting the selected at least one kind oflinks to the user equipment comprises:

transmitting the selected at least one kind oflinks to the user equipment through a protocol data unit in PDCP layer.

6. The methodof claim 1, wherein:

the transmitting the selected at least one kind oflinks to the user equipment comprises:

transmitting the selected at least one kind oflinks to the user equipment through a dataprotocol data unit in PDCP layer.

7. The methodof claim 6, whereinthe selected at least one kind oflinks is carried by a header of thedata protocol data unit.

8. The method of claim 1, wherein:

the transmitting the selected at least one kind ofinks to the user equipment comprises:

transmitting the selected at least one kind oflinks to the user equipment through a control element of medium access control layer.

9. The methodof any one of claims 1 to 8,

before the transmitting the selected at least one kind oflinks to the user equipment, furthercomprising:

composing the at least two kinds of links and a combination of the at least two kinds of linksinto a sequence in a certain order, and

transmitting the sequence to the user equipment.

10. The method of claim 9, wherein:

the transmitting the selected at least one kind oflinks to the user equipment comprises:

obtaining a link selection instruction based on a positional relationship in the sequence between acurrent link of the user equipment and the selected at least one kind oflinks; and

transmitting the link selection instruction to the user equipment, so that the user equipment performs communications using a linkindicated by the relationship.

11. The methodof claim 9, wherein:

the link selection instruction transmitted to the user equipment is carried in a minimum data bit.

12. The methodof claim 9, wherein:

the link selection instruction transmitted to the user equipment is carried in a single data bit.

13. The methodof one of claims 1 to 8, wherein:

the at least two kinds of links comprises a long-term evolution network and a new radio network.

14. A communication method, comprising:

receiving a link selection instruction from a base station through a user equipment, thelink selection instruction carries at least one kind of links selected by evaluating a transmission quality of at least two kinds of links which are selected to use bythe user equipment; and

performing uplink communication using the selected at least one kind oflinks.

15. The methodof claim 14, wherein:

the link selection instruction comprises at least one of a radio resource control information, a control protocol data unit /data protocol data unit in a packet data aggregation protocol, and a control elementof a medium access control layer.

16. The methodof claim 15, further comprising:

receiving an valid time period of the selected at least one kind of links from the base station;

the performing uplink communicationusing the selected at least one kind oflinks comprises:

performinguplink communication only within the valid time period using the selected at least one kind of links.

17. A base station comprising a first processing circuit and a first communication circuit electrically coupled to each other, the first processing circuit executing instructions at operation to implementthe method in one of claims 1 to 13.

18. A user equipment comprising a first processing circuit and a first communication circuit electrically coupled to each other, thefirst processing circuit executing instructions at operation to implementthe method in one of claims 14 to 16.

19. A communication method, comprising:

detecting an uplink to be performed bya user equipment through a base station, so as to determine whether the link supports PDCPfunction; and

transmitting an activating / deactivating instruction to the user equipment if the uplink supports PDCP function, so that the user equipment enables / disables PDCP function in an uplink communication.

20. The method of claim 19, wherein:

the transmitting theactivating / deactivating instruction to the user equipment if the uplink supports PDCP function comprises:

transmitting theactivating instruction to the user equipment through a data protocol data unit in a packet data aggregation protocol.

21. The methodof claim 20, wherein theactivating instruction is carried by a header of the data protocol data unit.

22. A communication method, comprising:

receiving an activating / deactivating instruction from a base station through a user equipment, the activating / deactivating instruction is transmitted by the base station based on a detectedPDCPfunction supported by an uplink to be performed by the UE.

enabling / disabling the detectedPDCP function in an uplink communication through the UE.

23. The method of claim 22, wherein:

the activating instruction includes a data protocol data unit in a packet data aggregation protocol.

24. A base station comprising a second processing circuit and a second communication circuit electrically coupled to each other, thesecond processing circuit executing instructions at operation to implementthe method in one of claims 19 to 21.

25. a UE including a second processing circuit and a second communication circuit electrically coupled to each other, the second processing circuit executing instructions at operation to implement the method in one of claims 22 to 24.

26. A devicewith a storage function, wherein the device is stored with instructions,the instructions are executed to implement the method in one of claims 1-13, 14-16, 19-21, and 22-23.

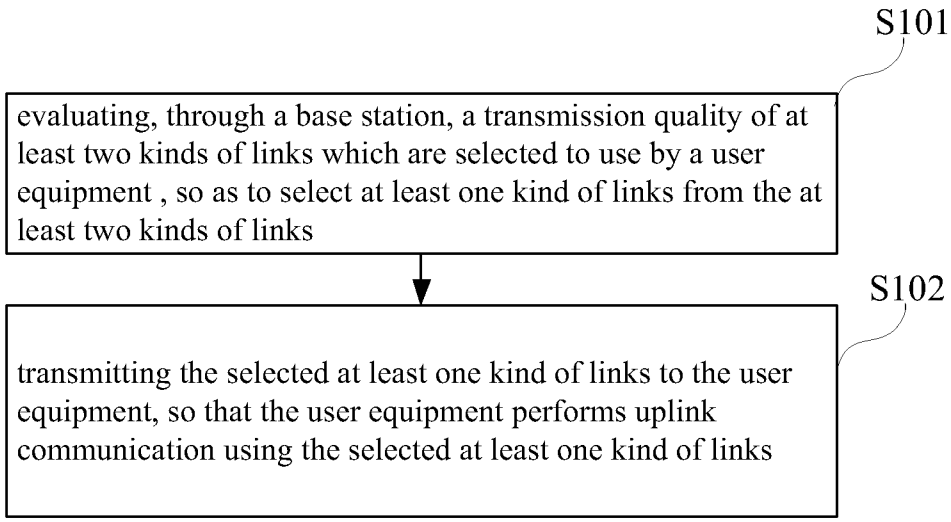


FIG. 1

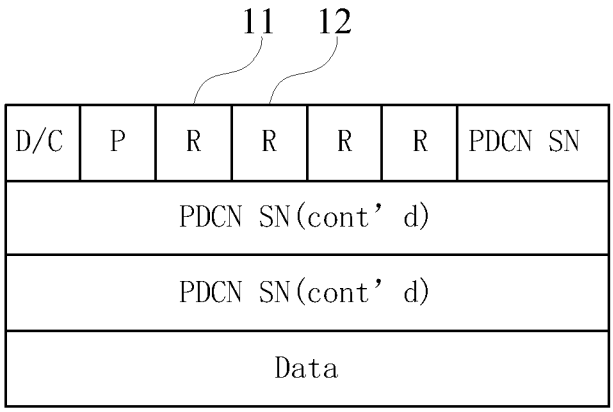


FIG. 2

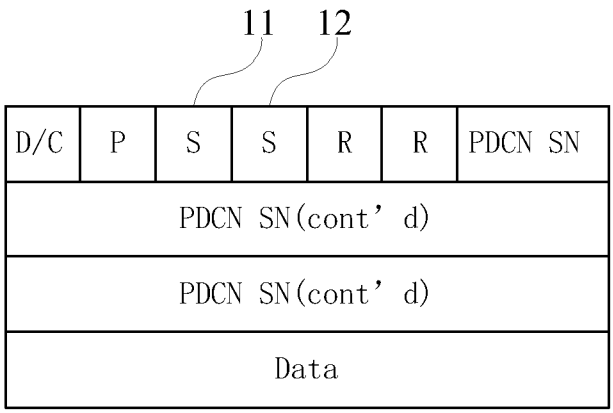


FIG. 3

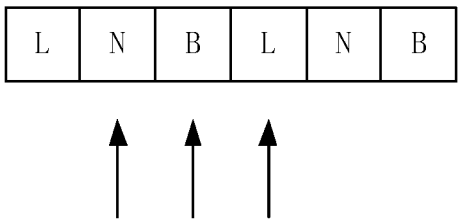


FIG. 4

Current Communication Method	Instruction is 0	Instruction is 1
LTE only (L)	Both (B)	NR only (N)
NR only (N)	LTE only (L)	Both (B)
Both (B)	NR only (N)	LTE only (L)

FIG. 5

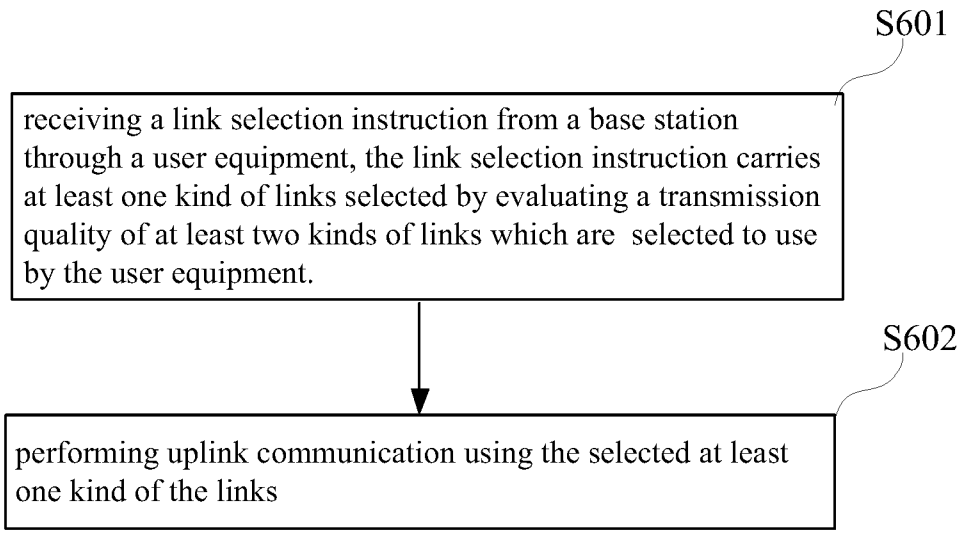


FIG. 6

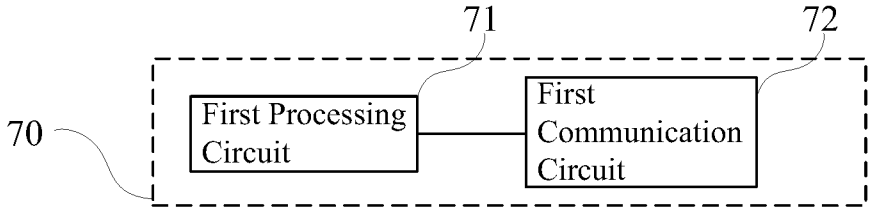


FIG. 7

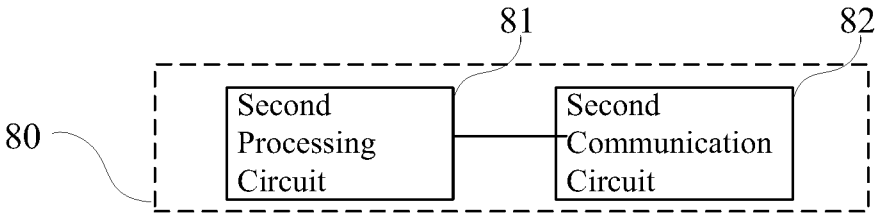


FIG. 8

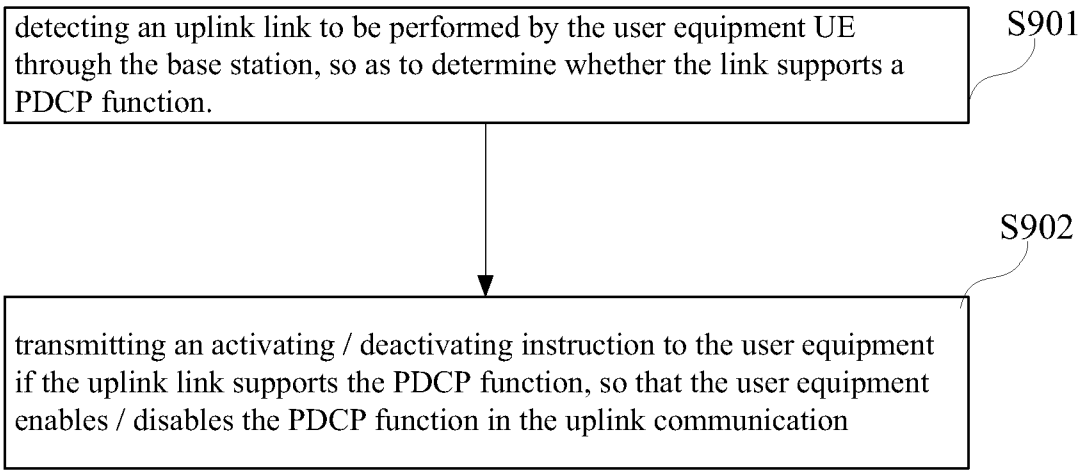


FIG. 9

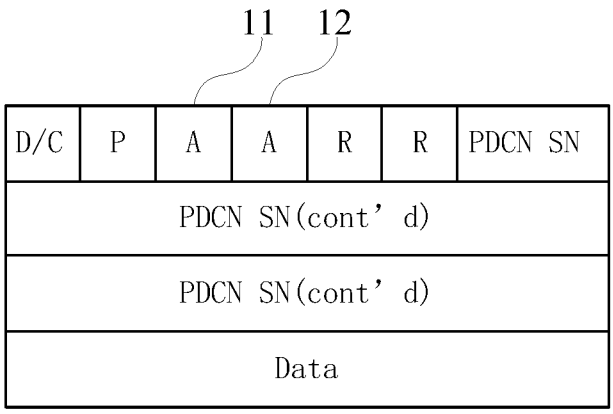


FIG. 10

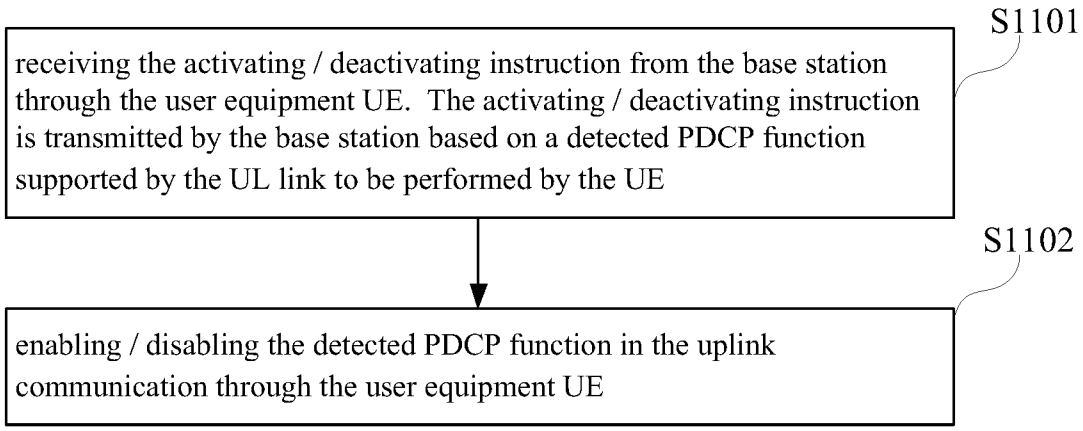


FIG. 11

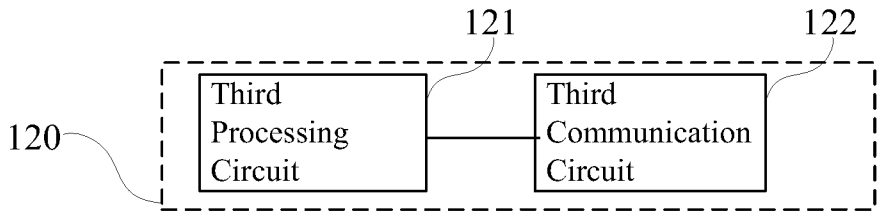


FIG. 12

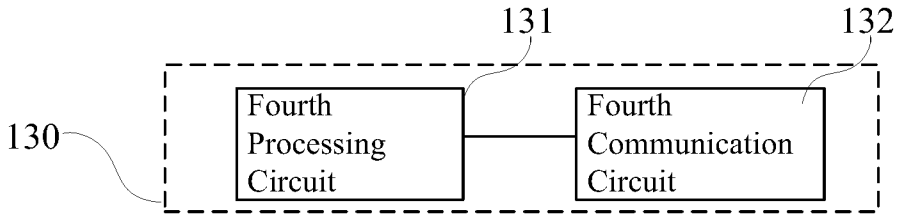


FIG. 13

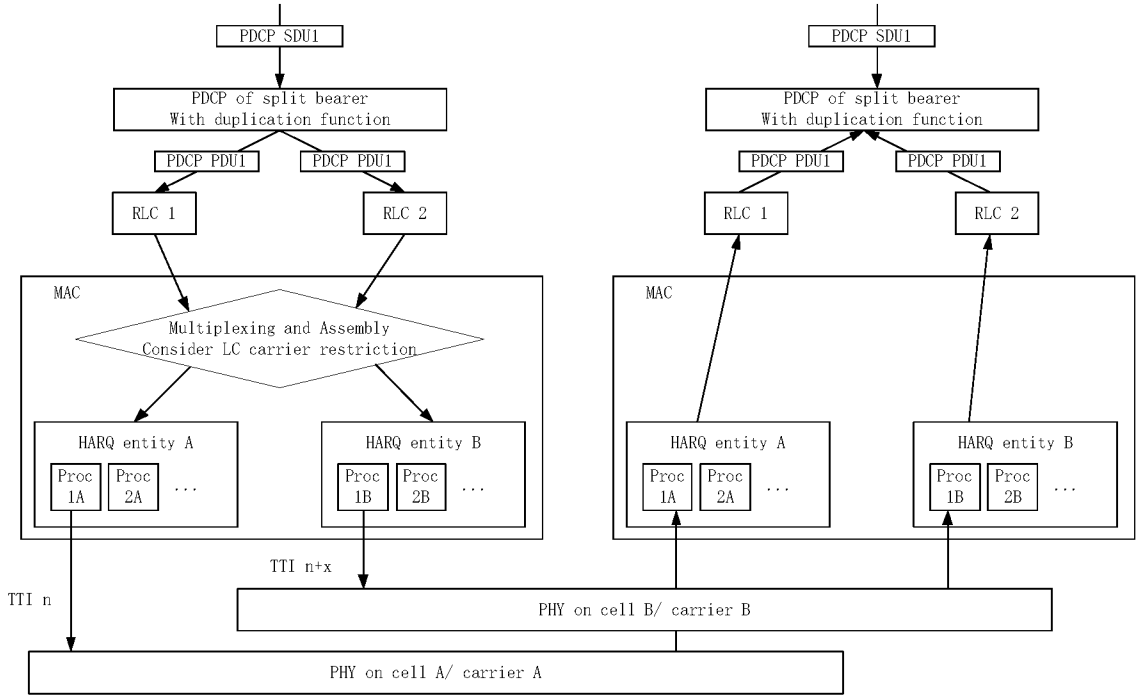

PDCP SDU1
PDCP of split bearer
With duplication function
PDCP PDU1
PDCP PDU1
RLC 1
RLC 2
MAC
Multiplexing and Assembly
Consider LC carrier restriction
HARQ entity A
Proc 1A
Proc 2A
HARQ entity B
Proc 1B
Proc 2B
TTI n
TTI n+x
PHY on cell B/ carrier B
PHY on cell A/ carrier A

FIG. 14

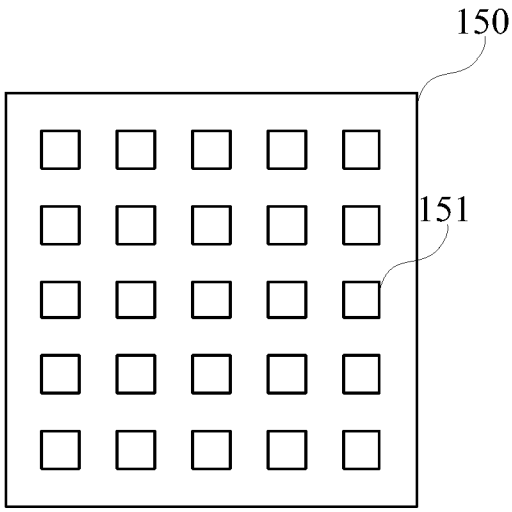

150
151

FIG. 15

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2017/107949

A. CLASSIFICATION OF SUBJECT MATTER

H04W 76/00(2018.01)i; H04W 48/20(2009.01)i; H04W 40/12(2009.01)i; H04W 80/02(2009.01)i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H04W

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

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

CNTXT,CNABS,CNKI,VEN:radio access technology, RAT, first, second, different, multiple, select, quality, PDCP, MAC, support, omit, activate, enable, disable, deactivate

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 105659690 A (LG ELECTRONICS INC.) 08 June 2016 (2016-06-08) see description, paragraphs [0100]-[0130], and figures 10, 11	1-18, 26
Y	CN 105659690 A (LG ELECTRONICS INC.) 08 June 2016 (2016-06-08) see description, paragraphs [0100]-[0130], and figures 10, 11	19-25
Y	CN 105027611 A (OPTIS CELLULAR TECHNOLOGY LLC) 04 November 2015 (2015-11-04) see description, paragraphs [0030]-[0032]	19-25
X	CN 105491682 A (SAMSUNG ELECTRONICS CO., LTD.) 13 April 2016 (2016-04-13) see description, paragraphs [0082]-[0103], and figure 9	1-18, 26
Y	CN 105723668 A (QUALCOMM INC.) 29 June 2016 (2016-06-29) see description, paragraphs [0073]-[0079], and figure 5	19-25
A	US 2007004445 A1 (DORSEY DONALD A ET AL.) 04 January 2007 (2007-01-04) see the whole document	1-26

☐ Further documents are listed in the continuation of Box C. ☑ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
18 January 2018	**24 February 2018**

Name and mailing address of the ISA/CN	Authorized officer
STATE INTELLECTUAL PROPERTY OFFICE OF THE P.R.CHINA **6, Xitucheng Rd., Jimen Bridge, Haidian District, Beijing 100088** **China**	**MENG,Wenting**
Facsimile No. **(86-10)62019451**	Telephone No. **(86-10)62089383**

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2017/107949

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

[1] (1)Claims 1, 14, 17, 18 and corresponding claim 26 relate to methods and devices for evaluating a transmission quality of links, selecting links for a UE, and performing uplink communication.

[2] (2)Claims 19, 22, 24, 25 and corresponding claim 26 relate to methods and devices for determining whether an uplink supports PDCP function, transmitting an instruction to a UE, and enabling or disabling the PDCP function in the uplink communication.

[3] There is no common or corresponding special technical feature among the inventions above within the meaning of Rule 13.2 PCT. The application, hence does not meet the requirements of unity of invention as defined in Rule 13.1 PCT.

1. ☑ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2017/107949

Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)			Publication date (day/month/year)
CN	105659690	A	08 June 2016	EP	3061309	A4	14 June 2017
				KR	20160074477	A	28 June 2016
				WO	2015060544	A1	30 April 2015
				US	2016255619	A1	01 September 2016
				EP	3061309	A1	31 August 2016
				JP	2016535556	A	10 November 2016
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				CA	2894794	A1	26 June 2014
				RU	2015129064	A	25 January 2017
				WO	2014097223	A2	26 June 2014
				WO	2014097223	A3	13 November 2014
				US	9265031	B2	16 February 2016
				EP	2936871	A2	28 October 2015
				JP	2016507942	A	10 March 2016
				BR	112015014456	A2	11 July 2017
				KR	2015100749	A	02 September 2015
				IN	201502279	P2	05 February 2016
CN	105491682	A	13 April 2016	EP	3007512	A1	13 April 2016
				KR	20160041325	A	18 April 2016
				US	2016100449	A1	07 April 2016
				AU	2015328907	A1	23 March 2017
				WO	2016056817	A1	14 April 2016
				CA	2961456	A1	14 April 2016
				IN	201737014413	A	25 August 2017
CN	105723668	A	29 June 2016	JP	2017502545	A	19 January 2017
				US	2015117357	A1	30 April 2015
				EP	3063909	B1	20 December 2017
				US	9585048	B2	28 February 2017
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				EP	3063909	A1	07 September 2016
				US	9722731	B2	01 August 2017
				WO	2015065914	A1	07 May 2015
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				EP	1908323	A1	09 April 2008
				CN	101213857	A	02 July 2008
				KR	20080037628	A	30 April 2008