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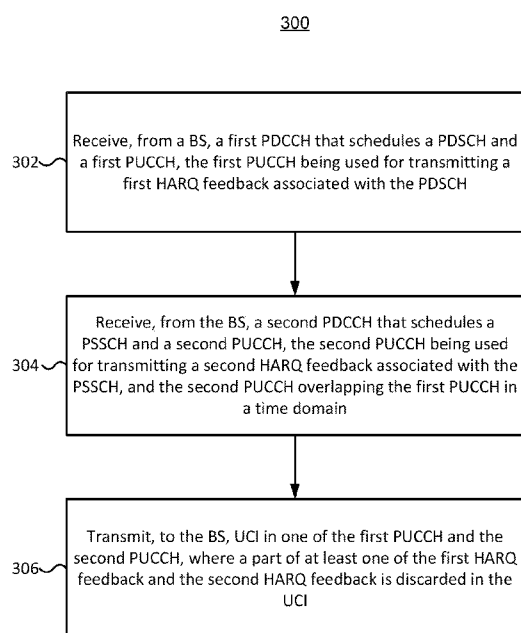


FIG. 3

(57) Abstract: A method for wireless communication performed by a UE is provided. The method includes: receiving, from a base station (BS), a first physical downlink control channel (PDCCH) that schedules a physical downlink shared channel (PDSCH) and a first physical uplink control channel (PUCCH), the first PUCCH being used for transmitting a first hybrid automatic repeat request (HARQ) feedback associated with the PDSCH; receiving, from the BS, a second PDCCH that schedules a physical sidelink shared channel (PSSCH) and a second PUCCH, the second PUCCH being used for transmitting a second HARQ feedback associated with the PSSCH, and the second PUCCH overlapping the first PUCCH in a time domain; and transmitting, to the BS, uplink control information (UCI) in one of the first PUCCH and the second PUCCH; wherein a part of at least one of the first HARQ feedback and the second HARQ feedback is discarded in the UCI.

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METHOD AND APPARATUS FOR HANDLING HARQ FEEDBACK

CROSS-REFERENCE TO RELATED APPLICATION(S)

[0001] The present disclosure claims the benefit of and priority of provisional U.S. Patent Application Serial No. 62/888,051, filed on August 16, 2019, entitled “Mechanism for HARQ feedback of sidelink resource allocation mode 1” (“the ‘051 provisional”). The disclosure of the ‘051 provisional is hereby incorporated fully by reference into the present disclosure.

FIELD

[0002] The present disclosure is related to wireless communication, and more particularly, to a method for handling hybrid automatic repeat request (HARQ) feedback in cellular wireless communication networks.

BACKGROUND

[0003] With the tremendous growth in the number of connected devices and the rapid increase in user/network traffic volume, various efforts have been made to improve different aspects of wireless communication for cellular wireless communication systems, such as fifth generation (5G) New Radio (NR), by improving data rate, latency, reliability and mobility.

5 [0004] The 5G NR system is designed to provide flexibility and configurability to optimize the network services and types, accommodating various use cases such as enhanced Mobile Broadband (eMBB), massive Machine-Type Communication (mMTC), and Ultra-Reliable and Low-Latency Communication (URLLC).

[0005] However, as the demand for radio access continues to increase, there exists a need for further improvements in the art.

SUMMARY

[0006] The present disclosure is directed to a method for handling HARQ feedback in cellular wireless communication networks.

[0007] According to an aspect of the present disclosure, a method for wireless communication performed by a UE is provided. The method includes: receiving, from a base station (BS), a first physical downlink control channel (PDCCH) that schedules a physical downlink shared channel (PDSCH) and a first physical uplink control channel (PUCCH), the first PUCCH being used for transmitting a first hybrid automatic repeat request (HARQ) feedback associated with the PDSCH; receiving, from the BS, a second PDCCH that schedules a physical sidelink shared channel (PSSCH) and a second PUCCH, the second PUCCH being used for transmitting a second HARQ

feedback associated with the PSSCH, and the second PUCCH overlapping the first PUCCH in a time domain; and transmitting, to the BS, uplink control information (UCI) in one of the first PUCCH and the second PUCCH; wherein a part of at least one of the first HARQ feedback and the second HARQ feedback is discarded in the UCI.

[0008] According to another aspect of the present disclosure, a UE is provided that includes one or more non-transitory computer-readable media containing computer-executable instructions embodied therein and at least one processor coupled to the one or more non-transitory computer-readable media. The at least one processor is configured to execute the computer-executable instructions to: receive, from a BS, a first PDCCH that schedules a PDSCH and a first PUCCH, the first PUCCH being used for transmitting a first HARQ feedback associated with the PDSCH; receive, from the BS, a second PDCCH that schedules a PSSCH and a second PUCCH, the second PUCCH being used for transmitting a second HARQ feedback associated with the PSSCH, and the second PUCCH overlapping the first PUCCH in a time domain; and transmit, to the BS, UCI in one of the first PUCCH and the second PUCCH; wherein a part of at least one of the first HARQ feedback and the second HARQ feedback is discarded in the UCI.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] Aspects of the present disclosure are best understood from the following detailed description when read with the accompanying drawings. Various features are not drawn to scale. Dimensions of various features may be arbitrarily increased or reduced for clarity of discussion.

[0010] Fig. 1 is a diagram illustrating an example SL resource allocation mode according to an example implementation of the present disclosure.

[0011] Fig. 2 is a diagram illustrating another example SL resource allocation mode according to an example implementation of the present disclosure.

[0012] Fig. 3 is a flowchart of a method performed by a UE for handling HARQ feedback according to an example implementation of the present disclosure.

[0013] Fig. 4 is a diagram illustrating an example PUCCH conflict scenario according to an example implementation of the present disclosure.

[0014] Fig. 5 is a diagram illustrating another example PUCCH conflict scenario according to an example implementation of the present disclosure.

[0015] Fig. 6 is a block diagram illustrating a node for wireless communication in accordance with various aspects of the present disclosure.

DETAILED DESCRIPTION

[0016] The following description contains specific information related to implementations of

the present disclosure. The drawings and their accompanying detailed description are merely directed to implementations.

[0017] However, the present disclosure is not limited to these implementations. Other variations and implementations of the present disclosure will be obvious to those skilled in the art.

[0018] Unless noted otherwise, like or corresponding elements among the drawings may be indicated by like or corresponding reference numerals. Moreover, the drawings and illustrations in the present disclosure are generally not to scale and are not intended to correspond to actual relative dimensions.

[0019] For the purpose of consistency and ease of understanding, like features may be identified (although, in some examples, not shown) by the same numerals in the drawings. However, the features in different implementations may be different in other respects and shall not be narrowly confined to what is shown in the drawings.

[0020] The phrases “in one implementation,” or “in some implementations,” may each refer to one or more of the same or different implementations. The term “coupled” is defined as connected whether directly or indirectly through intervening components and is not necessarily limited to physical connections. The term “comprising” means “including, but not necessarily limited to” and specifically indicates open-ended inclusion or membership in the so-described combination, group, series or equivalent. The expression “at least one of A, B and C” or “at least one of the following: A, B and C” means “only A, or only B, or only C, or any combination of A, B and C.”

[0021] The terms “system” and “network” may be used interchangeably. The term “and/or” is only an association relationship for describing associated objects and represents that multiple relationships may exist such that A and/or B may indicate that A exists alone, A and B exist at the same time, or B exists alone. The character “/” generally represents that the associated objects are in an “or” relationship.

[0022] For the purposes of explanation and non-limitation, specific details such as functional entities, techniques, protocols, and standards are set forth for providing an understanding of the present disclosure. In other examples, detailed description of well-known methods, technologies, systems, and architectures are omitted so as not to obscure the description with unnecessary details.

[0023] Persons skilled in the art will recognize that any network function(s) or algorithm(s) disclosed may be implemented by hardware, software or a combination of software and hardware. Disclosed functions may correspond to modules which may be software, hardware, firmware, or any combination thereof.

[0024] A software implementation may include computer executable instructions stored on a computer readable medium such as memory or other type of storage devices. One or more

microprocessors or general-purpose computers with communication processing capability may be programmed with corresponding executable instructions and perform the disclosed network function(s) or algorithm(s).

[0025] The microprocessors or general-purpose computers may include Applications Specific Integrated Circuitry (ASIC), programmable logic arrays, and/or using one or more Digital Signal Processor (DSPs). Although some of the present disclosure is directed to software installed and executing on computer hardware, alternative implementations as firmware or as hardware or combination of hardware and software are well within the scope of the present disclosure. The computer readable medium includes but is not limited to Random Access Memory (RAM), Read Only Memory (ROM), Erasable Programmable Read-Only Memory (EPROM), Electrically Erasable Programmable Read-Only Memory (EEPROM), flash memory, Compact Disc Read-Only Memory (CD-ROM), magnetic cassettes, magnetic tape, magnetic disk storage, or any other equivalent medium capable of storing computer-readable instructions.

[0026] A radio communication network architecture such as a Long Term Evolution (LTE) system, an LTE-Advanced (LTE-A) system, an LTE-Advanced Pro system, or a 5G NR Radio Access Network (RAN) typically includes at least one base station (BS), at least one UE, and one or more optional network elements that provide connection within a network. The UE communicates with the network such as a Core Network (CN), an Evolved Packet Core (EPC) network, an Evolved Universal Terrestrial RAN (E-UTRAN), a 5G Core (5GC), or an internet via a RAN established by one or more BSs.

[0027] A UE may include but is not limited to a mobile station, a mobile terminal or device, or a user communication radio terminal. The UE may be portable radio equipment that includes but is not limited to a mobile phone, a tablet, a wearable device, a sensor, a vehicle, or a Personal Digital Assistant (PDA) with wireless communication capability. The UE is configured to receive and transmit signals over an air interface to one or more cells in a RAN.

[0028] The BS may be configured to provide communication services according to at least a Radio Access Technology (RAT) such as Worldwide Interoperability for Microwave Access (WiMAX), Global System for Mobile communications (GSM) that is often referred to as 2G, GSM Enhanced Data rates for GSM Evolution (EDGE) RAN (GERAN), General Packet Radio Service (GPRS), Universal Mobile Telecommunication System (UMTS) that is often referred to as 3G based on basic wideband-code division multiple access (W-CDMA), high-speed packet access (HSPA), LTE, LTE-A, evolved LTE (eLTE) that is LTE connected to 5GC, NR (often referred to as 5G), and/or LTE-A Pro. However, the scope of the present disclosure is not limited to these protocols.

[0029] The BS may include but is not limited to a node B (NB) in the UMTS, an evolved node

B (eNB) in LTE or LTE-A, a radio network controller (RNC) in UMTS, a BS controller (BSC) in the GSM/GERAN, a ng-eNB in an E-UTRA BS in connection with 5GC, a next generation Node B (gNB) in the 5G-RAN, or any other apparatus capable of controlling radio communication and managing radio resources within a cell. The BS may serve one or more UEs via a radio interface.

[0030] The BS is operable to provide radio coverage to a specific geographical area using a plurality of cells forming the RAN. The BS supports the operations of the cells. Each cell is operable to provide services to at least one UE within its radio coverage.

[0031] Each cell (often referred to as a serving cell) provides services to serve one or more UEs within its radio coverage such that each cell schedules the downlink (DL) and optionally uplink (UL) resources to at least one UE within its radio coverage for DL and optionally UL packet transmissions. The BS can communicate with one or more UEs in the radio communication system via the plurality of cells.

[0032] A cell may allocate sidelink (SL) resources for supporting Proximity Service (ProSe) or Vehicle to Everything (V2X) service. Each cell may have overlapped coverage areas with other cells.

[0033] As discussed previously, the frame structure for NR supports flexible configurations for accommodating various next generation (e.g., 5G) communication requirements such as Enhanced Mobile Broadband (eMBB), Massive Machine Type Communication (mMTC), and Ultra-Reliable and Low-Latency Communication (URLLC), while fulfilling high reliability, high data rate and low latency requirements. The Orthogonal Frequency-Division Multiplexing (OFDM) technology in the 3rd Generation Partnership Project (3GPP) may serve as a baseline for an NR waveform. The scalable OFDM numerology such as adaptive sub-carrier spacing, channel bandwidth, and Cyclic Prefix (CP) may also be used.

[0034] Two coding schemes are considered for NR, specifically Low-Density Parity-Check (LDPC) code and Polar Code. The coding scheme adaption may be configured based on channel conditions and/or service applications.

[0035] When a transmission time interval (TTI) of a single NR frame includes DL transmission data, a guard period, and UL transmission data, the respective portions of the DL transmission data, the guard period, and the UL transmission data may be configured based on the network dynamics of NR. SL resources may also be provided in an NR frame to support ProSe services or V2X services.

[0036] Abbreviations of several terms mentioned in the present disclosure are explained as follows:

CSI: channel state information

PRB: physical resource block

RRC: radio resource control

SR: scheduling request

SL-RRC: RRC signaling transmitted on SL channel

SIB-SL: System Information Block transmitted on SL channel

MIB-SL: Master Information Block transmitted on SL channel

UCI: Uplink control information, which may include SR, HARQ, and CSI feedback

[0037] There are multiple resource allocation modes for SL transmission. In resource allocation mode 1, a BS (e.g., a gNB) may schedule SL resource(s) to be used by UE for SL transmission(s) for unicast and groupcast. A transmitter UE (also referred to as Tx UE) may transmit a transport block (TB) to a receiver UE (also referred to as Rx UE) on the SL resource scheduled by the BS. The Rx UE may send HARQ feedback to the Tx UE. The HARQ feedback may be a one-bit signal indicating acknowledgement (ACK) or negative acknowledgement (NACK). The HARQ feedback may also be referred to as HARQ-ACK information in the present disclosure. In one implementation, the Tx UE may report HARQ feedback (also referred to as SL HARQ feedback) via Uu link to the BS. For example, the Tx UE may indicate to the BS a need for retransmission of the transmitted TB by using the SL HARQ feedback. Since the HARQ feedback is transmitted via Uu link, the UE may use PUCCH and/or physical uplink shared channel (PUSCH) to transmit HARQ bits.

[0038] According to the HARQ codebook generation procedure described in 3GPP TS 38.213, a HARQ codebook may be associated with two values K0 and K1. The value K0 may be in an information element (IE) *PDSCH-TimeDomainResourceAllocationList*. The value K1 may be in an IE *dl-DataToUL-ACK*. K0 may be an offset between the DL slot in which the PDCCH for DL scheduling is received and the DL slot in which PDSCH data is scheduled. K1 may be an offset between the DL slot in which the data is scheduled on PDSCH and the UL slot in which the HARQ feedback for the scheduled PDSCH data needs to be sent.

[0039] In one implementation, downlink control information (DCI) in SL resource allocation mode 1 (e.g., DCI_SL) may contain resource allocation information about physical sidelink control channel (PSCCH) and/or physical sidelink shared channel (PSSCH). New parameters, such as K0_1, K0_2, K0_SL and K1_SL, may be introduced.

[0040] Fig. 1 is a diagram 100 illustrating an example SL resource allocation mode according to an example implementation of the present disclosure. The UE may receive DCI (e.g., DCI_SL) in PDCCH 102 that schedules PSCCH 104, which may carry sidelink control information (SCI) that schedules PSSCH 106. PDCCH 102 may also schedule PUCCH 108, which may be used for transmitting, to a BS, HARQ feedback associated with the PSSCH 106. The parameter K0_1 may indicate a time offset between the PDCCH 102 and the PSCCH 104. The parameter K0_2 may

indicate a time offset between the PSCCH 104 and the PSSCH 106. The parameter K1_SL may indicate a time offset between the PDCCH 102 and the PUCCH 108.

[0041] Fig. 2 is a diagram 200 illustrating another example SL resource allocation mode according to an example implementation of the present disclosure. The UE may receive DCI (e.g., DCI_SL) in PDCCH 202 that schedules PSSCH 206. The PDCCH 202 may also schedule PUCCH 208, which may be used for transmitting, to a BS, HARQ feedback associated with the PSSCH 206. The parameter K0_SL may indicate a time offset between the PDCCH 202 and the PSSCH 206. The parameter K1_SL may indicate a time offset between the PDCCH 202 and the PUCCH 208.

[0042] Case 1: generating HARQ codebook for SL resource allocation mode 1

[0043] Case 1-1: excluding PSSCH/PSCCH candidate

[0044] In one implementation, if at least one symbol of a PSSCH candidate time resource indicated by SCI is configured as DL or flexible (FL), the PSSCH candidate may be excluded from a PSSCH candidate list. Remaining PSSCH candidates may be denoted as valid PSSCH candidates. For example, a parameter K0_2 may be configured via RRC signaling as $K0_2 = \{0, 1, 2, 3\}$. The parameter K0_2 may indicate a time offset between PSCCH and PSSCH. The UE may receive SCI in slot n, and the PSSCH candidate may be in slot n+0, slot n+1, slot n+2, or slot n+3, where n is an integer. The UE may exclude a PSSCH candidate scheduled by the SCI from a PSSCH candidate list if the PSSCH candidate overlaps with a DL/FL symbol.

[0045] In one implementation, if at least one symbol of a PSSCH candidate time resource indicated by DCI_SL is configured as DL/FL, the PSSCH candidate may be excluded from a PSSCH candidate list. Remaining PSSCH candidates may be denoted as valid PSSCH candidates. For example, a parameter K0_SL may be configured via RRC signaling as $K0_SL = \{0, 1, 2, 3\}$. The parameter K0_SL may indicate a time offset between PDCCH and PSSCH. The UE may receive DCI_SL in slot n, and the PSSCH candidate may be in slot n+0, slot n+1, slot n+2, or slot n+3, where n is an integer. The UE may exclude a PSSCH candidate scheduled by the DCI_SL from a PSSCH candidate list if the PSSCH candidate overlaps with a DL/FL symbol.

[0046] In one implementation, if at least one symbol of a PSCCH candidate time resource indicated by a DCI_SL is configured as DL/FL, the PSCCH candidate may be excluded from a PSCCH candidate list. Remaining PSCCH candidates may be denoted as valid PSCCH candidates. For example, a parameter K0_1 may be configured via RRC as $K0_1 = \{0, 1, 2, 3\}$. The parameter K0_1 may indicate a time offset between PDCCH and PSCCH. The UE may receive DCI_SL in slot n, and the PSCCH candidate may be in slot n+0, slot n+1, slot n+2, or slot n+3, where n is an integer. The UE may exclude a PSCCH candidate scheduled by the DCI_SL from a PSCCH candidate list if the PSCCH candidate overlaps with a DL/FL symbol.

[0047] Case 1-2: generating HARQ codebook according to *sl-DataToUL-ACK* and/or PSSCH time domain resource allocation

[0048] In one implementation, the UE may report SL HARQ-ACK information in a PUCCH associated with only one (or X, X being a positive integer) PSSCH for all PSSCH candidates. The UE may expect to only receive one PSSCH successfully before the UE reports the SL HARQ feedback. In one implementation, the value X may be reported by UE capability. The UE may transmit, to the BS, a UE capability that indicates a maximum number of bits in the SL HARQ feedback.

[0049] Case 2: configuration of SL HARQ codebook type

[0050] In one implementation, the UE may receive a message that indicates whether a HARQ codebook type for SL transmission is semi-static or dynamic. In one implementation, there may be a new IE *SL-HARQ-ACK-Codebook* contained in RRC/SL-RRC/SIB/SIB-SL/MIB-SL. The IE *SL-HARQ-ACK-Codebook* may indicate SL HARQ-ACK codebook is either semi-static or dynamic.

[0051] The IE *SL-HARQ-ACK-Codebook* may be configured per resource pool (e.g., resource pool for scheduled PSCCH and/or PSSCH), per bandwidth part (BWP) (e.g., DL BWP, SL BWP, UL BWP), per anchor carrier, per cell, per cell group (e.g., master cell group, secondary cell group), or per UE. In one implementation, the IE *SL-HARQ-ACK-Codebook* may be valid in specific area, which may be indicated by an IE *systemInformationAreaID*, a list of (physical) cell identities, zones, ranges, etc.

[0052] The IE *HARQ-ACK-Codebook* may indicate an SL HARQ codebook type. An example data structure of the IE *SL-HARQ-ACK-Codebook* may be provided as follows. In one implementation, if the IE *SL-HARQ-ACK-Codebook* is not configured, the default value may be “semi-static” or “dynamic.”

```
SL-HARQ-ACK-Codebook ::= ENUMERATED {
    semi-static, dynamic, all, spare1
}
```

[0053] In one implementation, the SL HARQ codebook type may be the same as the HARQ codebook type of a cell that contains scheduling information (e.g., DCI_SL). In one implementation, a HARQ codebook type of a HARQ feedback associated with PSSCH scheduled by a BS may be the same as a HARQ codebook type configured by the BS for transmitting HARQ feedback associated with PDSCH. For example, the UE may be configured to perform SL transmission on cell #0. The HARQ codebook type associated with PDSCH on cell #0 may be dynamic. In one implementation, an IE *pdsch-HARQ-ACK-Codebook* of cell #0 may indicate that HARQ codebook type on cell #0 is “dynamic codebook.” The UE may expect to generate a

dynamic HARQ codebook for SL transmission. That is, the UE may expect that SCI or DCI_SL indicates a downlink assignment index for SL (e.g., SL_DAI) for the dynamic SL HARQ codebook.

[0054] In one implementation, SL HARQ codebook type may be included in UE capability. The UE may inform the BS whether it supports dynamic/semi-static/both HARQ codebook type for SL operation.

[0055] Case 3: multiplexing UCI and SL HARQ feedback

[0056] Fig. 3 is a flowchart of a method 300 performed by a UE for handling HARQ feedback according to an example implementation of the present disclosure. In action 302, the UE may receive, from a BS, a first PDCCH that schedules a PDSCH and a first PUCCH. The first PUCCH may be used for transmitting a first HARQ feedback associated with the PDSCH. The first HARQ feedback may be also referred to as HARQ feedback for PDSCH, DL HARQ feedback, or Uu HARQ feedback.

[0057] In action 304, the UE may receive, from the BS, a second PDCCH that schedules a PSSCH and a second PUCCH. The second PUCCH may be used for transmitting a second HARQ feedback associated with the PSSCH. The second HARQ feedback may be also referred to as HARQ feedback for PSSCH or SL HARQ feedback. The second PUCCH overlaps the first PUCCH in a time domain (also referred to as PUCCH conflict). In one implementation, the second PUCCH and the first PUCCH may be different, and the second PUCCH may partially or fully overlap the first PUCCH in the time domain. In one implementation, the second PUCCH may be the same as the first PUCCH. That is, the UE may be indicated to transmit the first HARQ feedback and the second HARQ feedback in the same PUCCH resource.

[0058] In action 306, the UE may transmit, to the BS, UCI in one of the first PUCCH and the second PUCCH, where a part of at least one of the first HARQ feedback and the second HARQ feedback is discarded in the UCI. In one implementation, the UE may multiplex the first HARQ feedback with the second HARQ feedback in one of the first PUCCH and the second PUCCH. In one implementation, the UE may discard part of the first HARQ feedback and/or part of the second HARQ feedback when multiplexing the first HARQ feedback with the second HARQ feedback. In one implementation, the UE may drop/discard (part of) the first HARQ feedback in the UCI. In one implementation, the UE may drop/discard (part of) the second HARQ feedback in the UCI. In one implementation, the UCI may include only one of the first HARQ feedback and the second HARQ feedback.

[0059] Fig. 4 is a diagram 400 illustrating an example PUCCH conflict scenario according to an example implementation of the present disclosure. The UE may receive, from a BS, a first PDCCH 402 that schedules a PDSCH 404 and a first PUCCH 406. The first PUCCH 406 may be

used for transmitting a first HARQ feedback associated with the PDSCH 404. The UE may receive, from the BS, a second PDCCH 412 that schedules a PSSCH 414 and a second PUCCH 416. The second PUCCH 416 may be used for transmitting a second HARQ feedback associated with the PSSCH 414. The second PUCCH 416 overlaps the first PUCCH 406 in a time domain. The UE may transmit, to the BS, UCI in one of the first PUCCH 406 and the second PUCCH 416, where a part of at least one of the first HARQ feedback and the second HARQ feedback is discarded in the UCI.

[0060] Fig. 5 is a diagram 500 illustrating another example PUCCH conflict scenario according to an example implementation of the present disclosure. In this example, the first PUCCH in action 302 in Fig. 3 and the second PUCCH in action 304 in Fig. 3 are the same, represented as PUCCH 506 in Fig. 5. The UE may receive, from a BS, a first PDCCH 502 that schedules a PDSCH 504 and a PUCCH 506. The PUCCH 506 may be used for transmitting a first HARQ feedback associated with the PDSCH 504. The UE may receive, from the BS, a second PDCCH 512 that schedules a PSSCH 514 and the PUCCH 506. The PUCCH 506 may be used for transmitting a second HARQ feedback associated with the PSSCH 514. The UE may transmit, to the BS, UCI in the PUCCH 506, where a part of at least one of the first HARQ feedback and the second HARQ feedback is discarded in the UCI.

[0061] In one implementation, the UE may receive a message that indicates a dedicated resource for the SL HARQ feedback. In one implementation, there may be a new IE *SL-PUCCHresource* contained in RRC/SL-RRC/SIB/SIB-SL, which indicates PUCCH resource(s) dedicated for the SL HARQ feedback. In one implementation, the PUCCH resource dedicated for the SL HARQ feedback may not overlap with PUCCH resource for UCI (e.g., including DL HARQ feedback) in the time/frequency domain. In one implementation, if the IE *SL-PUCCHresource* is not present in RRC/SL-RRC/SIB/SIB-SL, the UE may determine that the SL HARQ feedback can be multiplexed with UCI (e.g., including DL HARQ feedback) on PUCCH resource.

[0062] An example data structure of the IE *SL-PUCCHresource* is provided as follows:

```

SL-PUCCHresource ::= SEQUENCE {
    SL-pucch-ResourceId      SL-PUCCH-ResourceId,
    startingPRB              PRB-Id,
    intraSlotFrequencyHopping ENUMERATED { enabled }
    secondHopPRB            PRB-Id
    format                   CHOICE {
        format0              PUCCH-format0,
        format1              PUCCH-format1,
    }
}

```

format2	PUCCH-format2,
format3	PUCCH-format3,
format4	PUCCH-format4,
}	
initialCyclicShift	INTEGER(0..11),
nrofSymbols	INTEGER (1..2),
startingSymbolIndex	INTEGER(0..13)
}	

[0063] The IE *SL-PUCCHresource* may indicate PUCCH resource dedicated for the SL HARQ feedback. In one implementation, the UE does not expect that time/frequency domain resource of any PUCCH resource indicated by the IE *SL-PUCCHresource* overlaps with PUCCH resource for UCI. In one implementation, if the IE *SL-PUCCHresource* is not configured, the UE may multiplex the SL HARQ feedback with UCI (e.g., including DL HARQ feedback) on the PUCCH resource for the UCI.

[0064] In one implementation, the UE may receive a message that indicates whether the SL HARQ feedback can be multiplexed with UCI (e.g., including DL HARQ feedback) in a single PUCCH. In one implementation, there may be a new IE *SL-UCI-MUX* contained in RRC/SIB/SIB-SL/SL-RRC, which indicates whether or not the UE can multiplex UCI (e.g., including DL HARQ feedback) with the SL HARQ feedback. In one implementation, if the IE *SL-UCI-MUX* is not present in RRC/SIB/SIB-SL/SL-RRC, the UE may determine that the SL HARQ feedback can be multiplexed with the UCI (e.g., including DL HARQ feedback) on the PUCCH resource. In another implementation, if the IE *SL-UCI-MUX* is not present in RRC/SIB/SIB-SL/SL-RRC, the UE may determine that the SL HARQ feedback cannot be multiplexed with the UCI (e.g., including DL HARQ feedback) on the PUCCH resource.

[0065] The IE *SL-UCI-MUX* may indicate whether or not the UE can multiplex UCI with the SL HARQ feedback. The IE *SL-UCI-MUX* may be a one-bit indicator, having a value of either true or false. In one implementation, if the IE *SL-UCI-MUX* is not configured, the UE may multiplex the SL HARQ feedback with the UCI by default.

[0066] In one implementation, the UE may receive a message that indicates whether the SL HARQ feedback can be multiplexed in a PUSCH. In one implementation, there may be a new IE *SL-onPUSCH* contained in RRC/SIB/SIB-SL/SL-RRC, which indicates whether or not the UE can transmit the SL HARQ feedback on PUSCH, for example, when PUCCH resource contains the SL HARQ feedback that overlaps with the PUSCH. In one implementation, if the IE *SL-onPUSCH* is not present in RRC/SIB/SIB-SL/SL-RRC, the UE may determine that the SL HARQ feedback can be transmitted on the PUSCH. In another implementation, if the IE *SL-onPUSCH* is not present

in RRC/SIB/SIB-SL/SL-RRC, the UE may determine that the SL HARQ feedback cannot be transmitted on the PUSCH.

[0067] The IE *SL-onPUSCH* may indicate whether or not the UE can transmit the SL HARQ feedback on PUSCH. The IE *SL-onPUSCH* may be a one-bit indicator, having a value of either true or false. In one implementation, if the IE *SL-onPUSCH* is not configured, the UE may not transmit the SL HARQ feedback on PUSCH.

[0068] In one implementation, if the UE does not support transmission of the SL HARQ feedback on the PUSCH, the UE may transmit the PUSCH and drop the SL HARQ feedback when the PUCCH resource of the SL HARQ feedback overlaps with the PUSCH. For example, if the UE is indicated to transmit the SL HARQ feedback in slot $n+8$ by DCI_SL in slot n , and the UE is indicated to transmit the PUSCH in slot $n+8$ by a DCI format 0_1 in slot $n+4$, the UE may drop the SL HARQ feedback and transmit only the PUSCH on slot $n+8$ when the IE *SL-onPUSCH* has a value of “false.”

[0069] In one implementation, if the UE supports transmission of the SL HARQ feedback on the PUSCH, the UE may transmit the SL HARQ feedback and drop the PUSCH when the PUCCH resource for the SL HARQ feedback overlaps with the PUSCH.

[0070] In one implementation, the ability to multiplex UCI with SL HARQ feedback may be included in a UE capability. The UE may inform the BS whether it supports multiplexing UCI with the SL HARQ feedback. In one implementation, the UE may transmit, to the BS, a UE capability that indicates whether the UE supports multiplexing UCI (e.g., including DL HARQ feedback) with the SL HARQ feedback.

[0071] In one implementation, there may be a new IE *for-SL-HARQ* contained in PUCCH resource/PUCCH resource set configuration (e.g., IE *PUCCHresource*) in RRC/SIB. The IE *for-SL-HARQ* may be a one-bit indicator, having a value of either true or false. The PUCCH resource/PUCCH resources contained in the PUCCH resource set may contain SL HARQ feedback if the IE *for-SL-HARQ* has a value of “true.”

[0072] An example data structure of an IE *PUCCHresource* is provided as follows:

```

PUCCHresource ::= SEQUENCE {
    pucch-ResourceId          PUCCH-ResourceId,
    startingPRB               PRB-Id,
    intraSlotFrequencyHopping ENUMERATED { enabled }
    secondHopPRB              PRB-Id
    format                    CHOICE {
        format0                PUCCH-format0,
        format1                PUCCH-format1,
    }
}

```

```

        format2                PUCCH-format2,
        format3                PUCCH-format3,
        format4                PUCCH-format4,
    }
    PUCCH-format-x ::= SEQUENCE{
        initialCyclicShift      INTEGER(x_0..x_n),
        nrofSymbols             INTEGER(y_0..y_n),
        startingSymbolIndex     INTEGER(z_0..z_n)
    }
    for-SL-HARQ                Boolean
}

```

[0073] The IE *for-SL-HARQ* may indicate whether or not the SL HARQ feedback can be transmitted on the PUCCH resource. In one implementation, if the IE *for-SL-HARQ* is not configured, the UE may not transmit the SL HARQ feedback on the PUCCH.

[0074] Referring to the method 300 shown in Fig. 3, in one implementation, the UE may perform a prioritization procedure according to a prioritization rule and a payload size of the first PUCCH or the second PUCCH to determine the UCI in action 306 in Fig. 3. In one implementation, the first PUCCH may be further used for transmitting an SR and a CSI report. The first HARQ feedback may include HARQ control information for a first service type (e.g., eMBB) and HARQ control information for a second service type (e.g., URLLC). The prioritization rule may indicate a prioritization order of the HARQ control information for the first service type, the HARQ control information for the second service type, the SR, and the CSI report.

[0075] In one implementation, if a payload size of a PUCCH resource (e.g., the first PUCCH 406 in Fig. 4, the second PUCCH 416 in Fig. 4, or the PUCCH 506 in Fig. 5) cannot contain all SL HARQ feedback and UCI (which may include DL HARQ feedback, SR, CSI) bits, there may be a priority rule to decide which information may be transmitted on the PUCCH resource and which information may be dropped/discarded. In one implementation, the priority order may be URLLC HARQ > eMBB HARQ > SL HARQ > SR > CSI part I > CSI part II. The greater-than sign may be used to indicate priority order in the present disclosure. For example, URLLC HARQ > eMBB HARQ means URLLC HARQ has higher priority than eMBB HARQ. It should be noted that eMBB and URLLC here refer to the eMBB service and the URLLC service via the Uu interface.

[0076] The UE may differentiate eMBB service from URLLC service on the Uu interface in several ways. In one implementation, the UE may treat data in PDSCH as the URLLC service when there is an indicator contained in the scheduling DCI. In one implementation, the UE may

treat data in PDSCH as the URLLC service according to a DCI format. In one implementation, the UE may treat data in PDSCH as the URLLC service according to sub-slot numerology for HARQ feedback. In one implementation, the UE may treat data in PDSCH as the URLLC service according to a radio network temporary identifier (RNTI). In one implementation, the UE may treat data in PDSCH as the URLLC service according to a modulation and coding scheme (MCS) table for the PDSCH.

[0077] For example, a UE may be indicated to transmit SL HARQ feedback on PUCCH resource #3 and the UE may be also indicated to transmit Uu HARQ feedback and CSI feedback on the PUCCH resource #3. The priority order may be URLLC HARQ > eMBB HARQ > SL HARQ > SR > CSI part I > CSI part II. If {the number of SL HARQ feedback bits (O_{SL_ACK}) + the number of Uu HARQ feedback bits (O_{ACK}) + the number of CSI feedback bits (O_{CSI}) + the total number of CRC bits for SL HARQ, Uu HARQ and CSI feedback (O_{CRC})} is greater than the payload size of the PUCCH resource #3, the UE may drop the CSI feedback first and then drop SL HARQ feedback bits until $\{O_{SL_ACK} + O_{ACK} + O_{CSI} + O_{CRC}\}$ is less than the payload size of the PUCCH resource #3. The payload size of the PUCCH resource may be related to the number of PRBs, the number of symbols, modulation and/or code rate.

[0078] In one implementation, the second PDCCH (e.g., the second PDCCH 412 in Fig. 4, or the second PDCCH 512 in Fig. 5) may contain SCI that schedules the PSSCH (e.g., the PSSCH 414 in Fig. 4, or the PSSCH 514 in Fig. 5) and includes a priority indicator of the second HARQ feedback. The priority of the SL HARQ feedback may depend on a priority information indicator (e.g., ProSe per-packet priority (PPPP)) in the scheduling SCI. In one implementation, a priority indicator having a smaller value may indicate a higher priority.

[0079] In one implementation, there may be an index configured in RRC signaling for UCI of eMBB (e.g., eMBB HARQ feedback, eMBB SR, or eMBB CSI feedback). The index may indicate a threshold for dropping the UCI of eMBB. If the priority indicator in the scheduling SCI has a value less than the configured index for the UCI of eMBB, the UE may drop the UCI for eMBB. Otherwise, the UE may drop the SL HARQ feedback.

[0080] For example, a UE is configured with an index (e.g., “3”) for dropping eMBB UCI, and PPPP in SCI or DCI_SL is “2”. The UE may drop the eMBB UCI if the PUCCH resource for the eMBB UCI overlaps the PUCCH resource for the SL HARQ feedback that is associated with the PSSCH scheduled by the SCI or the DCI_SL.

[0081] In one implementation, there may be an index configured in RRC signaling for UCI of URLLC (e.g., URLLC HARQ feedback, URLLC SR, or URLLC CSI feedback). The index may indicate a threshold for dropping the UCI of URLLC. If the priority indicator in the scheduling SCI has a value less than the configured index for the UCI of URLLC, the UE may drop the UCI

for URLLC. Otherwise, UE may drop the SL HARQ feedback.

[0082] In one implementation, SL HARQ feedback and UCI (e.g., including DL HARQ feedback) may be independently reported. Referring to the method 300 shown in Fig. 3, in one implementation, one of the first HARQ feedback and the second HARQ feedback may be discarded in the UCI in action 306. The UCI may include only one of the first HARQ feedback and the second HARQ feedback.

[0083] In one implementation, if the time/frequency domain of a PUCCH resource for SL HARQ feedback overlaps a PUCCH resource for DL HARQ feedback, there may be a priority rule to decide which information may be transmitted on the PUCCH resource. In one implementation, the priority order may be PUCCH resource containing URLLC HARQ > PUCCH resource containing eMBB HARQ > PUCCH resource containing SL HARQ > PUCCH resource containing SR > PUCCH resource containing CSI part I > PUCCH resource containing CSI part II.

[0084] For example, a UE may be indicated to transmit SL HARQ feedback on SL-PUCCH resource #3 in the 10th and 11th symbols of the slot n and the UE may be also indicated to transmit Uu HARQ feedback and CSI feedback on PUCCH resource #2 in the 9th and 10th symbols of the slot n. The priority order may be URLLC HARQ > eMBB HARQ > SL HARQ > SR > CSI part I > CSI part II. Since the SL-PUCCH resource #3 partially overlaps the PUCCH resource #2, the UE may drop the SL-PUCCH resource #3 for the SL HARQ feedback and only transmit the PUCCH resource #2 for the Uu HARQ feedback in the slot n.

[0085] In one implementation, the second PDCCH (e.g., the second PDCCH 412 in Fig. 4, or the second PDCCH 512 in Fig. 5) may contain SCI that schedules the PSSCH (e.g., the PSSCH 414 in Fig. 4, or the PSSCH 514 in Fig. 5) and includes a priority indicator of the second HARQ feedback. The priority of the SL HARQ feedback may depend on a priority information indicator (e.g., PPPP) in the scheduling SCI. In one implementation, the priority of a PUCCH resource may depend on the highest priority of UCI contained in the PUCCH resource. In one implementation, a priority indicator having a smaller value may indicate a higher priority.

[0086] In one implementation, there may be an index configured in RRC signaling for UCI of eMBB (e.g., eMBB HARQ feedback, eMBB SR, or eMBB CSI feedback). The index may indicate a threshold for dropping the UCI of eMBB. If the priority indicator in the scheduling SCI has a value less than the configured index for the UCI of eMBB, the UE may drop the UCI for eMBB.

[0087] In one implementation, there may be an index configured in RRC signaling for UCI of URLLC (e.g., URLLC HARQ feedback, URLLC SR, or URLLC CSI feedback). The index may indicate a threshold for dropping the UCI of URLLC. If the priority indicator in the scheduling

SCI has a value less than the configured index for the UCI of URLLC, the UE may drop the UCI for URLLC.

[0088] For example, a UE is configured with an index (e.g., “3”) for dropping URLLC UCI, and PPPP in SCI or DCI_SL is “2”. The UE may drop the URLLC UCI if the PUCCH resource for the URLLC UCI overlaps with the PUCCH resource for the SL HARQ feedback that is associated with the PSSCH scheduled by the SCI or the DCI_SL.

[0089] Fig. 6 is a block diagram illustrating a node 600 for wireless communication according to the present disclosure. As illustrated in Fig. 6, the node 600 may include a transceiver 620, a processor 628, a memory 634, one or more presentation components 638, and at least one antenna 636. The node 600 may also include an RF spectrum band module, a BS communications module, a network communications module, and a system communications management module, Input / Output (I/O) ports, I/O components, and a power supply (not shown).

[0090] Each of the components may directly or indirectly communicate with each other over one or more buses 640. The node 600 may be a UE or a BS that performs various functions disclosed with reference to Figs. 1 through 5.

[0091] The transceiver 620 has a transmitter 622 (e.g., transmitting/transmission circuitry) and a receiver 624 (e.g., receiving/reception circuitry) and may be configured to transmit and/or receive time and/or frequency resource partitioning information. The transceiver 620 may be configured to transmit in different types of subframes and slots including but not limited to usable, non-usable and flexibly usable subframes and slot formats. The transceiver 620 may be configured to receive data and control channels.

[0092] The node 600 may include a variety of computer-readable media. Computer-readable media may be any available media that may be accessed by the node 600 and include both volatile and non-volatile media, removable and non-removable media.

[0093] The computer-readable media may include computer storage media and communication media. Computer storage media include both volatile and non-volatile, removable and non-removable media implemented in any method or technology for storage of information such as computer-readable instructions, data structures, program modules or data.

[0094] Computer storage media include RAM, ROM, EEPROM, flash memory or other memory technology, CD-ROM, Digital Versatile Disks (DVD) or other optical disk storage, magnetic cassettes, magnetic tape, magnetic disk storage or other magnetic storage devices. Computer storage media do not include a propagated data signal. Communication media typically embody computer-readable instructions, data structures, program modules or other data in a modulated data signal such as a carrier wave or other transport mechanism and include any information delivery media.

[0095] The term “modulated data signal” means a signal that has one or more of its characteristics set or changed in such a manner as to encode information in the signal. Communication media include wired media such as a wired network or direct-wired connection, and wireless media such as acoustic, RF, infrared and other wireless media. Combinations of any of the previously listed components should also be included within the scope of computer-readable media.

[0096] The memory 634 may include computer-storage media in the form of volatile and/or non-volatile memory. The memory 634 may be removable, non-removable, or a combination thereof.

[0097] Example memory includes solid-state memory, hard drives, optical-disc drives, etc. As illustrated in Fig. 6, the memory 634 may store computer-readable, computer-executable instructions 632 (e.g., software codes) that are configured to cause the processor 628 to perform various disclosed functions with reference to Figs. 1 through 5. Alternatively, the instructions 632 may not be directly executable by the processor 628 but be configured to cause the node 600 (e.g., when compiled and executed) to perform various functions disclosed herein.

[0098] The processor 628 (e.g., having processing circuitry) may include an intelligent hardware device, e.g., a Central Processing Unit (CPU), a microcontroller, an ASIC, etc. The processor 628 may include memory.

[0099] The processor 628 may process the data 630 and the instructions 632 received from the memory 634, and information transmitted and received via the transceiver 620, the base band communications module, and/or the network communications module. The processor 628 may also process information to be sent to the transceiver 620 for transmission via the antenna 636 to the network communications module for transmission to a core network.

[0100] One or more presentation components 638 present data to a person or another device. Examples of presentation components 638 include a display device, a speaker, a printing component, and a vibrating component.

[0101] In view of the present disclosure, it is obvious that various techniques may be used for implementing the concepts in the present disclosure without departing from the scope of those concepts. Moreover, while the concepts have been disclosed with specific reference to certain implementations, a person of ordinary skill in the art may recognize that changes may be made in form and detail without departing from the scope of those concepts.

[0102] As such, the described implementations are to be considered in all respects as illustrative and not restrictive. It should also be understood that the present disclosure is not limited to the particular implementations disclosed and many rearrangements, modifications, and substitutions are possible without departing from the scope of the present disclosure.

CLAIMS

WHAT IS CLAIMED IS:

1. A user equipment (UE) comprising:
one or more non-transitory computer-readable media containing computer-executable instructions embodied therein; and
at least one processor coupled to the one or more non-transitory computer-readable media, the at least one processor configured to execute the computer-executable instructions to:
receive, from a base station (BS), a first physical downlink control channel (PDCCH) that schedules a physical downlink shared channel (PDSCH) and a first physical uplink control channel (PUCCH), the first PUCCH being used for transmitting a first hybrid automatic repeat request (HARQ) feedback associated with the PDSCH;
receive, from the BS, a second PDCCH that schedules a physical sidelink shared channel (PSSCH) and a second PUCCH, the second PUCCH being used for transmitting a second HARQ feedback associated with the PSSCH, and the second PUCCH overlapping the first PUCCH in a time domain; and
transmit, to the BS, uplink control information (UCI) in one of the first PUCCH and the second PUCCH;
wherein a part of at least one of the first HARQ feedback and the second HARQ feedback is discarded in the UCI.
2. The UE of claim 1, wherein the first PUCCH is the same as the second PUCCH.
3. The UE of claim 1, wherein the at least one processor is further configured to execute the computer-executable instructions to:
receive a message that indicates a dedicated resource for the second HARQ feedback.
4. The UE of claim 1, wherein the at least one processor is further configured to execute the computer-executable instructions to:
receive a message that indicates whether the first HARQ feedback can be multiplexed with the second HARQ feedback in a single PUCCH.
5. The UE of claim 1, wherein the at least one processor is further configured to execute the computer-executable instructions to:
receive a message that indicates whether the second HARQ feedback can be multiplexed

in a physical uplink shared channel (PUSCH).

6. The UE of claim 1, wherein the at least one processor is further configured to execute the computer-executable instructions to:

transmit, to the BS, a UE capability that indicates whether the UE supports multiplexing the first HARQ feedback with the second HARQ feedback.

7. The UE of claim 1, wherein the at least one processor is further configured to execute the computer-executable instructions to:

perform a prioritization procedure according to a prioritization rule and a payload size of the first PUCCH or the second PUCCH to determine the UCI.

8. The UE of claim 7, wherein the second PDCCH contains sidelink control information (SCI) that schedules the PSSCH and includes a priority indicator of the second HARQ feedback.

9. The UE of claim 7, wherein the first PUCCH is further used for transmitting a scheduling request (SR) and a channel state information (CSI) report, the first HARQ feedback includes HARQ control information for a first service type and HARQ control information for a second service type, and the prioritization rule indicates a prioritization order of the HARQ control information for the first service type, the HARQ control information for the second service type, the SR, and the CSI report.

10. The UE of claim 1, wherein the UCI includes only one of the first HARQ feedback and the second HARQ feedback.

11. The UE of claim 1, wherein the at least one processor is further configured to execute the computer-executable instructions to:

receive a message that indicates whether a HARQ codebook type of the second HARQ feedback is semi-static or dynamic.

12. The UE of claim 1, wherein a HARQ codebook type of the second HARQ feedback is the same as a HARQ codebook type configured by the BS for transmitting the first HARQ feedback.

13. The UE of claim 1, wherein the at least one processor is further configured to execute the computer-executable instructions to:

transmit, to the BS, a UE capability that indicates a maximum number of bits in the second HARQ feedback.

14. A method for wireless communication performed by a user equipment (UE), the method comprising:

receiving, from a base station (BS), a first physical downlink control channel (PDCCH) that schedules a physical downlink shared channel (PDSCH) and a first physical uplink control channel (PUCCH), the first PUCCH being used for transmitting a first hybrid automatic repeat request (HARQ) feedback associated with the PDSCH;

receiving, from the BS, a second PDCCH that schedules a physical sidelink shared channel (PSSCH) and a second PUCCH, the second PUCCH being used for transmitting a second HARQ feedback associated with the PSSCH, and the second PUCCH overlapping the first PUCCH in a time domain; and

transmitting, to the BS, uplink control information (UCI) in one of the first PUCCH and the second PUCCH;

wherein a part of at least one of the first HARQ feedback and the second HARQ feedback is discarded in the UCI.

15. The method of claim 14, further comprising:

receiving a message that indicates a dedicated resource for the second HARQ feedback.

16. The method of claim 14, further comprising:

receiving a message that indicates whether the first HARQ feedback can be multiplexed with the second HARQ feedback in a single PUCCH.

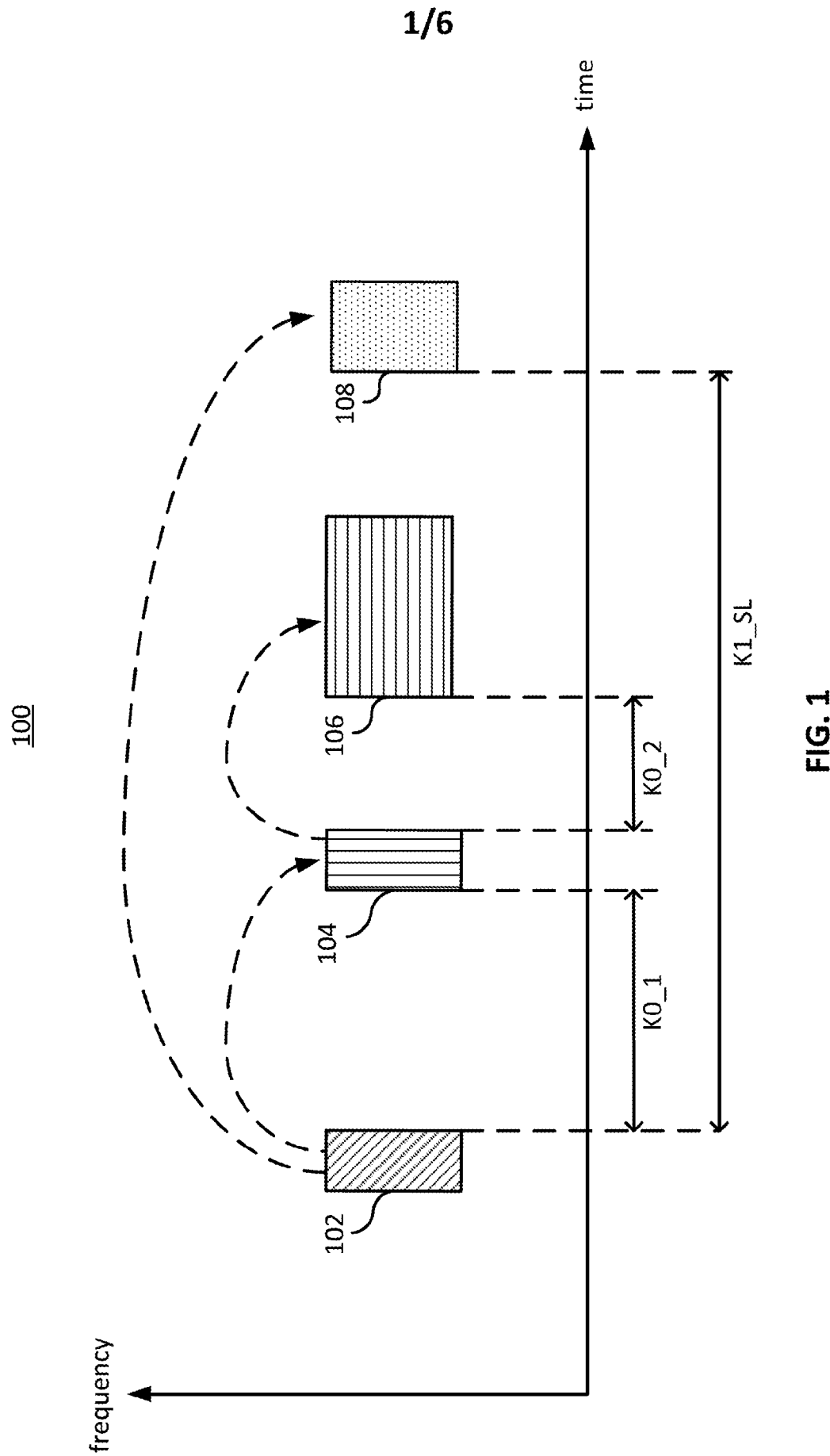
17. The method of claim 14, further comprising:

receiving a message that indicates whether the second HARQ feedback can be multiplexed in a physical uplink shared channel (PUSCH).

18. The method of claim 14, further comprising:

transmitting, to the BS, a UE capability that indicates whether the UE supports multiplexing the first HARQ feedback with the second HARQ feedback.

19. The method of claim 14, further comprising:
performing a prioritization procedure according to a prioritization rule and a payload size of the first PUCCH or the second PUCCH to determine the UCI, wherein the second PDCCH contains sidelink control information (SCI) that schedules the PSSCH and includes a priority indicator of the second HARQ feedback.
20. The method of claim 14, wherein the UCI includes only one of the first HARQ feedback and the second HARQ feedback.



200

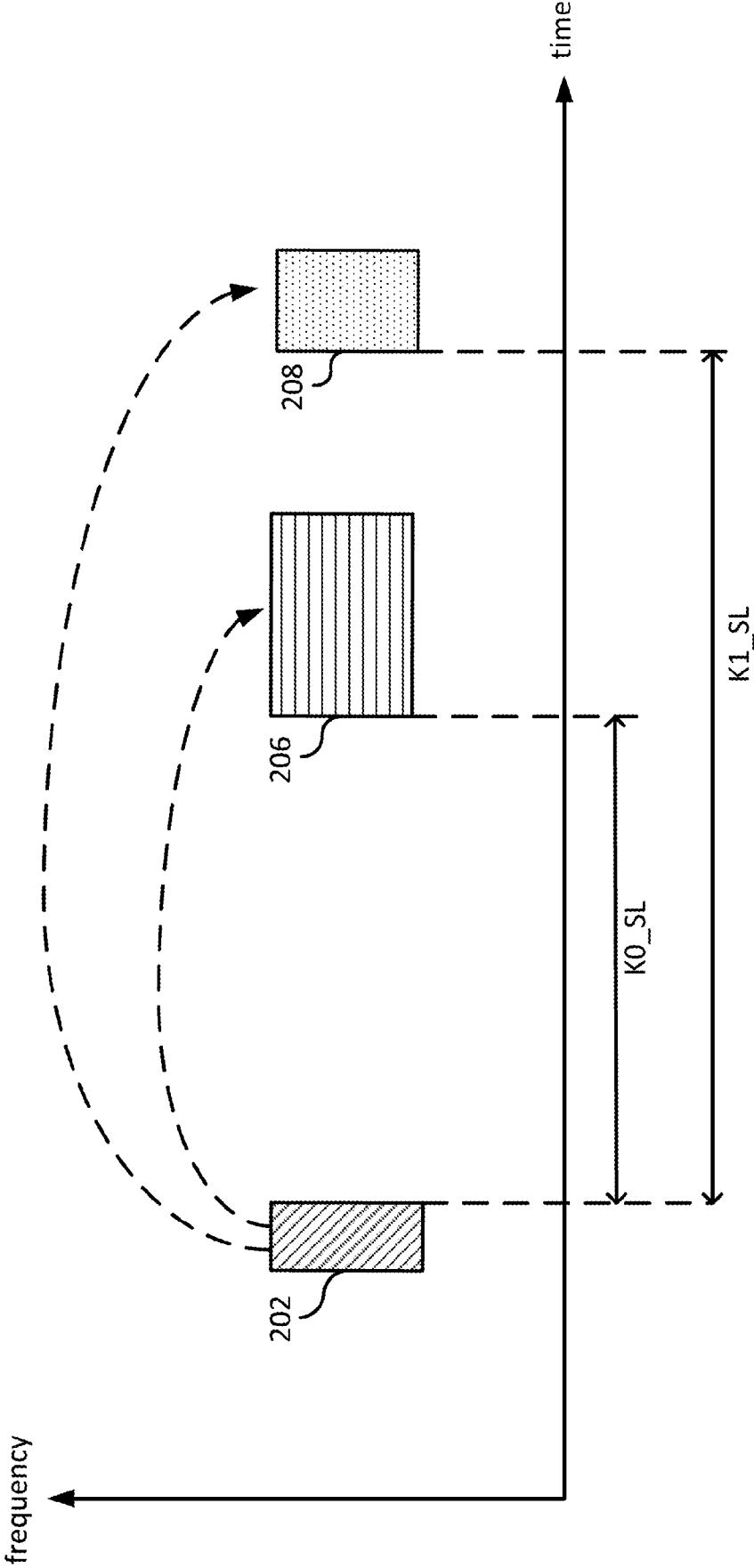


FIG. 2

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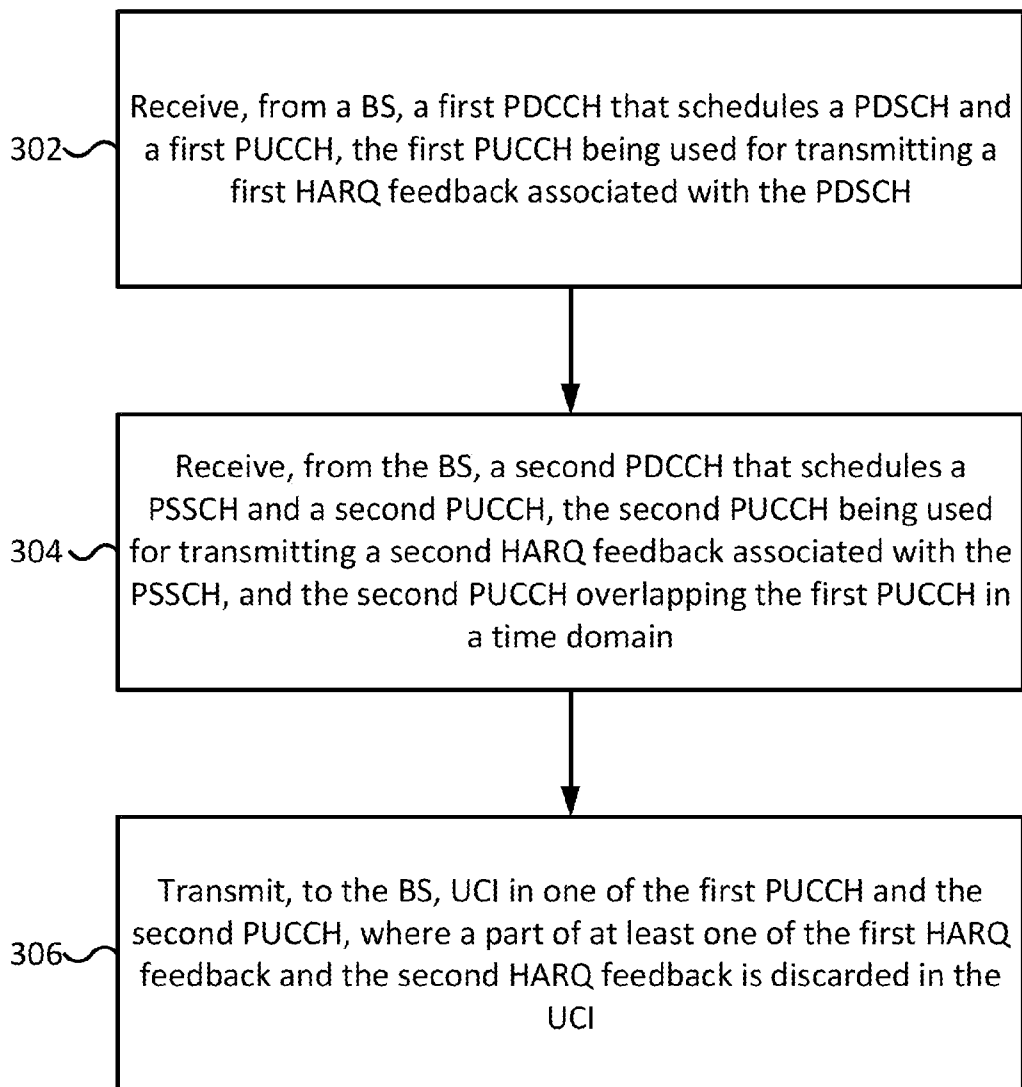
300

FIG. 3

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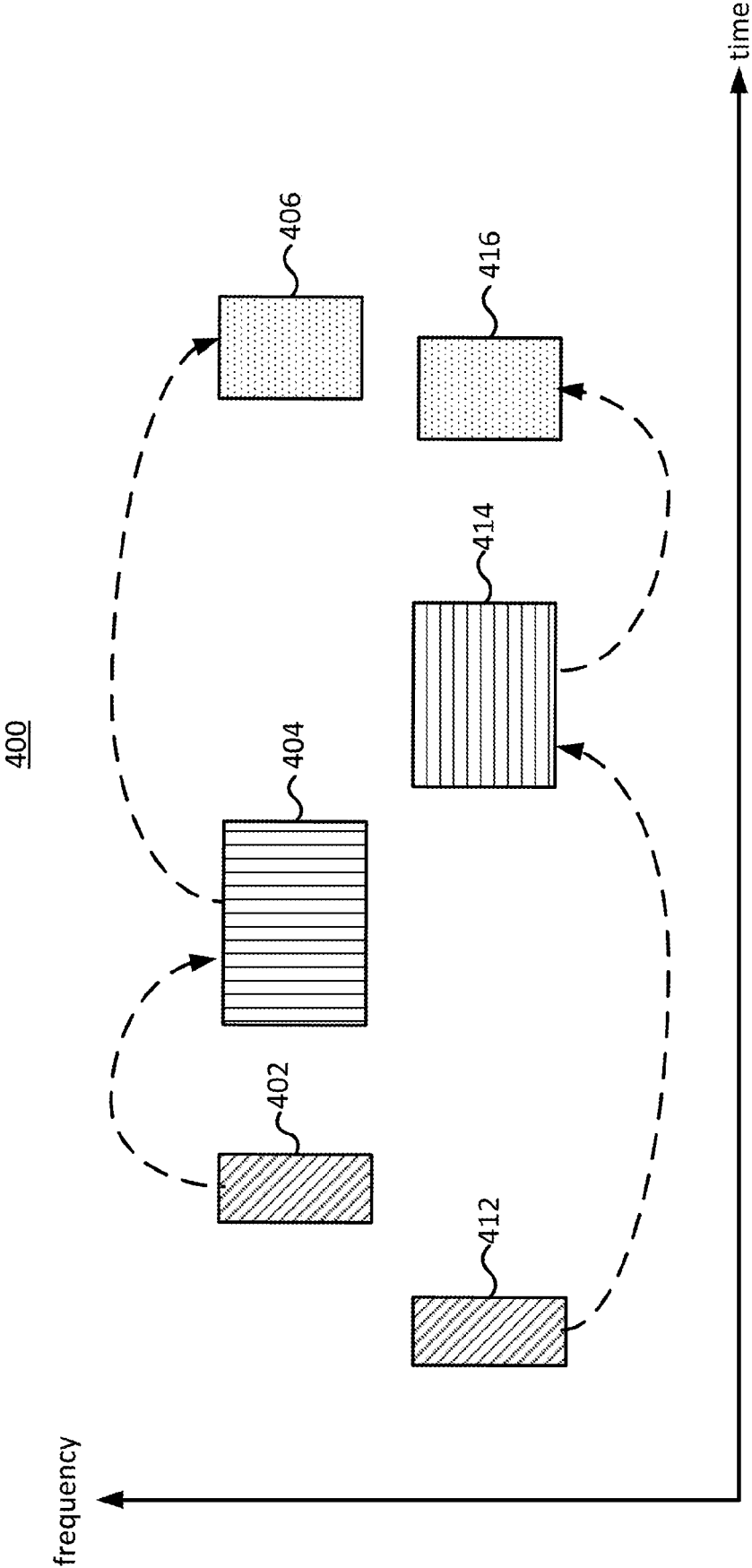


FIG. 4

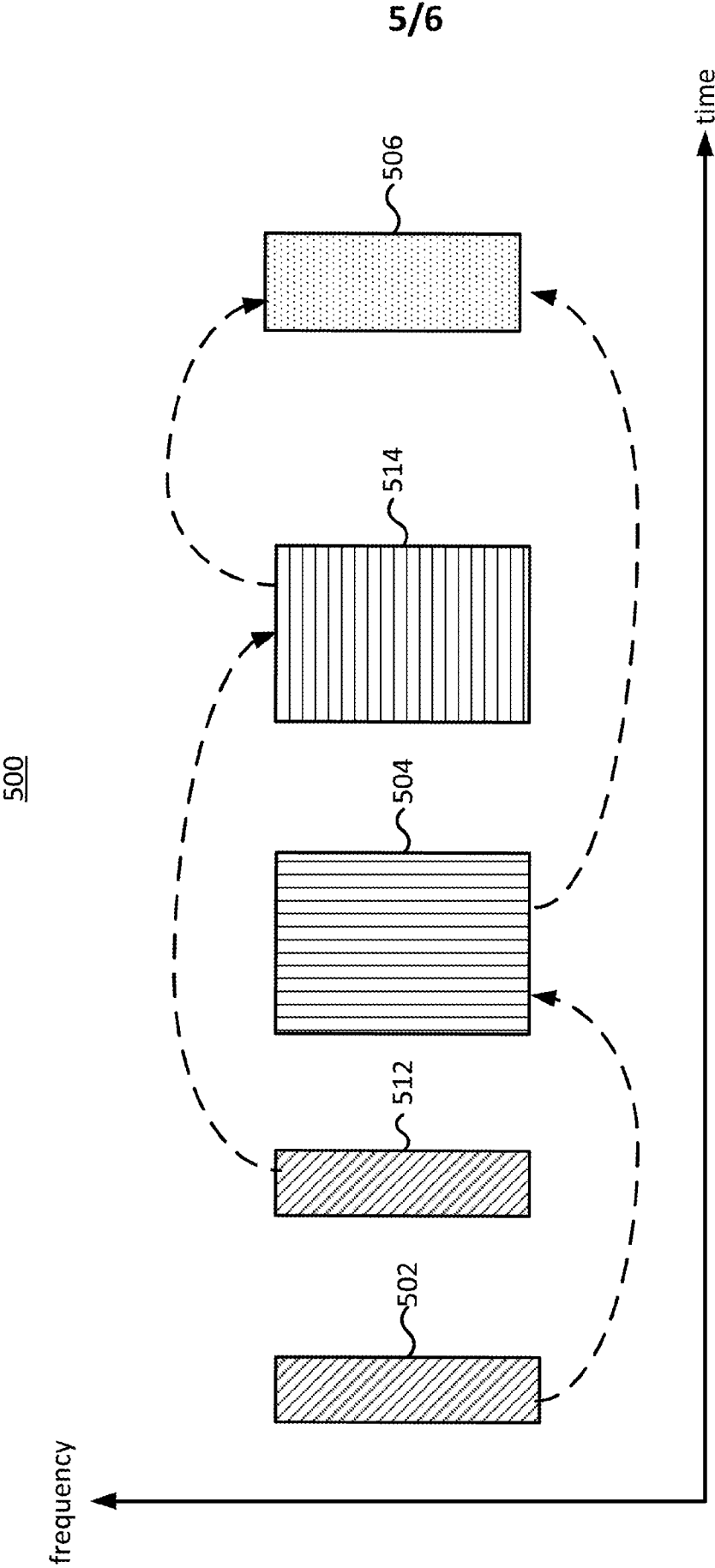


FIG. 5

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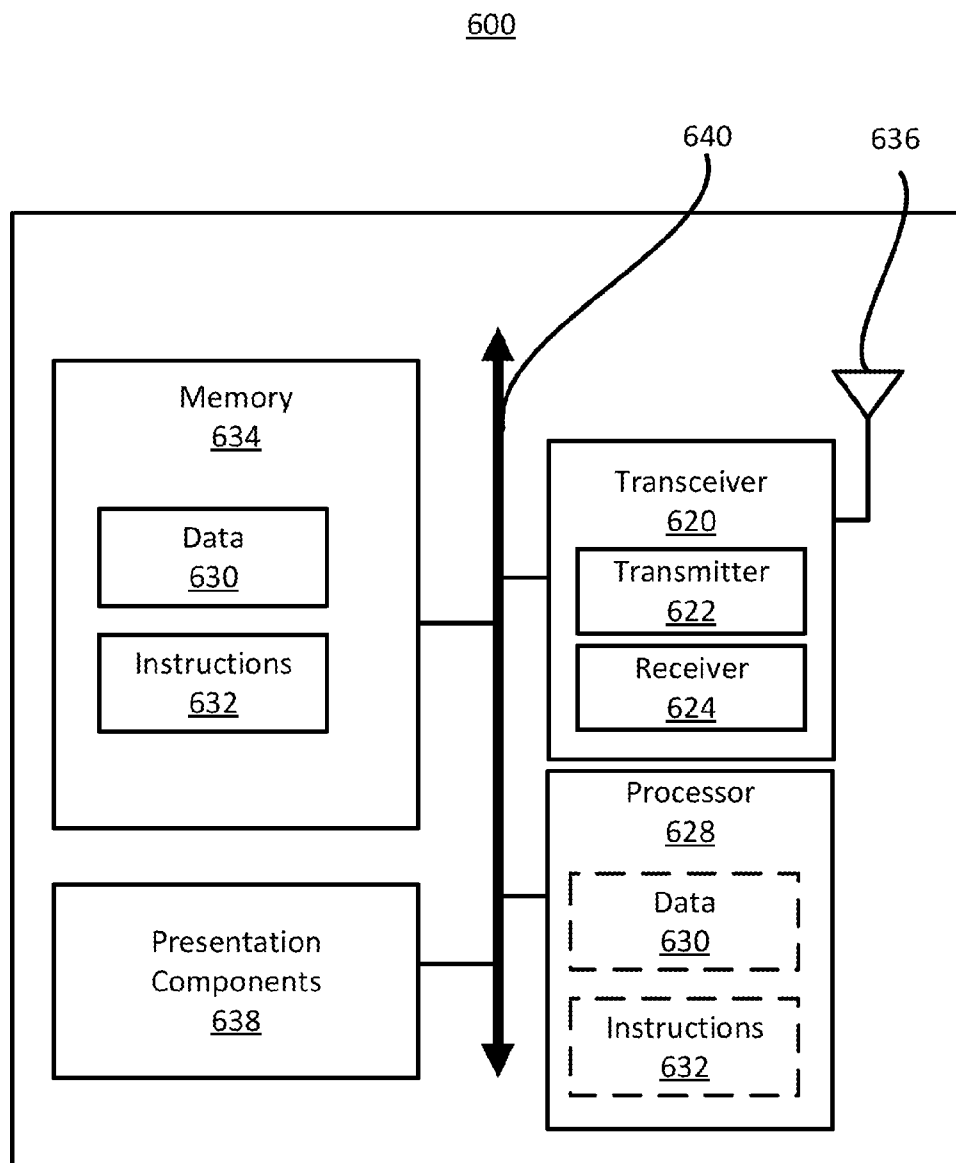


FIG. 6

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2020/109132

A. CLASSIFICATION OF SUBJECT MATTER

H04W 74/00(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)

H04L; 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)

CNPAT,WPI,EPODOC,CNKI,3GPP:HARQ,PUCCH,collision,collide, conflict, Uu,sidelink, report, joint,UCI

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	HUAWEI et al. "Sidelink resource allocation mode 1" <i>3GPP TSG RAN WG1 Meeting #99 R1-1911883</i> , 22 November 2019 (2019-11-22), section 3	1-20
PX	HUAWEI et al. "Sidelink resource allocation mode 1" <i>3GPP TSG RAN WG1 Meeting #98bis R1-1910055</i> , 20 October 2019 (2019-10-20), section 3	1-20
A	ERICSSON. "Handling collisions of sTTI and TTI in UL" <i>3GPP TSG-RAN WG1 Meeting #89 R1-1708841</i> , 19 May 2017 (2017-05-19), section 2.2	1-20
A	US 2015358138 A1 (MEDIATEK INC.) 10 December 2015 (2015-12-10) the whole document	1-20
A	HUAWEI et al. "Discussion on HARQ support for NR sidelink" <i>3GPP TSG-RAN WG2 #106 R2-1907414</i> , 17 May 2019 (2019-05-17), the whole document	1-20

☐ 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

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"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

02 November 2020

Date of mailing of the international search report

18 November 2020

Name and mailing address of the ISA/CN

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YU,Yongjiao

Facsimile No. (86-10)62019451

Telephone No. 86-(010)-53961745

International application No.
PCT/CN2020/109132

Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)			Publication date (day/month/year)
US	2015358138	A1	10 December 2015	WO	2015018071	A1	12 February 2015
				BR	112015028156	A2	25 July 2017
				CN	106165329	A	23 November 2016