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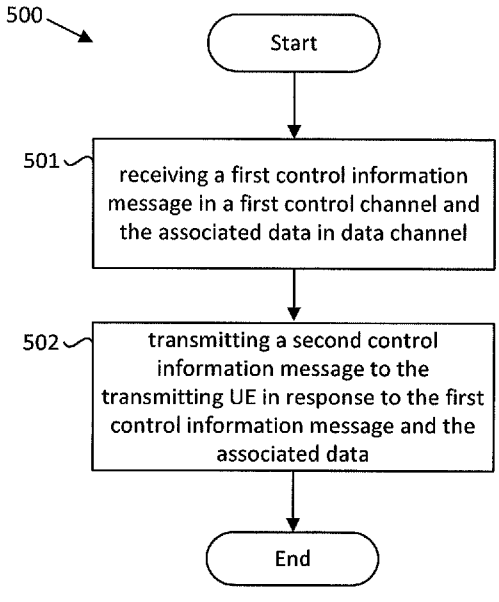

Figure 5

(57) Abstract: A method and apparatus a method and apparatus for receiving and transmitting a control information in a communication system supporting NR sidelink communication is disclosed. The method for receiving a control information comprising: receiving a first control information message in a first control channel and the associated data in data channel, the first control information message including an indicator of identification information; transmitting a second control information message to the transmitting UE in response to the first control information message and the associated data, wherein the second control information message is associated with the identification information.

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METHOD AND APPARATUS FOR RECEIVING AND TRANSMITTING CONTROL INFORMATION IN A COMMUNICATION SYSTEM SUPPORTING NR SIDELINK COMMUNICATION

FIELD

[0001] The subject matter disclosed herein relates generally to wireless communications, and more particularly relates to a method and apparatus for receiving and transmitting a control information in a communication system supporting NR sidelink communication.

BACKGROUND

[0002] The following abbreviations are herewith defined, at least some of which are referred to within the following description: Third Generation Partnership Project ("3GPP"), New Radio("NR"), Long Term Evolution("LTE"), Vehicle to Vehicle("V2V"), NR NodeB ("gNB"), Vehicle to Everything("V2X"), Sidelink Control Information ("SCI"), Uplink (UL), Downlink (DL), Radio Resource Control ("RRC"), Cyclic Redundancy Check ("CRC"), User Entity/Equipment (Mobile Terminal) (UE).

[0003] In 3GPP LTE V2V/V2X, one of important service requirements is communication range. That is because maximized communication range can give the driver(s) ample response time (e.g. 4 seconds). So V2X broadcast communication design should ensure that the communication range is large enough so that the broadcast signal can be detected by a large number of UEs. In 3GPP NR V2X, the required communication range is varies from 50 meters to 1000 meters, and the reliability requirement of advanced service is more stringent. Both 3GPP Rel-12/Rel-13 D2D communication and 3GPP Rel-14 V2V communication are typical broadcast-based communications, wherein one of the main objectives is to enable as many receivers as possible to successfully decode the messages. Mechanisms such as blind (re)transmission without feedback are no longer suitable for unicast communication. Enhancements to sidelink communication should be studied to support physical layer HARQ feedback procedure to meet the requirements for resource utilization efficiency, throughput, QoS, reliability, complexity and power consumption. In NR sidelink unicast communication, SCI plays an important role in resource allocation and data transmission. To meet the requirements of NR V2X, further study of transmission and reception of SCI for NR sidelink unicast communication is needed.

[0004] References

[0005] [1] R1-1808519, LG

[0006] [2] R1-1808696, Intel

BRIEF SUMMARY

[0007] A method and apparatus for receiving and transmitting control information in a communication system supporting NR sidelink communication is disclosed.

[0008] A method for receiving, at a receiving user equipment, control information from a transmitting user equipment in a communication system supporting sidelink communication, the method comprising: receiving a first control information message in a first control channel and the associated data in data channel, the first control information message including an indicator of identification information; transmitting a second control information message to the transmitting UE in response to the first control information message and the associated data, wherein the second control information message is associated with the identification information.

[0009] In one embodiment, the second control information is scrambled by the identification information.

[0010] In one embodiment, the second control information includes the indicator of identification information.

[0011] In one embodiment, the identification information comprises one of the following: a session ID or link ID; a source ID and a destination ID; or a destination ID and a temporary ID, wherein the session ID or link ID, the source ID and the destination ID are indicated by higher layer of the transmitting user equipment or by base station, the temporary ID is selected by physical layer of transmitting user equipment or indicated by higher layer of the transmitting user equipment or base station.

[0012] In one embodiment, the second control information message is carried on a first control channel or on a dedicated feedback channel, wherein the first control channel or the dedicated feedback channel is transmitted on a feedback resource, the feedback resource is indicated in the first control information message can be indicated according to any one of following: indicating a time offset between the first control message and the feedback resource(s), or between the associated data and the feedback resource(s); indicating a time offset and frequency offset between the first control message and the feedback resource(s), or between the associated data and the feedback resource(s); indicating a feedback resource set; or indicating a feedback resource time window. Further, it includes selecting a feedback resource from the feedback resource set or the feedback resource time window.

[0013] In one embodiment, the second control information message is generated based on a decoding result of data and includes one or more of following indicators: an indicator of Hybrid Automatic Repeat Request (HARQ) feedback; an indicator of Hybrid Automatic Repeat Request (HARQ) process number; an indicator of resource collision, wherein an indicator of

Hybrid Automatic Repeat Request (HARQ) feedback comprising: an 'ACK' if successfully decode the data; a 'NACK' if unsuccessfully decode the data. The collision indicator indicates resource collision of associated data in data channel.

[0014] A method for transmitting, at a transmitting user equipment, a control information to a receiving user equipment in a communication system supporting sidelink communication, the method comprising: transmitting a first control information message in a first control channel and the associated data in data channel, the first control information message including an indicator of identification information; receiving a second control information message from the receiving UE in response to the first control information message and the associated data, wherein the second control information message is associated with the identification information.

[0015] In one embodiment, if the indicator of resource collision received by the transmitting UE is activated, the transmitting UE performs a resource reselection, or drops subsequent transmission or re-transmission.

[0016] A receiving user equipment for receiving a control information from a transmitting user equipment in a communication system supporting sidelink communication, the receiving user equipment comprising: a transceiver; a controller configured to control the transceiver to: receiving a first control information message in a first control channel and the associated data in data channel, the first control information message including an indicator of identification information; transmitting a second control information message to the transmitting UE in response to the first control information message and the associated data, wherein the second control information message is associated with the identification information.

[0017] A transmitting user equipment for transmitting a control information to a receiving user equipment in a communication system supporting sidelink communication, the transmitting user equipment comprising: a transceiver; a controller configured to control the transceiver to: transmitting a first control information message in a first control channel and the associated data in data channel, the first control information message including an indicator of identification information; receiving a second control information message from the receiving UE in response to the first control information message and the associated data, wherein the second control information message is associated with the identification information.

[0018] In one embodiment, if the indicator of resource collision received by the transmitting UE is activated, the transmitting UE performs a resource reselection, or drops subsequent transmission or re-transmission.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019] A more particular description of the embodiments briefly described above will be rendered by reference to specific embodiments that are illustrated in the appended drawings. Understanding that these drawings depict only some embodiments and are not therefore to be considered to be limiting of scope, the embodiments will be described and explained with additional specificity and detail through the use of the accompanying drawings, in which:

[0020] Figure 1 is a schematic diagram illustrating one embodiment of aNR-V2X communication system;

[0021] Figure 2 is a schematic diagram illustrating two resource allocation modes in NR sidelink communication;

[0022] Figure 3 is a schematic diagram illustrating a collision case when a Destination ID is used in SCI;

[0023] Figure 4 is a schematic diagram illustrating a collision case when a Destination ID is used in SCI;

[0024] Figure 5 is a method for receiving a control information in NR sidelink communication.

[0025] Figure 6 is a method for transmitting a control information in NR sidelink communication.

[0026] Figure 7 is a schematic diagram illustrating one example of Session ID for feedback;

[0027] Figure 8 is a schematic diagram illustrating one example of exact feedback resource indicated by SCI;

[0028] Figure 9 is a schematic diagram illustrating one example of HARQ feedback resource set indicated by SCI.

[0029] Figure 10 is a schematic block diagram illustrating the receiving user equipment and transmitting user equipment for transmitting and receiving control information in a communication system supporting sidelink communication.

DETAILED DESCRIPTION

[0030] As will be appreciated by one skilled in the art, aspects of the embodiments may be embodied as a system, apparatus, method, or program product. Accordingly, embodiments may take the form of an entirely hardware embodiment, an entirely software embodiment (including firmware, resident software, micro-code, etc.) or an embodiment combining software and hardware aspects that may all generally be referred to herein as a "circuit," "module" or "system." Furthermore, embodiments may take the form of a program product embodied in one

or more computer readable storage devices storing machine readable code, computer readable code, and program code, referred hereafter as code. The storage devices may be tangible, non-transitory, and non-transmission. The storage devices may not embody signals. In a certain embodiment, the storage devices only employ signals for accessing code.

[0031] Certain of the functional units described in this specification may be labeled as modules, in order to more particularly emphasize their implementation independence. For example, a module may be implemented as a hardware circuit comprising custom very-large-scale integration ("VLSI") circuits or gate arrays, off-the-shelf semiconductors such as logic chips, transistors, or other discrete components. A module may also be implemented in programmable hardware devices such as field programmable gate arrays, programmable array logic, programmable logic devices or the like.

[0032] Modules may also be implemented in code and software for execution by various types of processors. An identified module of code may, for instance, include one or more physical or logical blocks of executable code which may, for instance, be organized as an object, procedure, or function. Nevertheless, the executables of an identified module need not be physically located together, but may include disparate instructions stored in different locations which, when joined logically together, include the module and achieve the stated purpose for the module.

[0033] Indeed, a module of code may be a single instruction, or many instructions, and may even be distributed over several different code segments, among different programs, and across several memory devices. Similarly, operational data may be identified and illustrated herein within modules, and may be embodied in any suitable form and organized within any suitable type of data structure. The operational data may be collected as a single data set, or may be distributed over different locations including over different computer readable storage devices. Where a module or portions of a module are implemented in software, the software portions are stored on one or more computer readable storage devices.

[0034] Any combination of one or more computer readable medium may be utilized. The computer readable medium may be a computer readable storage medium. The computer readable storage medium may be a storage device storing the code. The storage device may be, for example, but not limited to, an electronic, magnetic, optical, electromagnetic, infrared, holographic, micromechanical, or semiconductor system, apparatus, or device, or any suitable combination of the foregoing.

[0035] More specific examples (a non-exhaustive list) of the storage device would include the following: an electrical connection having one or more wires, a portable computer

diskette, a hard disk, a random access memory ("RAM"), a read-only memory ("ROM"), an erasable programmable read-only memory ("EPROM" or Flash memory), a portable compact disc read-only memory ("CD-ROM"), an optical storage device, a magnetic storage device, or any suitable combination of the foregoing. In the context of this document, a computer readable storage medium may be any tangible medium that can contain, or store a program for use by or in connection with an instruction execution system, apparatus, or device.

[0036] Code for carrying out operations for embodiments may be any number of lines and may be written in any combination of one or more programming languages including an object oriented programming language such as Python, Ruby, Java, Smalltalk, C++, or the like, and conventional procedural programming languages, such as the "C" programming language, or the like, and machine languages such as assembly languages. The code may execute entirely on the user's computer, partly on the user's computer, as a stand-alone software package, partly on the user's computer and partly on a remote computer or entirely on the remote computer or server. In the latter scenario, the remote computer may be connected to the user's computer through any type of network, including a local area network ("LAN") or a wide area network ("WAN"), or the connection may be made to an external computer (for example, through the Internet using an Internet Service Provider).

[0037] Reference throughout this specification to "one embodiment," "an embodiment," or similar language means that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least one embodiment. Thus, appearances of the phrases "in one embodiment," "in an embodiment," and similar language throughout this specification may, but do not necessarily, all refer to the same embodiment, but mean "one or more but not all embodiments" unless expressly specified otherwise. The terms "including," "comprising," "having," and variations thereof mean "including but not limited to," unless expressly specified otherwise. An enumerated listing of items does not imply that any or all ofthe items are mutually exclusive, unless expressly specified otherwise. The terms "a," "an," and "the" also refer to "one or more" unless expressly specified otherwise.

[0038] Furthermore, the described features, structures, or characteristics of the embodiments may be combined in any suitable manner. In the following description, numerous specific details are provided, such as examples of programming, software modules, user selections, network transactions, database queries, database structures, hardware modules, hardware circuits, hardware chips, etc., to provide a thorough understanding of embodiments. One skilled in the relevant art will recognize, however, that embodiments may be practiced without one or more of the specific details, or with other methods, components, materials, and so

forth. In other instances, well-known structures, materials, or operations are not shown or described in detail to avoid obscuring aspects of an embodiment.

[0039] Aspects of the embodiments are described below with reference to schematic flowchart diagrams and schematic block diagrams of methods, apparatuses, systems, and program products according to embodiments. It will be understood that each block of the schematic flowchart diagrams and schematic block diagrams, and combinations of blocks in the schematic flowchart diagrams and schematic block diagrams, can be implemented by code. The code may be provided to a processor of a general purpose computer, special purpose computer, or other programmable data processing apparatus to produce a machine, such that the instructions, which execute via the processor of the computer or other programmable data processing apparatus, create means for implementing the functions/acts specified in the schematic flowchart diagrams and schematic block diagrams block or blocks.

[0040] The code may also be stored in a storage device that can direct a computer, other programmable data processing apparatus, or other devices to function in a particular manner, such that the instructions stored in the storage device produce an article of manufacture including instructions which implement the function/act specified in the schematic flowchart diagrams and schematic block diagrams block or blocks.

[0041] The code may also be loaded onto a computer, other programmable data processing apparatus, or other devices to cause a series of operational steps to be performed on the computer, other programmable apparatus or other devices to produce a computer implemented process such that the code which execute on the computer or other programmable apparatus provide processes for implementing the functions/acts specified in the flowchart and block diagram block or blocks.

[0042] The schematic flowchart diagrams and schematic block diagrams in the Figures illustrate the architecture, functionality, and operation of possible implementations of apparatuses, systems, methods and program products according to various embodiments. In this regard, each block in the schematic flowchart diagrams and schematic block diagrams may represent a module, segment, or portion of code, which includes one or more executable instructions of the code for implementing the specified logical function(s).

[0043] It should also be noted that, in some alternative implementations, the functions noted in the block may occur out of the order noted in the Figures. For example, two blocks shown in succession may, in fact, be executed substantially concurrently, or the blocks may sometimes be executed in the reverse order, depending upon the functionality involved. Other

steps and methods may be conceived that are equivalent in function, logic, or effect to one or more blocks, or portions thereof, of the illustrated Figures.

[0044] Although various arrow types and line types may be employed in the flowchart and block diagrams, they are understood not to limit the scope of the corresponding embodiments. Indeed, some arrows or other connectors may be used to indicate only the logical flow of the depicted embodiment. For instance, an arrow may indicate a waiting or monitoring period of unspecified duration between enumerated steps of the depicted embodiment. It will also be noted that each block of the block diagrams and flowchart diagrams, and combinations of blocks in the block diagrams and flowchart diagrams, can be implemented by special purpose hardware-based systems that perform the specified functions or acts, or combinations of special purpose hardware and code.

[0045] The description of elements in each figure may refer to elements of proceeding figures. Like numbers refer to like elements in all figures, including alternate embodiments of like elements.

[0046] Figure 1 depicts an embodiment of NR-V2X communication system 100. In one embodiment, the wireless communication system 100 may includes gNB 104 and Vehicles 102. Even though a specific number of gNB 104 and Vehicle 102 are depicted in Figure 1, one skilled in the art will recognize that any number of gNB 104 and Vehicle 102 may be included in the NR V2X communication system 100. In Figure 1, solid lines denote downlink communication channels from gNB 104 to Vehicle 102 and dotted line denote sidelink communication channels between the two vehicles. Here, for illustration purposes, direction of each arrow indicates the direction of data transmission, without limiting discussed embodiments. Here, Vehicles can also be User Entity/Equipments (Mobile Terminals) (UEs).

[0047] Figure 2 is a schematic diagram illustrating two resource allocation modes of NR-V2X sidelink communication. For NR V2X discussion, two resource allocation modes are being considered, e.g. Mode 1: gNB schedules sidelink resource(s) to be used by Vehicle for sidelink transmission(s); and Mode 2: Vehicle determines (i.e. gNB does not schedule) sidelink transmission resource(s) within sidelink resources configured by gNB/network or pre-configured sidelink resources

[0048] . To introduce unicast sidelink communication for NR V2X, the feedback transmission and resource allocation should be considered.

[0049] In Figure 2, Circle 201 denotes the coverage area supported by gNB, and the meanings of lines and arrows are the same as that of Figure 1.

[0050] Figure 2(a) describes resource allocation Mode 1 of NR-V2X sidelink communication. In this mode, gNB schedules sidelink resource(s) to be used by vehicles for sidelink communication. For example, in one case, feedback resources used by Vehicle B can be directly indicated by a DCI grant transmitted from gNB and be valid, only when Vehicle B is within a coverage area of gNB. This scheme has a shortcoming since it only works when Vehicle A and Vehicle B are both within coverage area of gNB. In another case, the feedback resource (set) to be used by Vehicle B can be indicated by gNB via Vehicle A, so at least, Vehicle A should be in coverage of gNB. In this scheme, the exact feedback resource to be used by Vehicle B can be determined by any one of Vehicles A and B, wherein Vehicle A selects a feedback resource for Vehicle B, or Vehicle B selects a feedback resource from an indicated feedback resource set.

[0051] Figure 2(b) describes resource allocation Mode 2 of NR-V2X sidelink communication. In Mode 2, Vehicles A or B can select sidelink transmission resource(s) from a set of sidelink resources configured by gNB or a network or a set of pre-configured sidelink resources. For example, in one case, the exact feedback resource for Vehicle B can be determined by Vehicle A. In another case, the exact feedback resource of Vehicle B can be determined by Vehicle B from Vehicle A indicated feedback resource set.

[0052] In NR-V2X sidelink communication, it is currently known that Destination, Source and Session ID may be supported for sidelink unicast communication.

[0053] Figure 3 is a schematic diagram illustrating a collision case when a Destination ID is used.

[0054] Similar to Figures 1 and 2, directions of the identified arrows denote direction of data transmission.

[0055] In a communication diagram depicted on the left portion of Figure 3, Vehicle A uses Destination ID=B in Sidelink Control Information(SCI) transmitted to Vehicle B, with Vehicle B performing blind detection of received data. In addition, Vehicle A uses Destination ID=C in SCI transmitted to Vehicle C, with Vehicle C performing blind detection of received data. This configuration allows for no transmission or reception misunderstanding among all Vehicles. Similarly, as part of feedback communication, Vehicle B also uses ID=B in SCI transmitted to Vehicle A and Vehicle C uses ID=C for feedback transmission to Vehicle A. Using a similar ID assignment approach, communication diagram depicted on the right side of Figure 3 shows Vehicle A and C transmit data to Vehicle B. Except for receiving HARQ feedback in the overlap resource set or time window, if Destination ID used for transmission and

feedback is set to B, e.g. ID = B, by both Vehicles A and C, Vehicle B cannot identify a Vehicle from which the data transmission originated from. Similarly, neither Vehicle A or C can distinguish the intended destination of feedback information transmitted by Vehicle B.

[0056] Figure 4 is a schematic diagram illustrating a collision example when a Source ID is used.

[0057] Communication diagram illustrated on the right side of Figure 4 identifies Vehicle A using Source ID set to A, i.e. ID=A, in SCI transmitted to Vehicle B. Similarly, Vehicle C uses Source ID=C in SCI transmitted to Vehicle B. Following this approach, there is no transmission or reception misunderstanding among each Vehicle. For the feedback, Vehicle B continues to use ID set to A, i.e. ID=A, for feedback transmissions to Vehicle A and Vehicle B uses ID set to C, i.e. ID=C, for feedback transmissions to Vehicle C. Similarly, there is obviously no collision. As shown on the left side in Figure 4, Vehicle A transmits data to Vehicle B and C, and except for receiving HARQ feedback in the overlap resource set or time window, if ID=A is used for transmission and feedback, Vehicle A cannot distinguish where the feedback information originates from.

[0058] To solve the above identified problems, a method for receiving and transmitting control information in NR sidelink communication is proposed.

[0059] Figure 5 is a schematic diagram illustrating a method for receiving control information in NR sidelink communication. The method includes steps 501-502 described below.

[0060] Step 501 describes receiving a first control information message in a first control channel and the associated data in data channel. The first control information message includes an indicator of identification information, and the identification information comprises one of the following: a session ID or link ID; a source ID and a destination ID; or a destination ID and a temporary ID;

[0061] Step 502 describes transmitting a second control information message to the transmitting UE in response to received first control information message and the associated data. The second control information message is associated with the identification information recieved.

[0062] Figure 6 is a schematic diagram illustrating a method for transmitting control information in NR sidelink communication.

[0063] Step 601 describes transmitting a first control information message in a first control channel and the associated data in data channel. the first control information message including an indicator of identification information, and the identification information comprises

one of the following: a session ID or link ID; a source ID and a destination ID; or a destination ID and a temporary ID;

[0064] Step 602 describes receiving a second control information message by the transmitting UE in response to the first control information message and the associated data being transmitted. The second control information message is associated with the identification information.

[0065] For both methods described above in connection with schematic diagrams of Figures 5 and 6 associated with the sidelink unicast communication, an originating Vehicle (i.e. transmitting user equipment – Tx UE) transmits SCI information over the Physical Sidelink Control Channel (PSCCH), and transmits data information over the Physical Sidelink Shared Channel (PSSCH). The SCI includes an indication part to indicate the time and frequency resource location of data information.

[0066] The SCI also includes an indication part to indicate the time and frequency resource location for feedback information transmission. It can indicate an exact feedback resource, or it can indicate a resource set or a feedback time window.

[0067] SCI also indicates a session ID, or source ID and destination ID, or destination ID and temporary ID indicator, wherein the session ID, the source ID and the destination ID are indicated by the higher layer of the transmitting user equipment (e.g., layer-2) or by base station (e.g., gNB). The temporary ID is selected by the physical layer of the transmitting user equipment or indicated by the higher layer of the transmitting user equipment (e.g., layer-2) or base station (e.g., gNB).

[0068] Receiving Vehicle (i.e. receiving user equipment) receives transmitted SCI information and its associated data transmission and decodes the indicated data, if the decoded ID belong to the receiving user equipment (Rx UE). If the decoding operation is performed successfully, Rx UE generates an ACK; else if decoding operation is not successful, Rx UE generates a NACK.

[0069] Rx UE transmits an ACK or a NACK information on an indicated feedback resource. If the indicated feedback resource is a resource set or a time window, Rx UE will select a feedback resource based on the available time slot or frequency resource.

[0070] Tx UE receives the feedback information for retransmission consideration. For this case, the collision indicator is also included in the SCI information received. It triggers either resource re-selection or drops resource re-transmission.

[0071] To achieve the objectives mentioned above, it can be considered to introduce two SCI formats.

[0072] SCI format A:

[0073] SCI format A is used for the scheduling of PSSCH and includes the following information:

[0074] -time and frequency resource location of data information;

[0075] -time and frequency resource location of feedback information;

[0076] -session ID or source ID and destination ID or destination ID and temporary ID indicator

[0077] The time and frequency resource location of feedback information can be indicated in a number of ways, specifically by:

[0078] - indicating an exact time and frequency resource location,

[0079] –indicating time offset from the received SCI transmission with the frequency resource being the same as the one used to receive SCI/data transmission;

[0080] -indicate time offset from the received data transmission where the frequency resource is the same as the resource used to receive SCI/data transmission.

[0081] - indicate a resource set or time window (this resource set and time window may start from a fixed offset, that is dependent on UE process timing, e.g. 4ms).

[0082] - in a bitmap manner, to indicate available feedback time resource (subframe);

[0083] -to indicate a window size;

[0084] –a fixed window size and a time offset.

[0085] SCI format B

[0086] SCI format B is used for the scheduling of PSSCH.

[0087] The following information is transmitted by means of the SCI format B:

[0088] -3 bits HARQ process number;

[0089] -1-bit ACK/NACK indicator;

[0090] -session ID or source ID and destination ID or destination ID and temporary ID indicator. If the session ID or source ID and destination ID or destination ID and temporary ID indicators are used to scramble on attached CRC to SCI, this field is not needed;

[0091] -1-bit collision indicator.

[0092] Figure 7 is a schematic diagram illustrating one example of Session ID used for feedback transmission.

[0093] In Figure 7, the Session ID is link-specific between Vehicle A and B or between Vehicle A and C. The Session ID can be obtained during connection establishment step by Vehicles coordination or information exchange, or indicated or configured by gNB. The Session ID is carried in SCI for data and associated feedback transmission. Here, the Session ID between

Vehicle A and B is 0, and the session ID between Vehicle A and C is 1. By this scheme, the problem that Vehicle A cannot distinguish the destination of feedback information is resolved.

[0094] In another embodiment, feedback ID is generated by the received Destination ID and Source ID. Destination ID and Source ID can be indicated by a higher layer of Vehicles or by gNB. The feedback ID includes two parts: the source ID and destination ID. For example, the size of Destination ID is 8 bits in received SCI, e.g., 10101010, and the size of source ID is 8bits in received SCI, e.g., 00000100. All of these 16 bits should be carried in data transmission associated SCI. The Destination ID and source ID are carried in SCI for data transmission and associated feedback.

[0095] In another embodiment, feedback ID is determined by Destination ID and temporary ID (temp ID).

[0096] Table 1 shows an example of a feedback ID that determined by Destination ID and temp ID.

[0097] <Table 1>

Indicator	**Temp ID**	**Feedback ID**
000	00000001	10101010 00000001
001	00000010	10101010 00000010
010	00000100	10101010 00000100
011	00001000	10101010 00001000
100	00010000	10101010 00010000
101	00100000	10101010 00100000
110	01000000	10101010 01000000
111	10000000	10101010 10000000

[0098] As shown in the table 1, the first 8 bits of the feedback ID field is the destination ID and the remaining 8 bits of the feedback ID field is temp ID. The indicator is used to indicate temp ID. The first 8 bits are dependent on the real Destination ID. The indicator can be indicated

or configured by gNB or randomly selected by the transmitter. For example, Vehicle A and C want to transmit data to Vehicle B (Destination ID =10101010), Vehicle A may select index 2 (indicator: 001) and Vehicle C may select index 6 (indicator 101). Thus, Vehicle B can distinguish transmissions via the identified feedback IDs.

[0099] If the HARQ process number is contained within feedback SCI, HARQ and a source indicator can be combined to distinguish transmission source (i.e., feedback destination). For example, Vehicle B and C want to feedback SCI to Vehicle A, Vehicle B and C may select two different source indicators. Thus, Vehicle A can distinguish feedbacks via the identified feedback IDs.

[00100] This mapping can be configured at the time of connection establishment procedure, similar to session ID. In that way, the session ID is shortened in transmitted SCI.

[00101] In another embodiment, the feedback ID is transmitted with ACK/NACK feedback. In detail, for feedback SCI, the attached CRC is scrambled by the feedback ID to distinguish feedback from different UEs/groups. The feedback ID is mentioned in above solutions.

[00102] Here, the feedback SCI format may be defined as SCI format B, feedback ID may be defined as session ID or source ID and destination ID or destination ID and temporary ID indicator

[00103] The feedback SCI (SCI format) content includes: HARQ ACK/NACK indicator, HARQ process number, collision indicator

[00104] Collision indicator is used to indicate resource selection collision from the receiver perspective. For example, if the decoded SCIs indicate a full or partial overlapping of resources, the collision indicator will be set to, for example a value of '1', to indicate the resource selection collision. If a transmission Vehicle receives a collision indicator, it may trigger a resource re-selection.

[00105] The collision indicator can indicate the collision for re-transmission resource, if the initial transmission resource and retransmission resource is indicated in SCI. If transmission Vehicle receives a collision indicator, it may drop the re-transmission.

[00106] Figure 8 is a schematic diagram illustrating one example of exact feedback resource indicated by SCI.

[00107] In Figure 8, only one exact feedback resource is indicated by transmission UE, from Vehicle B's perspective. The single unit identified in Figure 8 is slot, and the directions of arrows denote the directions of SCI and data transmission. First, Vehicle A sends SCI and data to Vehicle B in slot n, and then Vehicle B receives and decodes the received SCI

and data. If decoding fails, Vehicle B sends NACK to Vehicle A in the slot indicated by the received SCI, e.g. slot n+4. Vehicle A performs retransmission in slot 5 after receiving the NACK, and then Vehicle B receives and decodes the data again. If decoding succeeds, Vehicle B sends ACK to Vehicle A in the slot indicated by the received SCI (e.g., slot n+9) to end this process. The procedure between Vehicle A and Vehicle C is similar to the above described procedure. If decoding the data successfully in slot n, Vehicle B sends ACK in slot indicated by the SCI received from Vehicle C, e.g., slot n+4.

[00108] Figure 9 is a schematic diagram illustrating one example of HARQ feedback resource set indicated by SCI. Similar to Figure 8, the smallest unit in Figure 9 is slot, and the directions of arrows denote the directions of SCI and data transmission. Vehicle A sends SCI and data to Vehicle B and Vehicle C in slot n and slot n+1, respectively. Here, SCI indicates HARQ feedback resource set (or time window). Feedback slot(s) can be indicated in a bitmap manner, e.g., a 10ms pattern, or the time window of feedback slot(s) can be a fixed size. The time offset can be indicated in SCI, or time offset can be fixed, and the size of time window can be indicated in SCI (e.g., as shown in Figure 9, 4 slots). Here, time offset is the number of slots between SCI/data transmission and feedback transmission (e.g., as shown in Figure 9, 3 slots). Feedback UE selects feedback resource based on an indicated set (or in time window), e.g., as shown in Figure 9, Vehicle B and Vehicle C select slot n+6 and slot n+7 as feedback resources, respectively.

[00109] Figure 10 is a schematic block diagram illustrating the receiving user equipment and transmitting user equipment for transmitting and receiving a control information in a communication system supporting sidelink communication.

[00110] Referring to Figure 10, The user equipment includes a controller, a memory, and a transceiver. The controller implements a function, a process, and a method which are proposed in Figures 5 to 9above. Layers of a radio interface protocol may be implemented by the controller. The memory is connected with the controller to store various pieces of information for driving the controller. The transceiver is connected with the controller to transmit and receive a radio signal.

[00111] The memories may be positioned inside or outside the controllers and connected with the controllers by various well-known means. Further, the relay node may have a single antenna or multiple antennas.

[00112] In the embodiments described above, the components and the features of the embodiments are combined in a predetermined form. Each component or feature should be considered as an option unless otherwise expressly stated. Each component or feature may be

implemented not to be associated with other components or features. Further, the embodiment may be configured by associating some components and features. The order of the operations described in the embodiments may be changed. Some components or features of any embodiment may be included in another embodiment or replaced with the component and the feature corresponding to another embodiment. It is apparent that the claims that are not expressly cited in the claims are combined to form an embodiment or be included in a new claim.

[00113] The embodiments may be implemented by hardware, firmware, software, or combinations thereof. In the case of implementation by hardware, according to hardware implementation, the exemplary embodiment described herein may be implemented by using one or more application-specific integrated circuits (ASICs), digital signal processors (DSPs), digital signal processing devices (DSPDs), programmable logic devices (PLDs), field programmable gate arrays (FPGAs), processors, controllers, micro-controllers, microprocessors, and the like.

[00114] In the case of implementation by firmware or software, the embodiment may be implemented in the form of a module, a procedure, a function, and the like to perform the functions or operations described above. A software code may be stored in the memory and executed by the controller. The memory may be positioned inside or outside the controller and may transmit and receive data to/from the controller by various means.

CLAIMS

1. A method for receiving, at a receiving user equipment, a control information from a transmitting user equipment in a communication system supporting sidelink communication, said method comprising:

   receiving a first control information message in a first control channel and the associated data in data channel, the first control information message including an indicator of identification information;

   transmitting a second control information message to the transmitting UE in response to the first control information message and the associated data, wherein the second control information message is associated with the identification information.

2. The method of claim 1, wherein the second control information is scrambled by the identification information.

3. The method of claim 1, wherein the second control information includes the indicator of identification information.

4. The method of any one of claim 1-3, wherein the identification information comprising one of the following:

   a session ID or link ID;

   a source ID and a destination ID; or

   a destination ID and a temporary ID.

5. The method of claim 4, wherein the session ID, the source ID and the destination ID are indicated by higher layer of the transmitting user equipment or by base station.

6. The method of claim 4, wherein the temporary ID is selected by physical layer of transmitting user equipment or indicated by higher layer of the transmitting user equipment or base station.

7. The method of claim 1, wherein the second control information message is carried on a first control channel or on a dedicated feedback channel.

8. The method of claim 7, wherein the first control channel or the dedicated feedback channel is transmitted on a feedback resource, the feedback resource is indicated in the first control information message.

9. The method of claim 8, wherein the feedback resource indicated in the first control information message can be indicated according to any one of following:

   Indicating a time offset between the first control message and the feedback resource(s), or between the associated data and the feedback resource(s);

Indicating a time offset and frequency offset between the first control message and the feedback resource(s), or between the associated data and the feedback resource(s);

Indicating a feedback resource set; or

Indicating a feedback resource time window.

10. The method of claim 9, further comprising:

selecting a feedback resource from the feedback resource set or the feedback resource time window.

11. The method of claim 1, wherein the second control information message is generated based on a decoding result of data and includes one or more of following indicators:

an indicator of Hybrid Automatic Repeat Request (HARQ) feedback;

an indicator of Hybrid Automatic Repeat Request (HARQ) process number; and

an indicator of resource collision.

12. The method of claim 11, wherein an indicator of Hybrid Automatic Repeat Request (HARQ) feedback comprising;

an ACK' if successfully decode the data,

a 'NACK' if unsuccessfully decode the data.

13. The method of claim 11, wherein said collision indicator indicates resource collision of associated data in data channel.

14. A method for transmitting, at a transmitting user equipment, a control information to a receiving user equipment in a communication system supporting sidelink communication, the method comprising:

Transmitting a first control information message in a first control channel and the associated data in data channel, the first control information message including an indicator of identification information;

Receiving a second control information message from the receiving UE in response to the first control information message and the associated data, wherein the second control information message is associated with the identification information.

15. The method of claim 14, wherein the second control information is scrambled by the identification information.

16. The method of claim 14, wherein the second control information includes the indicator of identification information.

17. The method of any one of claim 14-16, wherein the identification information comprising one of the following:

a session ID or link ID;

a source ID and a destination ID; or

a destination ID and a temporary ID.

18. The method of claim 17,wherein the session ID, the source ID and the destination ID are indicated by higher layer of the transmitting user equipment or by base station.

19. The method of claim 17, wherein the temporary ID is selected by physical layer of transmitting user equipment or indicated by higher layer of the transmitting user equipment or base station.

20. The method of claim 14, wherein the second control information message is carried on a first control channel or on a dedicated feedback channel.

21. The method of claim 20, wherein the first control channel or the dedicated feedback channel is transmitted on a feedback resource, the feedback resource is indicated in the first control information message.

22. The method of claim 21, wherein the feedback resource indicated in the first control information message can be indicated according to any one of following:

Indicating a time offset between the first control message and the feedback resource(s), or between the associated data and the feedback resource(s);

Indicating a time offset and frequency offset between the first control message and the feedback resource(s), or between the associated data and the feedback resource(s);

Indicating a feedback resource set; or

Indicating a feedback resource time window.

23. The method of claim 22, further comprising:

selecting a feedback resource from the feedback resource set or the feedback resource time window.

24. The method of claim 14, wherein the second control information message is generated based on a decoding result of data and includes one or more of following indicators:

an indicator of Hybrid Automatic Repeat Request (HARQ) feedback;

an indicator of Hybrid Automatic Repeat Request (HARQ) process number; and

an indicator of resource collision.

25. The method of claim 24, wherein the collision indicator indicates resource selection collision of associated data in data channel.

26. The method of claim 25,

wherein if the indicator of resource collision received by the transmitting UE is activated, the transmitting UE performs a resource reselection, or drops subsequent transmission or re-transmission.

27. A receiving user equipment for receiving a control information from a transmitting user equipment in a communication system supporting sidelink communication, the receiving user equipment comprising:

a transceiver;

a controller configured to control the transceiver to:

receiving a first control information message in a first control channel and the associated data in data channel, the first control information message including an indicator of identification information;

transmitting a second control information message to the transmitting UE in response to the first control information message and the associated data, wherein the second control information message is associated with the identification information.

28. The receiving user equipment of claim 27, wherein the second control information is scrambled by the identification information.

29. The receiving user equipment of claim 27, wherein the second control information includes the indicator of identification information.

30. The receiving user equipment of any one of claim 27-29, wherein the identification information comprising one of the following:

a session ID or link ID;

a source ID and a destination ID; or

a destination ID and a temporary ID.

31. The receiving user equipment of claim 30,wherein the session ID, the source ID and the destination ID are indicated by higher layer of the transmitting user equipment or by base station.

32. The receiving user equipment of claim 30, wherein the temporary ID is selected by physical layer of transmitting user equipment or indicated by higher layer of the transmitting user equipment or base station.

33. The receiving user equipment of Claim 27, wherein the second control information message is carried on a first control channel or on a dedicated feedback channel.

34. The receiving user equipment of claim 33, wherein the first control channel or the dedicated feedback channel is transmitted on a feedback resource, the feedback resource is indicated in the first control information message.

35. The receiving user equipment of claim 34, wherein the feedback resource indicated in the first control information message can be indicated according to any one of following:

Indicating a time offset between the first control message and the feedback resource(s), or between the associated data and the feedback resource(s);

Indicating a time offset and frequency offset between the first control message and the feedback resource(s), or between the associated data and the feedback resource(s);

Indicating a feedback resource set; or

Indicating a feedback resource time window.

36. The receiving user equipment of claim 35, further comprising:

selecting a feedback resource from the feedback resource set or the feedback resource time window.

37. The receiving user equipment of claim 27, wherein the second control information message is generated based on a decoding result of data and includes one or more of following indicators:

an indicator of Hybrid Automatic Repeat Request (HARQ) feedback;

an indicator of Hybrid Automatic Repeat Request (HARQ) process number; and

an indicator of resource collision.

38. The receiving user equipment of claim 37, wherein an indicator of Hybrid Automatic Repeat Request (HARQ) feedback comprising;

an ACK' if successfully decode the data,

a 'NACK' if unsuccessfully decode the data.

39. The receiving user equipment of claim 37, wherein the collision indicator indicates resource collision of associated data in data channel.

40. A transmitting user equipment for transmitting a control information to a receiving user equipment in a communication system supporting sidelink communication, the transmitting user equipment comprising:

a transceiver;

a controller configured to control the transceiver to:

transmitting a first control information message in a first control channel and the associated data in data channel, the first control information message including an indicator of identification information;

receiving a second control information message from the receiving UE in response to the first control information message and the associated data, wherein the second control information message is associated with the identification information.

41. The transmitting user equipment of claim 40, wherein the second control information is scrambled by the identification information.

42. The transmitting user equipment of claim 40, wherein the second control information includes the indicator of identification information.

43. The transmitting user equipment of any one of claim 40-42, wherein the identification information comprising one of the following:

a session ID or link ID;

a source ID and a destination ID; or

a destination ID and a temporary ID.

44. The transmitting user equipment of claim 43,wherein the session ID, the source ID and the destination ID are indicated by higher layer of the transmitting user equipment or by base station.

45. The transmitting user equipment of claim 43, wherein the temporary ID is selected by physical layer of transmitting user equipment or indicated by higher layer of the transmitting user equipment or base station.

46. The transmitting user equipment of claim 40, wherein the second control information message is carried on a first control channel or on a dedicated feedback channel.

47. The transmitting user equipment of claim 46, wherein the first control channel or the dedicated feedback channel is transmitted on a feedback resource, the feedback resource is indicated in the first control information message.

48. The transmitting user equipment of claim 47, wherein the feedback resource indicated in the first control information message can be indicated according to any one of following:

Indicating a time offset between the first control message and the feedback resource(s), or between the associated data and the feedback resource(s);

Indicating a time offset and frequency offset between the first control message and the feedback resource(s), or between the associated data and the feedback resource(s);

Indicating a feedback resource set; or

Indicating a feedback resource time window.

49. The transmitting user equipment of claim 48, further comprising:

selecting a feedback resource from the feedback resource set or the feedback resource time window.

50. The transmitting user equipment of claim 40, wherein the second control information message is generated based on a decoding result of data and includes one or more of following indicators:

an indicator of Hybrid Automatic Repeat Request (HARQ) feedback;

an indicator of Hybrid Automatic Repeat Request (HARQ) process number; and

an indicator of resource collision.

51. The transmitting user equipment of claim 50, wherein the collision indicator indicates resource selection collision of associated data in data channel.

52. The transmitting user equipment of claim 51,

wherein if the indicator of resource collision received by the transmitting UE is activated, the transmitting UE performs a resource reselection, or drops subsequent transmission or re-transmission.

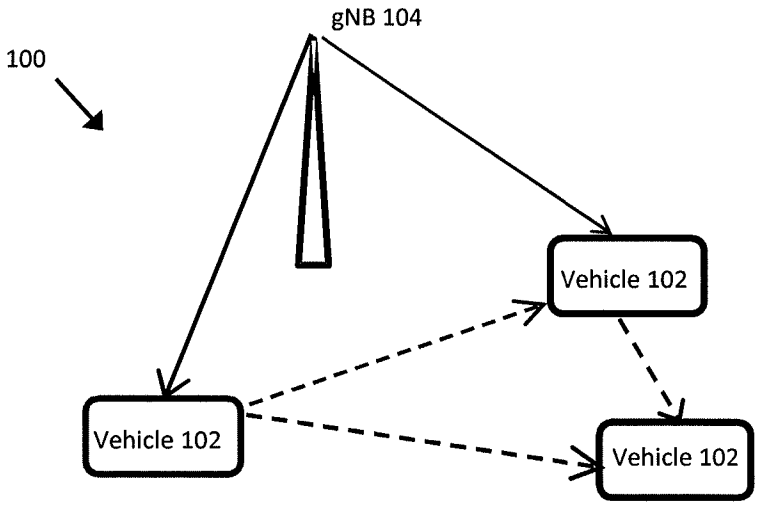

Figure 1

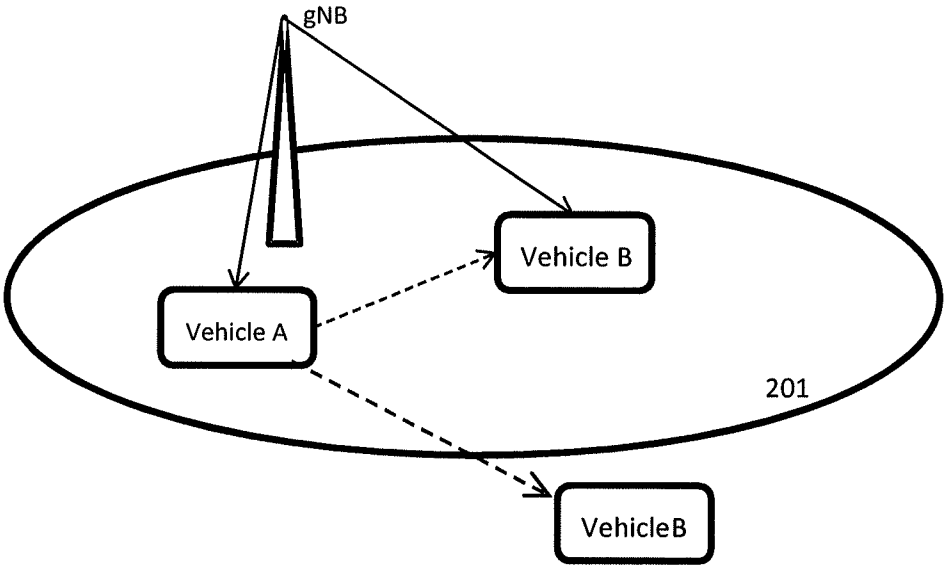

Figure 2(a)

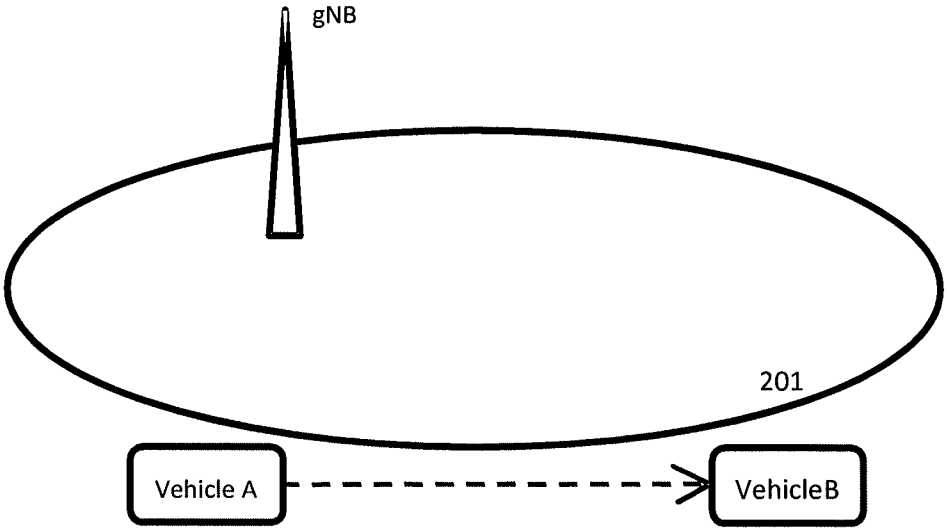

Figure 2(b)

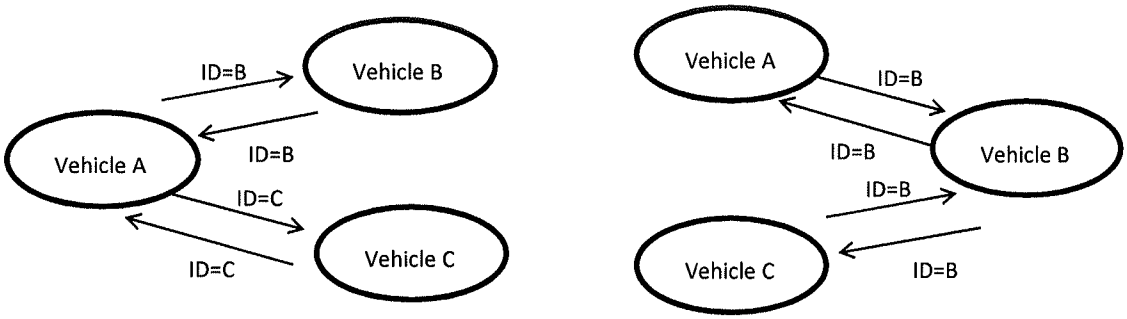

Figure 3

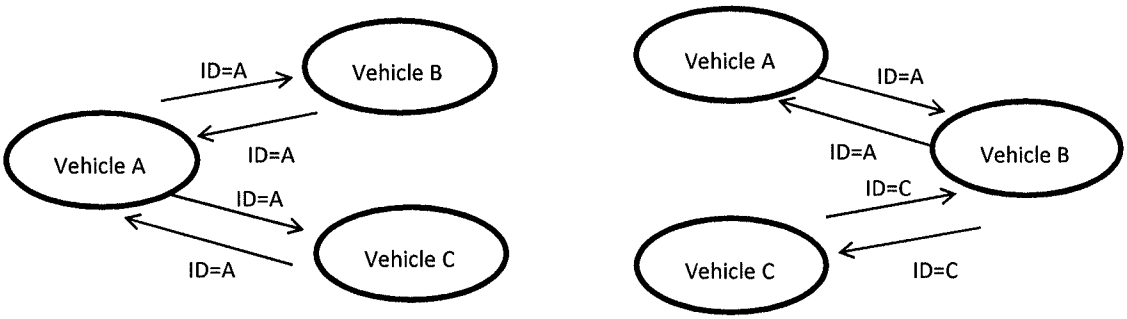

Figure 4

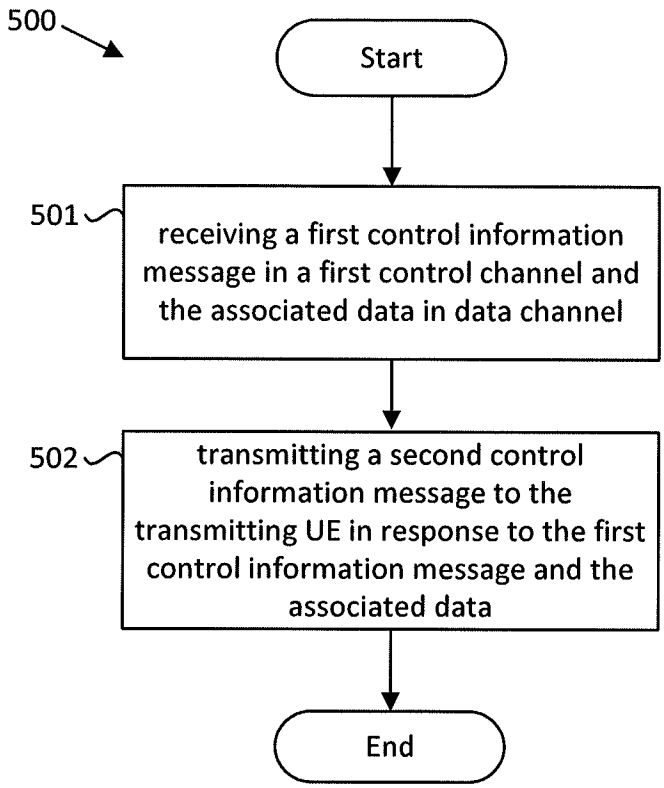

Figure 5

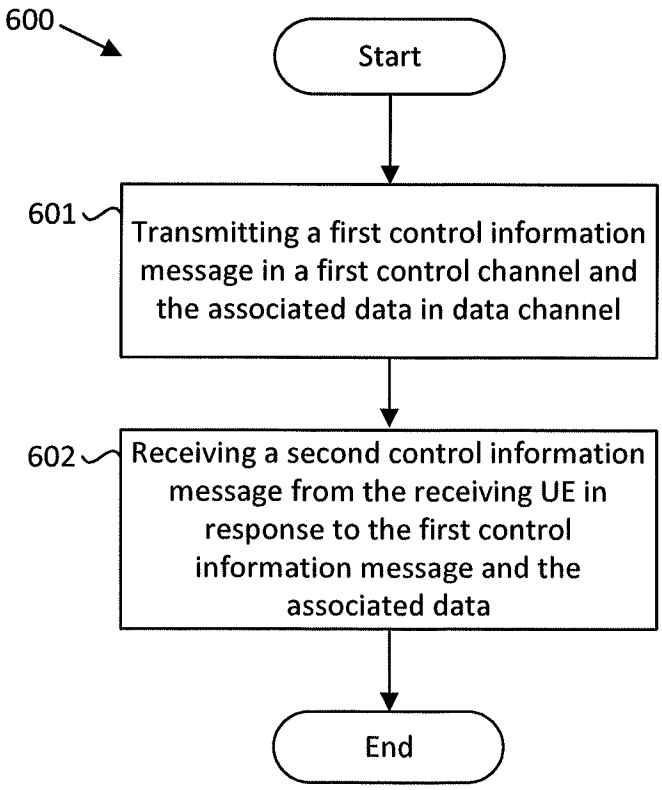

Figure 6

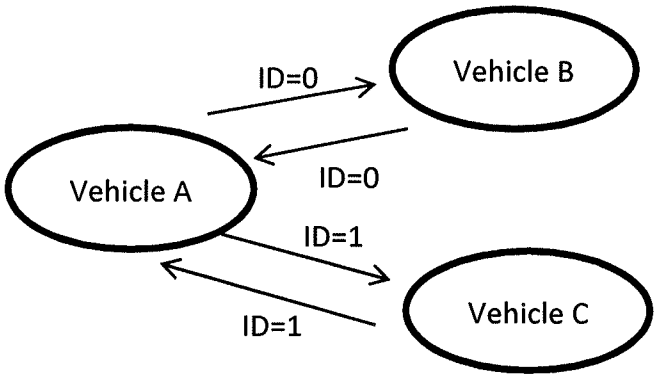

Figure 7

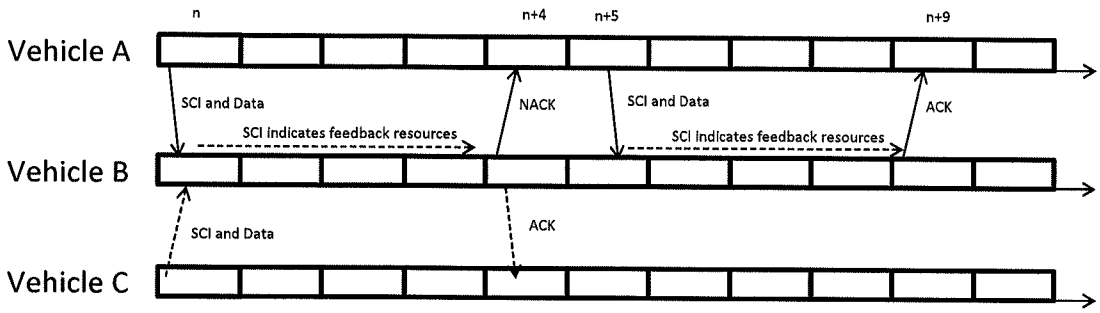

Figure 8

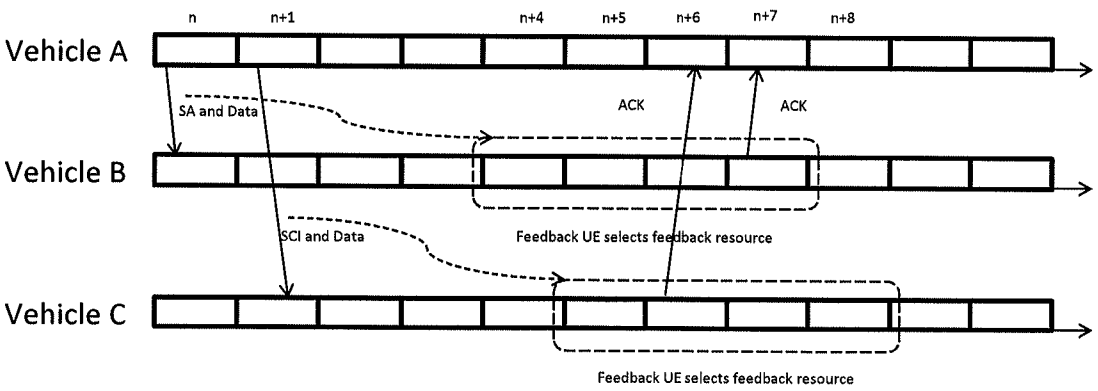

Figure 9

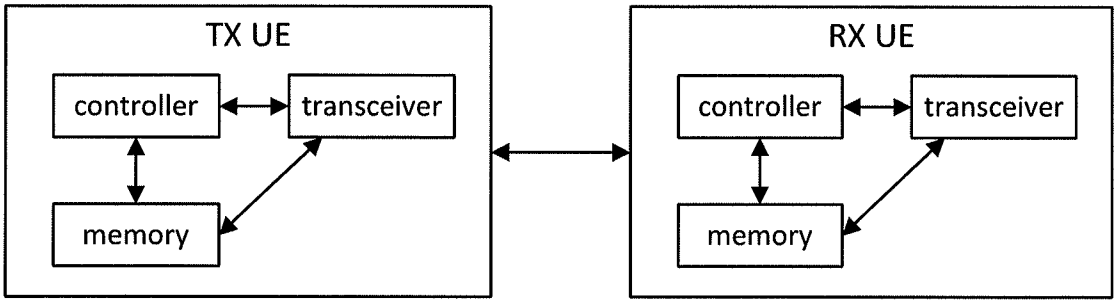
TX UE
controller
transceiver
memory
RX UE
controller
transceiver
memory

Figure 10

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2018/107846

A. CLASSIFICATION OF SUBJECT MATTER

H04W 72/02(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 H04Q

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)

CNPAT, CNKI, WPI, EPODOC, 3GPP, IEEE: V2X, sidelink, feedback,control, SCI, identif+, ID, indica+, UE, transmit+, receiv +, acknowledgement, ACK, HARQ, collision, confict, detect+, resource, reselect+, retransmission

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2017126266 A1 (NEC CORPORATION) 27 July 2017 (2017-07-27) description, paragraphs [0031]-[0052], [0080]-[0098], figures 7-8	1-52
A	WO 2017075798 A1 (PANASONIC INTELLECTUAL PROPERTY CORPORATION OF AMERICA) 11 May 2017 (2017-05-11) the whole document	1-52
A	CN 106412794 A (CHINA ACADEMY OF TELECOMMUNICATIONS TECHNOLOGY) 15 February 2017 (2017-02-15) the whole document	1-52
A	LG Electronics. "R1-1808519" *Discussion on support of unicast, groupcast and broadcast,* 24 August 2018 (2018-08-24), 第2部分	1-52
A	Intel Corporation. "R1-1808696" *Sidelink Resource Allocation Mechanisms for NR V2X Communication,* 24 August 2018 (2018-08-24), 第2-3部分	1-52

☐ 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
16 May 2019	**29 May 2019**

Name and mailing address of the ISA/CN	Authorized officer
National Intellectual Property Administration, PRC **6, Xitucheng Rd., Jimen Bridge, Haidian District, Beijing 100088** **China**	**LI,Yan**
Facsimile No. **(86-10)62019451**	Telephone No. **53961771**

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2018/107846

Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)			Publication date (day/month/year)
WO	2017126266	A1	27 July 2017	CN	108476390	A	31 August 2018
				EP	3406103	A1	28 November 2018
				US	2019007974	A1	03 January 2019
				JP	2019502329	A	24 January 2019
WO	2017075798	A1	11 May 2017	BR	112018007742	A2	23 October 2018
				AU	2015414030	A1	19 April 2018
				CO	2018003953	A2	10 July 2018
				JP	2018533868	A	15 November 2018
				US	2018263026	A1	13 September 2018
				EP	3372028	A1	12 September 2018
				CA	3000752	A1	11 May 2017
				CN	108432309	A	21 August 2018
				MX	2018004855	A	09 November 2018
				KR	20180080199	A	11 July 2018
				RU	2683977	C1	03 April 2019
CN	106412794	A	15 February 2017	JP	2018524945	A	30 August 2018
				EP	3328140	A1	30 May 2018
				KR	20180030125	A	21 March 2018
				TW	201705807	A	01 February 2017
				WO	2017012467	A1	26 January 2017
				US	2019007930	A1	03 January 2019