



US 20200337022A1

(19) **United States**

(12) **Patent Application Publication**
CHAE et al.

(10) **Pub. No.: US 2020/0337022 A1**

(43) **Pub. Date: Oct. 22, 2020**

(54) **METHOD FOR TRANSMITTING OR RECEIVING SIDE LINK SIGNAL RELATED TO FEEDBACK IN WIRELESS COMMUNICATION SYSTEM**

(71) Applicants: **LG ELECTRONICS INC.**, Seoul (KR); **SEOUL NATIONAL UNIVERSITY R&DB FOUNDATION**, Seoul (KR)

(72) Inventors: **Hyukjin CHAE**, Seoul (KR); **Seungil PARK**, Seoul (KR); **Bo Yeal KIM**, Uiwang-si (KR); **Sunghyun CHOI**, Seoul (KR)

(73) Assignees: **LG Electronics Inc.**, Seoul (KR); **Seoul National University R&DB Foundation**, Seoul (KR)

(21) Appl. No.: **16/306,124**

(22) PCT Filed: **Jun. 5, 2017**

(86) PCT No.: **PCT/KR2017/005852**

§ 371 (c)(1),

(2) Date: **Nov. 30, 2018**

Related U.S. Application Data

(60) Provisional application No. 62/362,604, filed on Jul. 15, 2016, provisional application No. 62/344,997, filed on Jun. 3, 2016.

Publication Classification

(51) **Int. Cl.**

H04W 72/02 (2006.01)

H04W 72/00 (2006.01)

H04L 5/00 (2006.01)

H04W 74/08 (2006.01)

H04B 17/336 (2006.01)

H04L 1/00 (2006.01)

H04W 4/40 (2006.01)

(52) **U.S. Cl.**

CPC **H04W 72/02** (2013.01); **H04W 72/005** (2013.01); **H04L 5/0055** (2013.01); **H04W 4/40** (2018.02); **H04B 17/336** (2015.01); **H04L 1/0003** (2013.01); **H04W 74/0825** (2013.01)

(57)

ABSTRACT

An embodiment of the present invention relates to a method for transmitting or receiving a side link signal by a first terminal in a wireless communication system, the method comprising the steps of: selecting a first resource through which the first terminal will transmit a message; determining a second resource, which is determined dependent on the position of the selected first resource and is to be used for performing feedback; and transmitting feedback information on the message and the second resource, wherein the feedback information is feedback information relating to a broadcast message received through at least a part of the second resource.

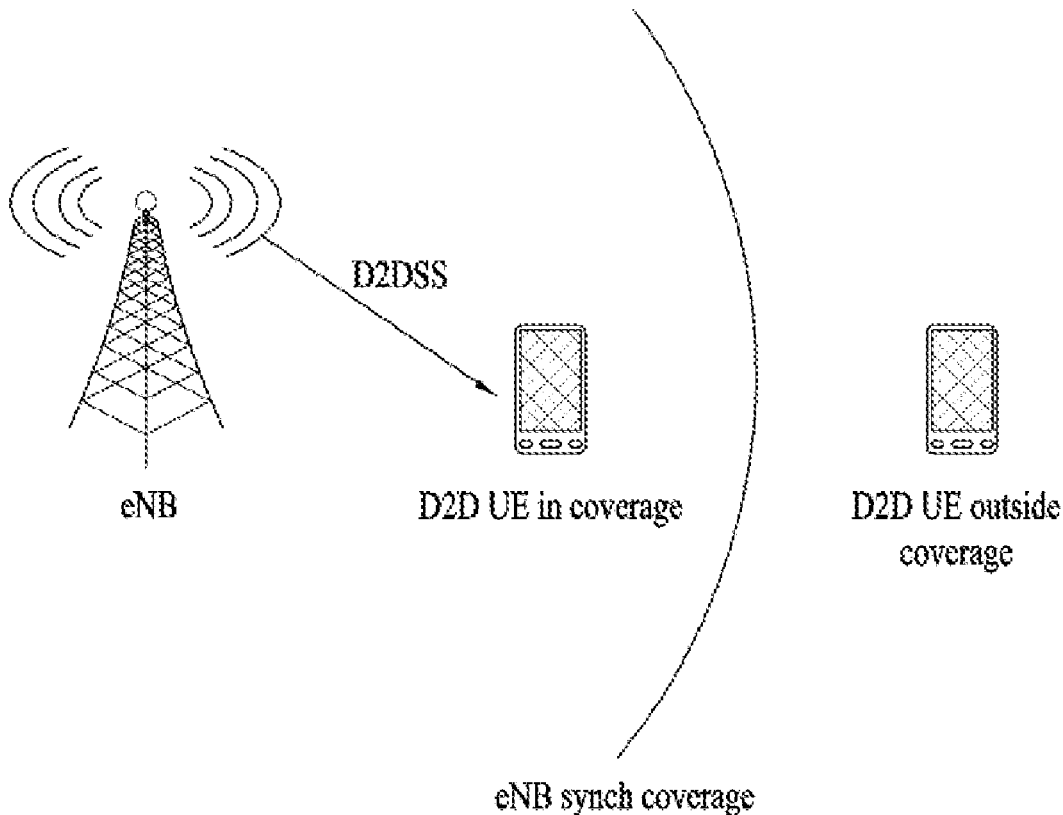


FIG. 1

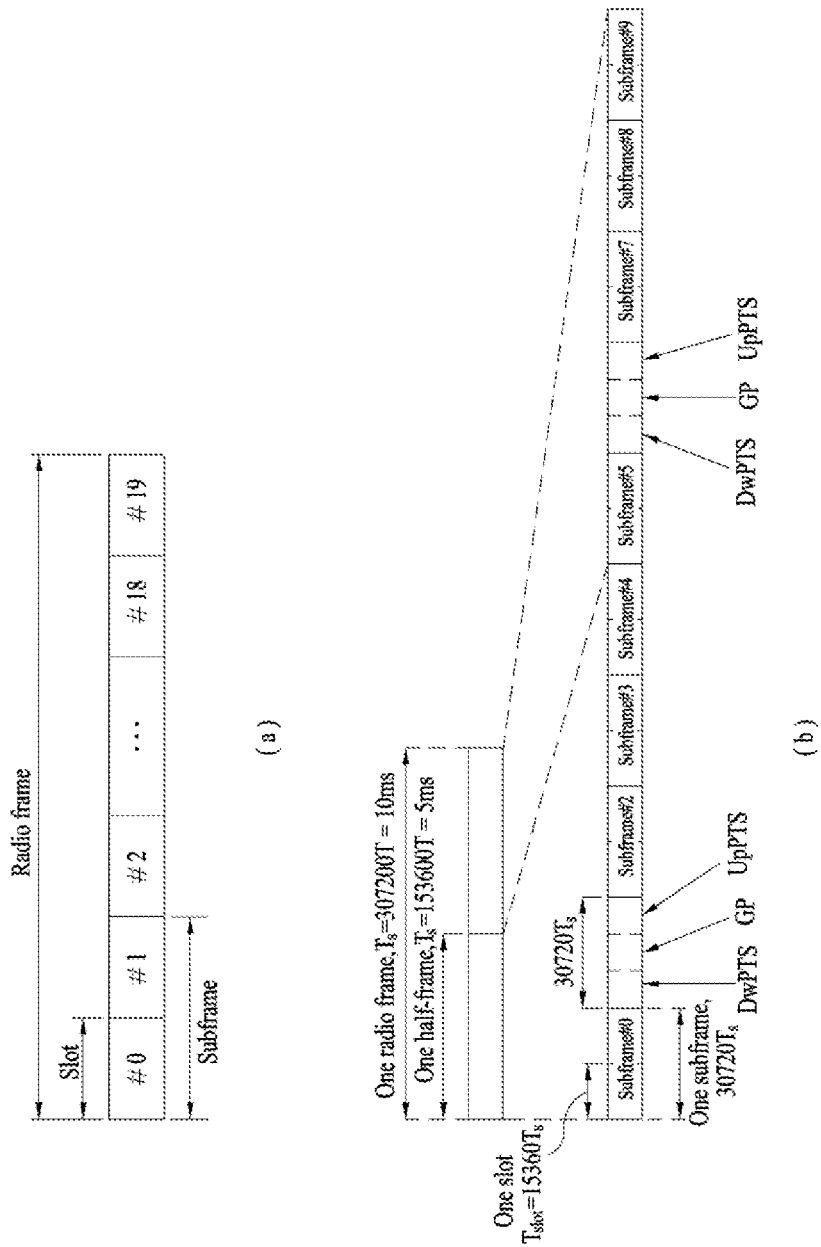


FIG. 2

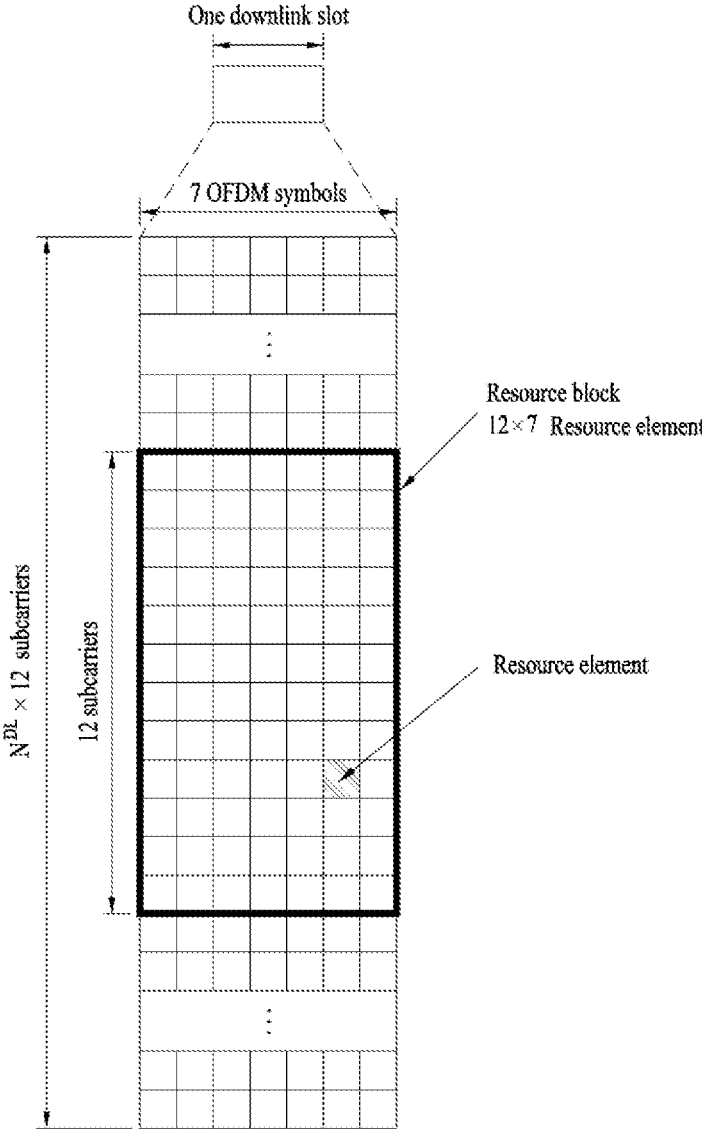


FIG. 3

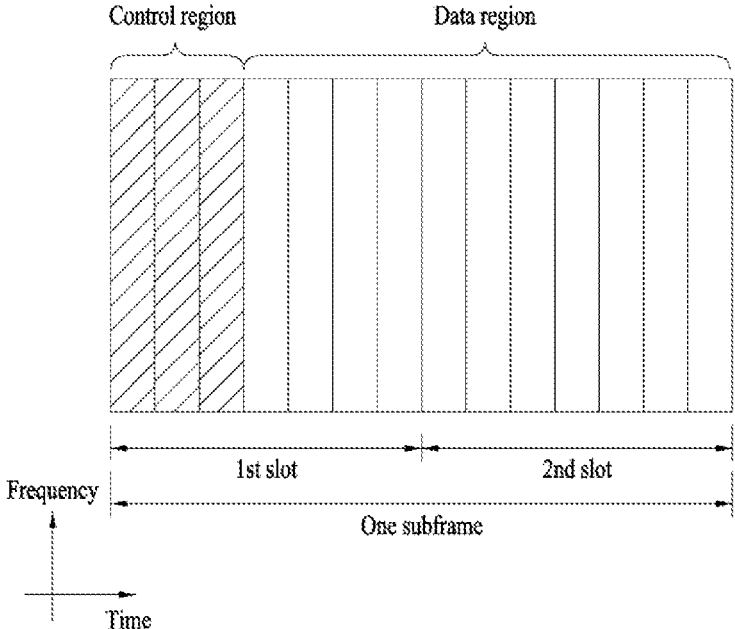


FIG. 4

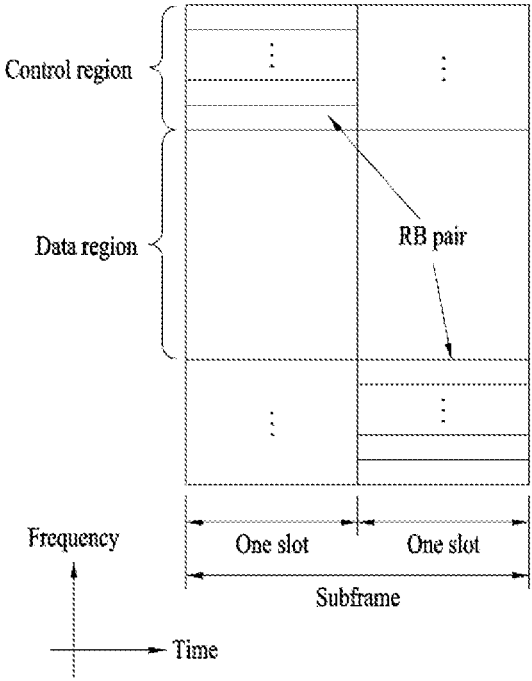
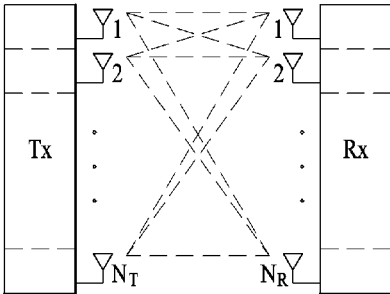
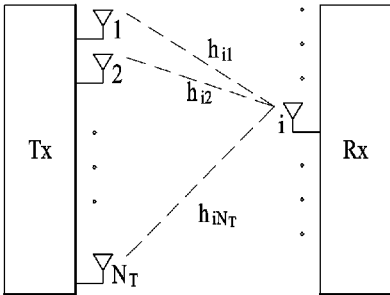


FIG. 5



(a)



(b)

FIG. 6

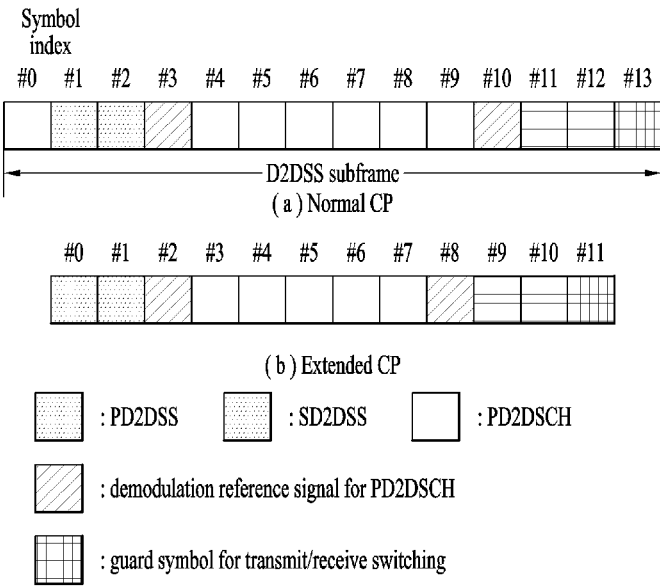


FIG. 7

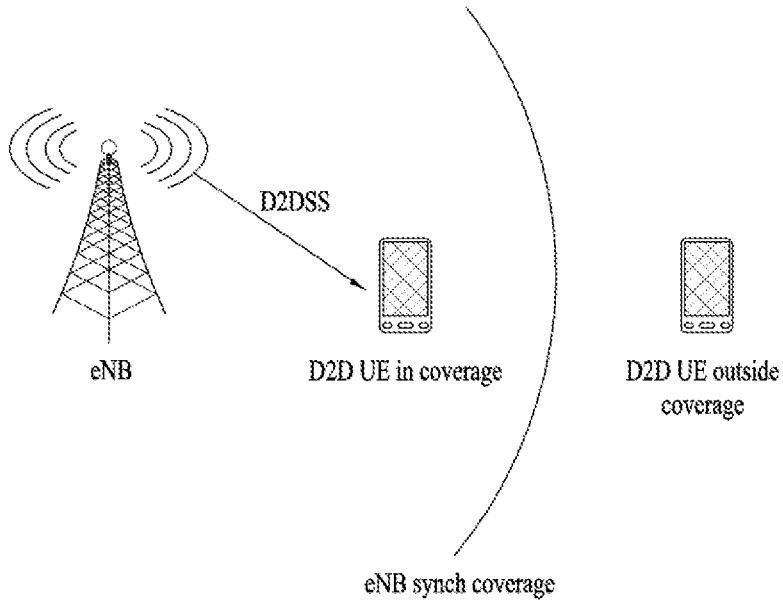
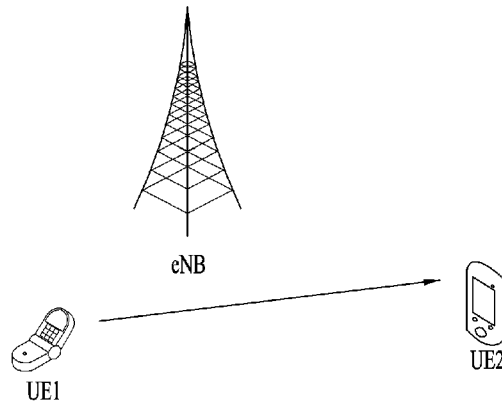
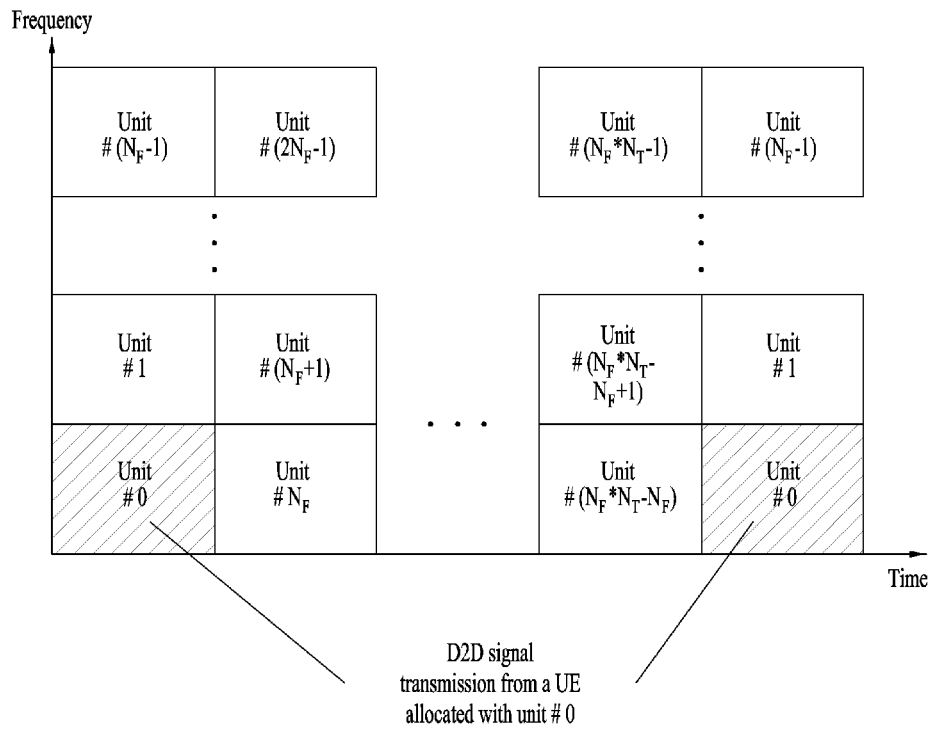


FIG. 8



(a)



(b)

FIG. 9

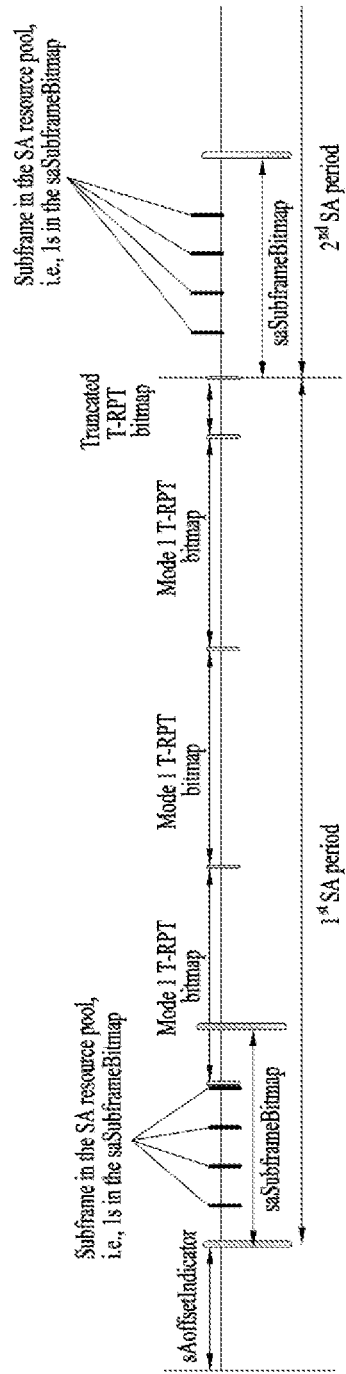


FIG. 10

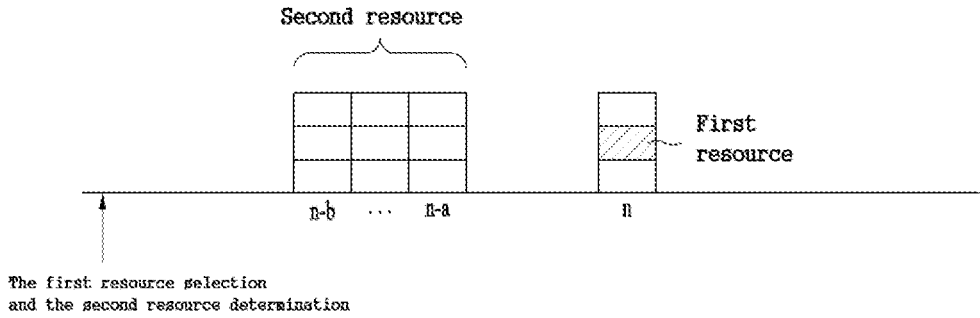


FIG. 11

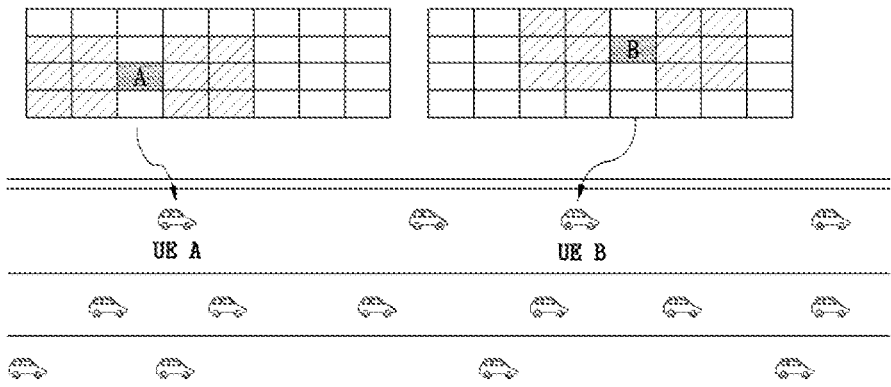


FIG. 12

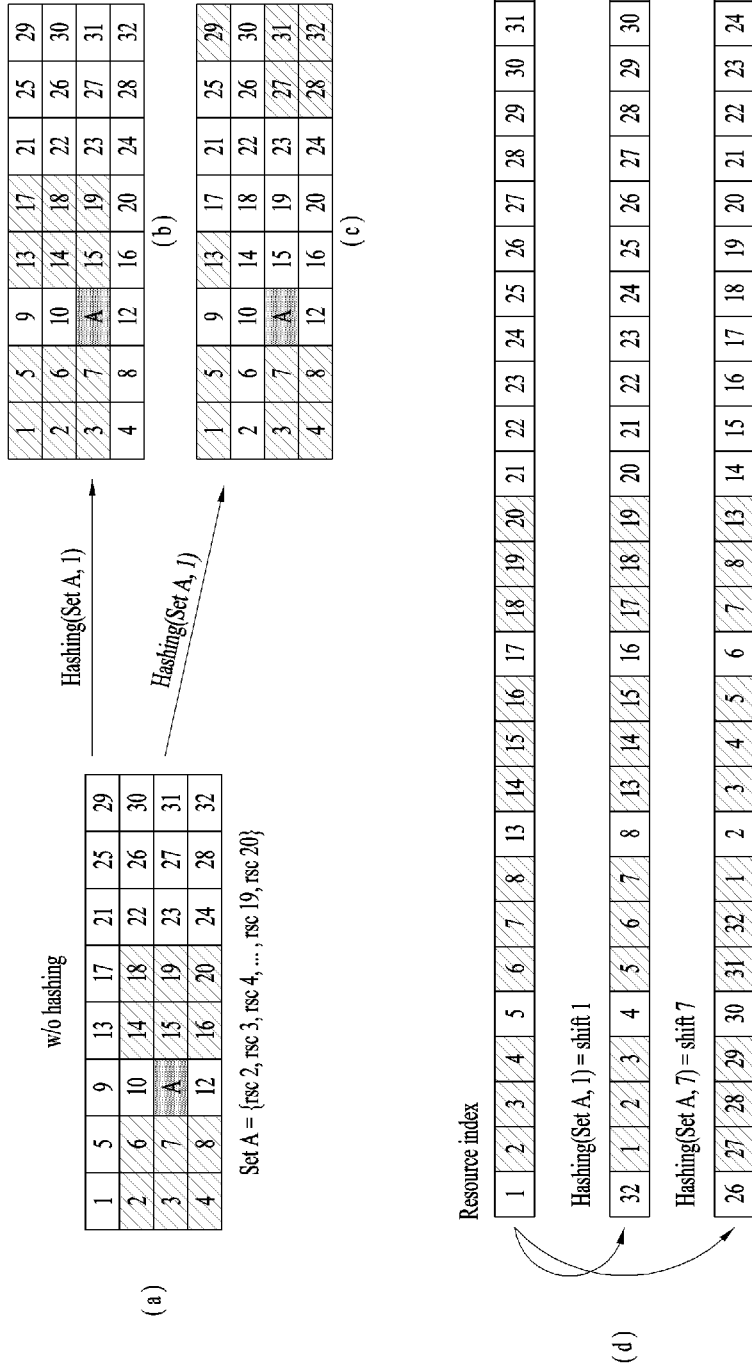
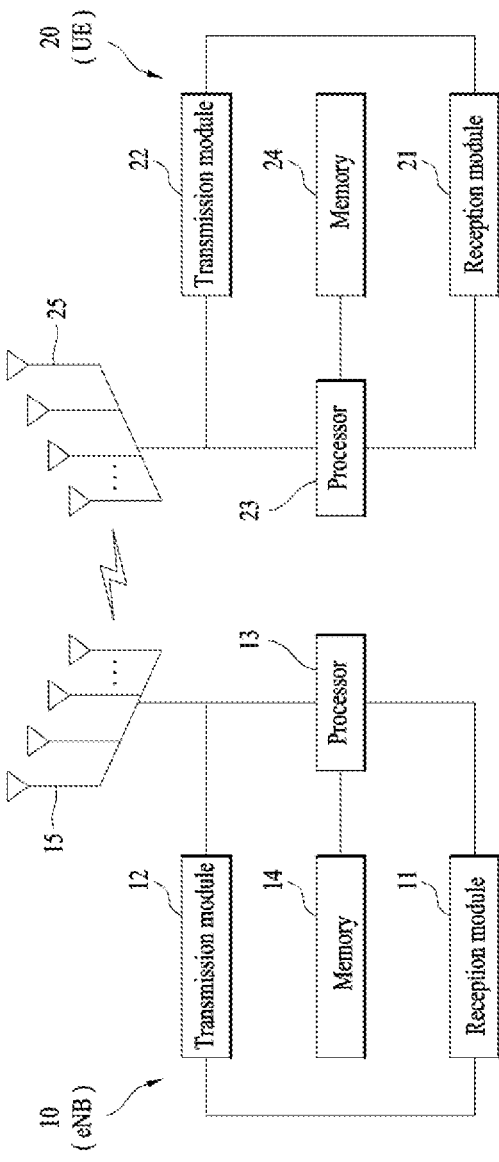


FIG. 13



**METHOD FOR TRANSMITTING OR
RECEIVING SIDE LINK SIGNAL RELATED
TO FEEDBACK IN WIRELESS
COMMUNICATION SYSTEM**

TECHNICAL FIELD

[0001] The present invention relates to a wireless communication system and, more particularly, to a method for transmitting or receiving a side link signal related to a feedback and an apparatus therefor.

BACKGROUND ART

[0002] Wireless communication systems have been widely deployed to provide various types of communication services such as voice or data. In general, a wireless communication system is a multiple access system that supports communication of multiple users by sharing available system resources (a bandwidth, transmission power, etc.) among them. For example, multiple access systems include a Code Division Multiple Access (CDMA) system, a Frequency Division Multiple Access (FDMA) system, a Time Division Multiple Access (TDMA) system, an Orthogonal Frequency Division Multiple Access (OFDMA) system, a Single Carrier Frequency Division Multiple Access (SC-FDMA) system, and a Multi-Carrier Frequency Division Multiple Access (MC-FDMA) system.

[0003] Device-to-Device (D2D) communication means a communication system for directly exchanging audio, data and the like between user equipments without passing through a base station (evolved NodeB: eNB) by establishing a direct link between the user equipments. D2D communication may include such a system as a UE-to-UE (user equipment-to-user equipment) communication, Peer-to-Peer communication and the like. And, the D2D communication system may be applicable to M2M (Machine-to-Machine) communication, MTC (Machine Type Communication) and the like.

[0004] D2D communication is currently considered as one of schemes for setting a load put on a base station due to the rapidly increasing data traffic. For instance, according to D2D communication, unlike an existing wireless communication system, since data is exchanged between devices without passing through a base station, overload of a network can be reduced. Moreover, by introducing D2D communication, it is able to expect effects such as procedure reduction of a base station, power consumption reduction of devices involved in D2D, data transmission speed increase, reception capability increase of a network, load distribution, extension of cell coverage and the like.

[0005] Currently, discussion on V2X (Vehicle to Everything) communication is in progress in a form associated with D2D communication. The V2X communication corresponds to a concept including V2V communication between vehicle UEs, V2P communication between a vehicle and a UE of a different type, and V2I communication between a vehicle and an RSU (roadside unit).

DISCLOSURE

Technical Problem

[0006] An object of the present invention is to provide a method for transmitting or receiving feedback information on a message which is broadcast from a side link.

[0007] Technical tasks obtainable from the present invention are non-limited by the above-mentioned technical task. And, other unmentioned technical tasks can be clearly understood from the following description by those having ordinary skill in the technical field to which the present invention pertains.

Technical Solution

[0008] In one embodiment of the present invention, a method for transmitting or receiving a side link signal by a first UE in a wireless communication system comprises the steps of selecting a first resource to which the first UE will transmit a message; determining a second resource, which is determined to be dependent on the position of the selected first resource and is to be used for performing a feedback; and transmitting the message and feedback information on the second resource, wherein the feedback information is feedback information on a broadcast message received through at least a part of the second resource.

[0009] In one embodiment of the present invention, a first UE for transmitting or receiving a side link signal in a wireless communication system comprises a transmitting module and a receiving module; and a processor, wherein the processor selects a first resource to which the first UE will transmit a message, determines a second resource, which is determined to be dependent on the position of the selected first resource and is to be used for performing a feedback, and transmits the message and feedback information on the second resource, wherein the feedback information is feedback information on a broadcast message received through at least a part of the second resource.

[0010] The broadcast message may be a Cooperative Awareness Message (CAM).

[0011] The feedback information may be an acknowledgement/negative acknowledgement for the broadcast message transmitted through at least a part of the second resource.

[0012] The feedback information may be information as to collision of resources in each part constituting the second resource.

[0013] The information as to collision may be determined through a detected energy level and message reception.

[0014] The first UE may determine that collision has occurred if the energy level is a previously set value or more and message reception has been failed.

[0015] The first UE may determine that collision has occurred if a received power is a previously set value or more and SINR is a previously set value or less.

[0016] The second resource may be included in a resource region between subframe n-a and subframe n-b if the first resource is included in subframe n, where b is a processing time for the feedback information, and a is greater than b.

[0017] The processing time for the feedback information may be a time required by the first UE to reflect a sensed result of the second resource in encoding.

[0018] The feedback information may be used for determination of one or more of resource reselection, MCS, RB size, retransmission times, and transmission power of the UE which has received the feedback information.

[0019] The first UE may be a vehicle to everything (V2X) UE.

[0020] The first resource may be repeated periodically for a previously set time if selected once.

Advantageous Effects

[0021] According to the present invention, a feedback may efficiently be provided to a side link message which is broadcast.

[0022] Effects obtainable from the present invention are non-limited by the above mentioned effect. And, other unmentioned effects can be clearly understood from the following description by those having ordinary skill in the technical field to which the present invention pertains.

BRIEF DESCRIPTION OF THE DRAWINGS

[0023] The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this specification, illustrate embodiments of the invention and together with the description serve to explain the principles of the invention

[0024] FIG. 1 is a diagram for a structure of a radio frame;

[0025] FIG. 2 is a diagram for a resource grid in a downlink slot;

[0026] FIG. 3 is a diagram for a structure of a downlink subframe;

[0027] FIG. 4 is a diagram for a structure of an uplink subframe;

[0028] FIG. 5 is a diagram for a configuration of a wireless communication system having multiple antennas;

[0029] FIG. 6 is a diagram for a subframe in which a D2D synchronization signal is transmitted;

[0030] FIG. 7 is a diagram for explaining relay of a D2D signal;

[0031] FIG. 8 is a diagram for an example of a D2D resource pool for performing D2D communication;

[0032] FIG. 9 is a diagram for explaining an SA period.

[0033] FIGS. 10 to 12 are diagrams for explaining various embodiments of the present invention; and

[0034] FIG. 13 is a diagram for configurations of a transmitter and a receiver.

BEST MODE FOR CARRYING OUT THE INVENTION

[0035] The embodiments of the present invention described hereinbelow are combinations of elements and features of the present invention. The elements or features may be considered selective unless otherwise mentioned. Each element or feature may be practiced without being combined with other elements or features. Further, an embodiment of the present invention may be constructed by combining parts of the elements and/or features. Operation orders described in embodiments of the present invention may be rearranged. Some constructions or features of any one embodiment may be included in another embodiment and may be replaced with corresponding constructions or features of another embodiment.

[0036] In the embodiments of the present invention, a description is made, centering on a data transmission and reception relationship between a Base Station (BS) and a User Equipment (UE). The BS is a terminal node of a network, which communicates directly with a UE. In some cases, a specific operation described as performed by the BS may be performed by an upper node of the BS.

[0037] Namely, it is apparent that, in a network comprised of a plurality of network nodes including a BS, various operations performed for communication with a UE may be

performed by the BS or network nodes other than the BS. The term ‘BS’ may be replaced with the term ‘fixed station’, ‘Node B’, ‘evolved Node B (eNode B or eNB)’, ‘Access Point (AP)’, etc. The term ‘relay’ may be replaced with the term ‘Relay Node (RN)’ or ‘Relay Station (RS)’. The term ‘terminal’ may be replaced with the term ‘UE’, ‘Mobile Station (MS)’, ‘Mobile Subscriber Station (MSS)’, ‘Subscriber Station (SS)’, etc.

[0038] The term “cell”, as used herein, may be applied to transmission and reception points such as a base station (eNB), sector, remote radio head (RRH) and relay, and may also be extensively used by a specific transmission/reception point to distinguish between component carriers.

[0039] Specific terms used for the embodiments of the present invention are provided to help the understanding of the present invention. These specific terms may be replaced with other terms within the scope and spirit of the present invention.

[0040] In some cases, to prevent the concept of the present invention from being ambiguous, structures and apparatuses of the known art will be omitted, or will be shown in the form of a block diagram based on main functions of each structure and apparatus. Also, wherever possible, the same reference numbers will be used throughout the drawings and the specification to refer to the same or like parts.

[0041] The embodiments of the present invention can be supported by standard documents disclosed for at least one of wireless access systems, Institute of Electrical and Electronics Engineers (IEEE) 802, 3rd Generation Partnership Project (3GPP), 3GPP Long Term Evolution (3GPP LTE), LTE-Advanced (LTE-A), and 3GPP2. Steps or parts that are not described to clarify the technical features of the present invention can be supported by those documents. Further, all terms as set forth herein can be explained by the standard documents.

[0042] Techniques described herein can be used in various wireless access systems such as Code Division Multiple Access (CDMA), Frequency Division Multiple Access (FDMA), Time Division Multiple Access (TDMA), Orthogonal Frequency Division Multiple Access (OFDMA), Single Carrier-Frequency Division Multiple Access (SC-FDMA), etc. CDMA may be implemented as a radio technology such as Universal Terrestrial Radio Access (UTRA) or CDMA2000. TDMA may be implemented as a radio technology such as Global System for Mobile communications (GSM)/General Packet Radio Service (GPRS)/Enhanced Data Rates for GSM Evolution (EDGE). OFDMA may be implemented as a radio technology such as IEEE 802.11 (Wi-Fi), IEEE 802.16 (WiMAX), IEEE 802.20, Evolved-UTRA (E-UTRA) etc. UTRA is a part of Universal Mobile Telecommunications System (UMTS). 3GPP LTE is a part of Evolved UMTS (E-UMTS) using E-UTRA. 3GPP LTE employs OFDMA for downlink and SC-FDMA for uplink. LTE-A is an evolution of 3GPP LTE. WiMAX can be described by the IEEE 802.16e standard (Wireless Metropolitan Area Network (WirelessMAN)-OFDMA Reference System) and the IEEE 802.16m standard (WirelessMAN-OFDMA Advanced System). For clarity, this application focuses on the 3GPP LTE and LTE-A systems. However, the technical features of the present invention are not limited thereto.

[0043] LTE/LTE-A resource structure/channel

[0044] With reference to FIG. 1, the structure of a radio frame will be described below.

[0045] In a cellular Orthogonal Frequency Division Multiplexing (OFDM) wireless Packet communication system, uplink and/or downlink data Packets are transmitted in subframes. One subframe is defined as a predetermined time period including a plurality of OFDM symbols. The 3GPP LTE standard supports a type-1 radio frame structure applicable to Frequency Division Duplex (FDD) and a type-2 radio frame structure applicable to Time Division Duplex (TDD).

[0046] FIG. 1(a) illustrates the type-1 radio frame structure. A downlink radio frame is divided into 10 subframes. Each subframe is further divided into two slots in the time domain. A unit time during which one subframe is transmitted is defined as a Transmission Time Interval (TTI). For example, one subframe may be 1 ms in duration and one slot may be 0.5 ms in duration. A slot includes a plurality of OFDM symbols in the time domain and a plurality of Resource Blocks (RBs) in the frequency domain. Because the 3GPP LTE system adopts OFDMA for downlink, an OFDM symbol represents one symbol period. An OFDM symbol may be referred to as an SC-FDMA symbol or symbol period. An RB is a resource allocation unit including a plurality of contiguous subcarriers in a slot.

[0047] The number of OFDM symbols in one slot may vary depending on a Cyclic Prefix (CP) configuration. There are two types of CPs: extended CP and normal CP. In the case of the normal CP, one slot includes 7 OFDM symbols. In the case of the extended CP, the length of one OFDM symbol is increased and thus the number of OFDM symbols in a slot is smaller than in the case of the normal CP. Thus when the extended CP is used, for example, 6 OFDM symbols may be included in one slot. If channel state gets poor, for example, during fast movement of a UE, the extended CP may be used to further decrease Inter-Symbol Interference (ISI).

[0048] In the case of the normal CP, one subframe includes 14 OFDM symbols because one slot includes 7 OFDM symbols. The first two or three OFDM symbols of each subframe may be allocated to a Physical Downlink Control Channel (PDCCH) and the other OFDM symbols may be allocated to a Physical Downlink Shared Channel (PDSCH).

[0049] FIG. 1(b) illustrates the type-2 radio frame structure. A type-2 radio frame includes two half frames, each having 5 subframes, a Downlink Pilot Time Slot (DwPTS), a Guard Period (GP), and an Uplink Pilot Time Slot (UpPTS). Each subframe is divided into two slots. The DwPTS is used for initial cell search, synchronization, or channel estimation at a UE. The UpPTS is used for channel estimation and acquisition of uplink transmission synchronization to a UE at an eNB. The GP is a period between an uplink and a downlink, which eliminates uplink interference caused by multipath delay of a downlink signal. One subframe includes two slots irrespective of the type of a radio frame.

[0050] The above-described radio frame structures are purely exemplary and thus it is to be noted that the number of subframes in a radio frame, the number of slots in a subframe, or the number of symbols in a slot may vary.

[0051] FIG. 2 illustrates the structure of a downlink resource grid for the duration of one downlink slot. A downlink slot includes 7 OFDM symbols in the time domain and an RB includes 12 subcarriers in the frequency domain, which does not limit the scope and spirit of the present invention. For example, a downlink slot may include 7

OFDM symbols in the case of the normal CP, whereas a downlink slot may include 6 OFDM symbols in the case of the extended CP. Each element of the resource grid is referred to as a Resource Element (RE). An RB includes 12×7 REs. The number of RBs in a downlink slot, NDL depends on a downlink transmission bandwidth. An uplink slot may have the same structure as a downlink slot.

[0052] FIG. 3 illustrates the structure of a downlink subframe. Up to three OFDM symbols at the start of the first slot in a downlink subframe are used for a control region to which control channels are allocated and the other OFDM symbols of the downlink subframe are used for a data region to which a PDSCH is allocated. Downlink control channels used in the 3GPP LTE system include a Physical Control Format Indicator CHannel (PCFICH), a Physical Downlink Control CHannel (PDCCH), and a Physical Hybrid automatic repeat request (HARQ) Indicator CHannel (PHICH). The PCFICH is located in the first OFDM symbol of a subframe, carrying information about the number of OFDM symbols used for transmission of control channels in the subframe. The PHICH delivers an HARQ ACKnowledgment/Negative ACKnowledgment (ACK/NACK) signal in response to an uplink transmission. Control information carried on the PDCCH is called Downlink Control Information (DCI). The DCI transports uplink or downlink scheduling information, or uplink transmission power control commands for UE groups. The PDCCH delivers information about resource allocation and a transport format for a Downlink Shared CHannel (DL-SCH), resource allocation information about an Uplink Shared CHannel (UL-SCH), paging information of a Paging CHannel (PCH), system information on the DL-SCH, information about resource allocation for a higher-layer control message such as a Random Access Response transmitted on the PDSCH, a set of transmission power control commands for individual UEs of a UE group, transmission power control information, Voice Over Internet Protocol (VoIP) activation information, etc. A plurality of PDCCHs may be transmitted in the control region. A UE may monitor a plurality of PDCCHs. A PDCCH is formed by aggregating one or more consecutive Control Channel Elements (CCEs). A CCE is a logical allocation unit used to provide a PDCCH at a coding rate based on the state of a radio channel. A CCE includes a plurality of RE groups. The format of a PDCCH and the number of available bits for the PDCCH are determined according to the correlation between the number of CCEs and a coding rate provided by the CCEs. An eNB determines the PDCCH format according to DCI transmitted to a UE and adds a Cyclic Redundancy Check (CRC) to control information. The CRC is masked by an Identifier (ID) known as a Radio Network Temporary Identifier (RNTI) according to the owner or usage of the PDCCH. If the PDCCH is directed to a specific UE, its CRC may be masked by a cell-RNTI (C-RNTI) of the UE. If the PDCCH is for a paging message, the CRC of the PDCCH may be masked by a Paging Indicator Identifier (P-RNTI). If the PDCCH carries system information, particularly, a System Information Block (SIB), its CRC may be masked by a system information ID and a System Information RNTI (SI-RNTI). To indicate that the PDCCH carries a Random Access Response in response to a Random Access Preamble transmitted by a UE, its CRC may be masked by a Random Access-RNTI (RA-RNTI).

[0053] FIG. 4 illustrates the structure of an uplink subframe. An uplink subframe may be divided into a control region and a data region in the frequency domain. A Physical Uplink Control Channel (PUCCH) carrying uplink control information is allocated to the control region and a Physical Uplink Shared Channel (PUSCH) carrying user data is allocated to the data region. To maintain the property of a single carrier, a UE does not transmit a PUSCH and a PUCCH simultaneously. A PUCCH for a UE is allocated to an RB pair in a subframe. The RBs of the RB pair occupy different subcarriers in two slots. Thus it is said that the RB pair allocated to the PUCCH is frequency-hopped over a slot boundary.

[0054] Reference Signals (RSs)

[0055] In a wireless communication system, a Packet is transmitted on a radio channel. In view of the nature of the radio channel, the Packet may be distorted during the transmission. To receive the signal successfully, a receiver should compensate for the distortion of the received signal using channel information. Generally, to enable the receiver to acquire the channel information, a transmitter transmits a signal known to both the transmitter and the receiver and the receiver acquires knowledge of channel information based on the distortion of the signal received on the radio channel. This signal is called a pilot signal or an RS.

[0056] In the case of data transmission and reception through multiple antennas, knowledge of channel states between Transmission (Tx) antennas and Reception (Rx) antennas is required for successful signal reception. Accordingly, an RS should be transmitted through each Tx antenna.

[0057] RSs may be divided into downlink RSs and uplink RSs. In the current LTE system, the uplink RSs include:

[0058] i) DeModulation-Reference Signal (DM-RS) used for channel estimation for coherent demodulation of information delivered on a PUSCH and a PUCCH; and

[0059] ii) Sounding Reference Signal (SRS) used for an eNB or a network to measure the quality of an uplink channel in a different frequency.

[0060] The downlink RSs are categorized into:

[0061] i) Cell-specific Reference Signal (CRS) shared among all UEs of a cell;

[0062] ii) UE-specific RS dedicated to a specific UE;

[0063] iii) DM-RS used for coherent demodulation of a PDSCH, when the PDSCH is transmitted;

[0064] iv) Channel State Information-Reference Signal (CSI-RS) carrying CSI, when downlink DM-RSs are transmitted;

[0065] v) Multimedia Broadcast Single Frequency Network (MBSFN) RS used for coherent demodulation of a signal transmitted in MBSFN mode; and

[0066] vi) positioning RS used to estimate geographical position information about a UE.

[0067] RSs may also be divided into two types according to their purposes: RS for channel information acquisition and RS for data demodulation. Since its purpose lies in that a UE acquires downlink channel information, the former should be transmitted in a broad band and received even by a UE that does not receive downlink data in a specific subframe. This RS is also used in a situation like handover. The latter is an RS that an eNB transmits along with downlink data in specific resources. A UE can demodulate the data by measuring a channel using the RS. This RS should be transmitted in a data transmission area.

[0068] Modeling of MIMO System

[0069] FIG. 5 is a diagram illustrating a configuration of a wireless communication system having multiple antennas.

[0070] As shown in FIG. 5(a), if the number of transmit antennas is increased to N_T and the number of receive antennas is increased to N_R , a theoretical channel transmission capacity is increased in proportion to the number of antennas, unlike the case where a plurality of antennas is used in only a transmitter or a receiver. Accordingly, it is possible to improve a transfer rate and to remarkably improve frequency efficiency. As the channel transmission capacity is increased, the transfer rate may be theoretically increased by a product of a maximum transfer rate R_0 upon utilization of a single antenna and a rate increase ratio R_i .

[Equation 1]

$$R_i = \min(N_T, N_R)$$

[0071] For instance, in an MIMO communication system, which uses 4 transmit antennas and 4 receive antennas, a transmission rate 4 times higher than that of a single antenna system can be obtained. Since this theoretical capacity increase of the MIMO system has been proved in the middle of 90's, many ongoing efforts are made to various techniques to substantially improve a data transmission rate. In addition, these techniques are already adopted in part as standards for various wireless communications such as 3G mobile communication, next generation wireless LAN and the like.

[0072] The trends for the MIMO relevant studies are explained as follows. First of all, many ongoing efforts are made in various aspects to develop and research information theory study relevant to MIMO communication capacity calculations and the like in various channel configurations and multiple access environments, radio channel measurement and model derivation study for MIMO systems, spatiotemporal signal processing technique study for transmission reliability enhancement and transmission rate improvement and the like.

[0073] In order to explain a communicating method in an MIMO system in detail, mathematical modeling can be represented as follows. It is assumed that there are N_T transmit antennas and N_R receive antennas.

[0074] Regarding a transmitted signal, if there are N_T transmit antennas, the maximum number of pieces of information that can be transmitted is N_T . Hence, the transmission information can be represented as shown in Equation 2.

[Equation 2]

$$S = [S_1, S_2, \dots, S_{N_T}]^T$$

[0075] Meanwhile, transmit powers can be set different from each other for individual pieces of transmission information S_1, S_2, \dots, S_{N_T} , respectively. If the transmit powers are set to P_1, P_2, \dots, P_{N_T} , respectively, the transmission information with adjusted transmit powers can be represented as Equation 3.

[Equation 3]

$$\hat{S} = [\hat{S}_1, \hat{S}_2, \dots, \hat{S}_{N_T}]^T = [P_1 S_1, P_2 S_2, \dots, P_{N_T} S_{N_T}]^T$$

[0076] In addition, \hat{S} can be represented as Equation 4 using diagonal matrix P of the transmission power.

[Equation 4]

$$\hat{s} = \begin{bmatrix} P_1 & & & 0 \\ & P_2 & & \\ & & \ddots & \\ 0 & & & P_{N_T} \end{bmatrix} \begin{bmatrix} s_1 \\ s_2 \\ \vdots \\ s_{N_T} \end{bmatrix} = P_S \quad \text{[Equation 4]}$$

[0077] Assuming a case of configuring N_T transmitted signals x_1, x_2, \dots, x_{N_T} , which are actually transmitted, by applying weight matrix W to the information vector \hat{S} having the adjusted transmit powers, the weight matrix W serves to appropriately distribute the transmission information to each antenna according to a transport channel state. X_1, X_2, \dots, X_{N_T} can be expressed by using the vector X as follows.

[Equation 5]

$$x = \begin{bmatrix} x_1 \\ x_2 \\ \vdots \\ x_i \\ \vdots \\ x_{N_T} \end{bmatrix} = \begin{bmatrix} w_{11} & w_{12} & \dots & w_{1N_T} \\ w_{21} & w_{22} & \dots & w_{2N_T} \\ \vdots & \vdots & \ddots & \vdots \\ w_{i1} & w_{i2} & \dots & w_{iN_T} \\ \vdots & \vdots & \ddots & \vdots \\ w_{N_T1} & w_{N_T2} & \dots & w_{N_TN_T} \end{bmatrix} \begin{bmatrix} \hat{s}_1 \\ \hat{s}_2 \\ \vdots \\ \hat{s}_j \\ \vdots \\ \hat{s}_{N_T} \end{bmatrix} = W\hat{s} = WP_S$$

[0078] In Equation 5, W_{ij} denotes a weight between an i^{th} transmit antenna and j^{th} information. W is also called a precoding matrix.

[0079] If the NR receive antennas are present, respective received signals y_1, y_2, \dots, y_{N_R} of the antennas can be expressed as follows.

[Equation 6]

$$y = [y_1, y_2, \dots, y_{N_R}]^T$$

[0080] If channels are modeled in the MIMO wireless communication system, the channels may be distinguished according to transmit/receive antenna indexes. A channel from the transmit antenna j to the receive antenna i is denoted by h_{ij} . In h_{ij} , it is noted that the indexes of the receive antennas precede the indexes of the transmit antennas in view of the order of indexes.

[0081] FIG. 5(b) is a diagram illustrating channels from the N_T transmit antennas to the receive antenna i. The channels may be combined and expressed in the form of a vector and a matrix. In FIG. 5(b), the channels from the N_T transmit antennas to the receive antenna i can be expressed as follows.

[Equation 7]

$$h_i^T = [h_{i1}, h_{i2}, \dots, h_{iN_T}]$$

[0082] Accordingly, all channels from the N_T transmit antennas to the N_R receive antennas can be expressed as follows.

[Equation 8]

$$H = \begin{bmatrix} h_1^T \\ h_2^T \\ \vdots \\ h_i^T \\ \vdots \\ h_{N_R}^T \end{bmatrix} = \begin{bmatrix} h_{11} & h_{12} & \dots & h_{1N_T} \\ h_{21} & h_{22} & \dots & h_{2N_T} \\ \vdots & \vdots & \ddots & \vdots \\ h_{i1} & h_{i2} & \dots & h_{iN_T} \\ \vdots & \vdots & \ddots & \vdots \\ h_{N_R1} & h_{N_R2} & \dots & h_{N_RN_T} \end{bmatrix}$$

[0083] An AWGN (Additive White Gaussian Noise) is added to the actual channels after a channel matrix H. The AWGN n_1, n_2, \dots, n_{N_R} respectively added to the N_R receive antennas can be expressed as follows.

[Equation 9]

$$n = [n_1, n_2, \dots, n_{N_R}]^T$$

[0084] Through the above-described mathematical modeling, the received signals can be expressed as follows.

[Equation 10]

$$y = \begin{bmatrix} y_1 \\ y_2 \\ \vdots \\ y_i \\ \vdots \\ y_{N_R} \end{bmatrix} = \begin{bmatrix} h_{11} & h_{12} & \dots & h_{1N_T} \\ h_{21} & h_{22} & \dots & h_{2N_T} \\ \vdots & \vdots & \ddots & \vdots \\ h_{i1} & h_{i2} & \dots & h_{iN_T} \\ \vdots & \vdots & \ddots & \vdots \\ h_{N_R1} & h_{N_R2} & \dots & h_{N_RN_T} \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ \vdots \\ x_j \\ \vdots \\ x_{N_T} \end{bmatrix} + \begin{bmatrix} n_1 \\ n_2 \\ \vdots \\ n_j \\ \vdots \\ n_{N_R} \end{bmatrix} = Hx + n$$

[0085] Meanwhile, the number of rows and columns of the channel matrix H indicating the channel state is determined by the number of transmit and receive antennas. The number of rows of the channel matrix H is equal to the number N_R of receive antennas and the number of columns thereof is equal to the number N_T of transmit antennas. That is, the channel matrix H is an $N_R \times N_T$ matrix.

[0086] The rank of the matrix is defined by the smaller of the number of rows and the number of columns, which are independent from each other. Accordingly, the rank of the matrix is not greater than the number of rows or columns. The rank $\text{rank}(H)$ of the channel matrix H is restricted as follows.

[Equation 11]

$$\text{rank}(H) \leq \min(N_T, N_R)$$

[0087] Additionally, the rank of a matrix can also be defined as the number of non-zero Eigen values when the matrix is Eigen-value-decomposed. Similarly, the rank of a matrix can be defined as the number of non-zero singular values when the matrix is singular-value-decomposed. Accordingly, the physical meaning of the rank of a channel matrix can be the maximum number of channels through which different pieces of information can be transmitted.

[0088] In the description of the present document, 'rank' for MIMO transmission indicates the number of paths capable of sending signals independently on specific time and frequency resources and 'number of layers' indicates the number of signal streams transmitted through the respective

paths. Generally, since a transmitting end transmits the number of layers corresponding to the rank number, one rank has the same meaning of the layer number unless mentioned specially.

[0089] Synchronization Acquisition of D2D UE

[0090] Now, a description will be given of synchronization acquisition between UEs in D2D communication based on the foregoing description in the context of the legacy LTE/LTE-A system. In an OFDM system, if time/frequency synchronization is not acquired, the resulting Inter-Cell Interference (ICI) may make it impossible to multiplex different UEs in an OFDM signal. If each individual D2D UE acquires synchronization by transmitting and receiving a synchronization signal directly, this is inefficient. In a distributed node system such as a D2D communication system, therefore, a specific node may transmit a representative synchronization signal and the other UEs may acquire synchronization using the representative synchronization signal. In other words, some nodes (which may be an eNB, a UE, and a Synchronization Reference Node (SRN, also referred to as a synchronization source)) may transmit a D2D Synchronization Signal (D2DSS) and the remaining UEs may transmit and receive signals in synchronization with the D2DSS.

[0091] D2DSSs may include a Primary D2DSS (PD2DSS) or a Primary Sidelink Synchronization Signal (PSSS) and a Secondary D2DSS (SD2DSS) or a Secondary Sidelink Synchronization Signal (SSSS). The PD2DSS may be configured to have a similar/modified/repeated structure of a Zadoff-chu sequence of a predetermined length or a Primary Synchronization Signal (PSS). Unlike a DL PSS, the PD2DSS may use a different Zadoff-chu root index (e.g., 26, 37). And, the SD2DSS may be configured to have a similar/modified/repeated structure of an M-sequence or a Secondary Synchronization Signal (SSS). If UEs synchronize their timing with an eNB, the eNB serves as an SRN and the D2DSS is a PSS/SSS. Unlike PSS/SSS of DL, the PD2DSS/SD2DSS follows UL subcarrier mapping scheme. FIG. 6 shows a subframe in which a D2D synchronization signal is transmitted. A Physical D2D Synchronization Channel (PD2DSCH) may be a (broadcast) channel carrying basic (system) information that a UE should first obtain before D2D signal transmission and reception (e.g., D2DSS-related information, a Duplex Mode (DM), a TDD UL/DL configuration, a resource pool-related information, the type of an application related to the D2DSS, etc.). The PD2DSCH may be transmitted in the same subframe as the D2DSS or in a subframe subsequent to the frame carrying the D2DSS. A DMRS can be used to demodulate the PD2DSCH.

[0092] The SRN may be a node that transmits a D2DSS and a PD2DSCH. The D2DSS may be a specific sequence and the PD2DSCH may be a sequence representing specific information or a codeword produced by predetermined channel coding. The SRN may be an eNB or a specific D2D UE. In the case of partial network coverage or out of network coverage, the SRN may be a UE.

[0093] In a situation illustrated in FIG. 7, a D2DSS may be relayed for D2D communication with an out-of-coverage UE. The D2DSS may be relayed over multiple hops. The following description is given with the appreciation that relay of an SS covers transmission of a D2DSS in a separate format according to a SS reception time as well as direct Amplify-and-Forward (AF)-relay of an SS transmitted by an

eNB. As the D2DSS is relayed, an in-coverage UE may communicate directly with an out-of-coverage UE.

[0094] D2D Resource Pool

[0095] FIG. 8 shows an example of a UE1, a UE2 and a resource pool used by the UE1 and the UE2 performing D2D communication. In FIG. 8(a), a UE corresponds to a terminal or such a network device as an eNB transmitting and receiving a signal according to a D2D communication scheme. A UE selects a resource unit corresponding to a specific resource from a resource pool corresponding to a set of resources and the UE transmits a D2D signal using the selected resource unit. A UE2 corresponding to a reception UE receives a configuration of a resource pool in which the UE1 is able to transmit a signal and detects a signal of the UE1 in the resource pool. In this case, if the UE1 is located at the inside of coverage of an eNB, the eNB can inform the UE1 of the resource pool. If the UE1 is located at the outside of coverage of the eNB, the resource pool can be informed by a different UE or can be determined by a predetermined resource. In general, a resource pool includes a plurality of resource units. A UE selects one or more resource units from among a plurality of the resource units and may be able to use the selected resource unit(s) for D2D signal transmission. FIG. 8(b) shows an example of configuring a resource unit. Referring to FIG. 8(b), the entire frequency resources are divided into the N_F number of resource units and the entire time resources are divided into the N_T number of resource units. In particular, it is able to define $N_F \cdot N_T$ number of resource units in total. In particular, a resource pool can be repeated with a period of N_T subframes. Specifically, as shown in FIG. 8, one resource unit may periodically and repeatedly appear. Or, an index of a physical resource unit to which a logical resource unit is mapped may change with a predetermined pattern according to time to obtain a diversity gain in time domain and/or frequency domain. In this resource unit structure, a resource pool may correspond to a set of resource units capable of being used by a UE intending to transmit a D2D signal.

[0096] A resource pool can be classified into various types. First of all, the resource pool can be classified according to contents of a D2D signal transmitted via each resource pool. For example, the contents of the D2D signal can be classified into various signals and a separate resource pool can be configured according to each of the contents. The contents of the D2D signal may include SA (scheduling assignment), a D2D data channel, and a discovery channel. The SA may correspond to a signal including information on a resource position of a D2D data channel, information on MCS (modulation and coding scheme) necessary for modulating and demodulating a data channel, information on a MIMO transmission scheme, information on TA (timing advance), and the like. The SA signal can be transmitted on an identical resource unit in a manner of being multiplexed with D2D data. In this case, an SA resource pool may correspond to a pool of resources that an SA and D2D data are transmitted in a manner of being multiplexed. The SA signal can also be referred to as a D2D control channel or a PSCCH (physical sidelink control channel). The D2D data channel (or, PSSCH (physical sidelink shared channel)) corresponds to a resource pool used by a transmission UE to transmit user data. If an SA and a D2D data are transmitted in a manner of being multiplexed in an identical resource unit, D2D data channel except SA information can be transmitted only in a resource pool for the D2D data

channel. In other word, resource elements (REs), which are used to transmit SA information in a specific resource unit of an SA resource pool, can also be used for transmitting D2D data in a D2D data channel resource pool. The discovery channel may correspond to a resource pool for a message that enables a neighboring UE to discover transmission UE transmitting information such as ID of the UE, and the like.

[0097] Although contents of D2D signal are identical to each other, it may use a different resource pool according to a transmission/reception attribute of the D2D signal. For example, in case of the same D2D data channel or the same discovery message, the D2D data channel or the discovery signal can be classified into a different resource pool according to a transmission timing determination scheme (e.g., whether a D2D signal is transmitted at the time of receiving a synchronization reference signal or the timing to which a prescribed timing advance is added) of a D2D signal, a resource allocation scheme (e.g., whether a transmission resource of an individual signal is designated by an eNB or an individual transmission UE selects an individual signal transmission resource from a pool), a signal format (e.g., number of symbols occupied by a D2D signal in a subframe, number of subframes used for transmitting a D2D signal), signal strength from an eNB, strength of transmit power of a D2D UE, and the like. For clarity, a method for an eNB to directly designate a transmission resource of a D2D transmission UE is referred to as a mode 1. If a transmission resource region is configured in advance or an eNB designates the transmission resource region and a UE directly selects a transmission resource from the transmission resource region, it is referred to as a mode 2. In case of performing D2D discovery, if an eNB directly indicates a resource, it is referred to as a type 2. If a UE directly selects a transmission resource from a predetermined resource region or a resource region indicated by the eNB, it is referred to as a type 1.

[0098] Transmission and Reception of SA

[0099] A mode 1 UE can transmit an SA signal (or, a D2D control signal, SCI (sidelink control information)) via a resource configured by an eNB. A mode 2 UE receives a configured resource to be used for D2D transmission. The mode 2 UE can transmit SA by selecting a time frequency resource from the configured resource.

[0100] The SA period can be defined as FIG. 9. Referring to FIG. 9, a first SA period can start at a subframe apart from a specific system frame as much as a prescribed offset (SAOffsetIndicator) indicated by higher layer signaling. Each SA period can include an SA resource pool and a subframe pool for transmitting D2D data. The SA resource pool can include subframes ranging from a first subframe of an SA period to the last subframe among subframes indicated by a subframe bitmap (saSubframeBitmap) to transmit SA. In case of mode 1, T-RPT (time-resource pattern for transmission) is applied to the resource pool for transmitting D2D data to determine a subframe in which an actual data is transmitted. As shown in the drawing, if the number of subframes included in an SA period except the SA resource pool is greater than the number of T-RPT bits, the T-RPT can be repeatedly applied and the lastly applied T-RPT can be applied in a manner of being truncated as many as the number of remaining subframes.

[0101] Meanwhile, in V2V (vehicle to vehicle) communication, a CAM (cooperative awareness message) of a

periodic message type, a DENM (decentralized environmental notification message) of an event triggered message type, and the like can be transmitted. The CAM can include dynamic status information of a vehicle such as direction and velocity, static data of a vehicle such as a size, and basic vehicle information such as external light status, path history, and the like. A size of the CAM may correspond to 50 to 300 bytes. The DENM may correspond to a message which is generated when an accidental status such as malfunction of a vehicle, an accident, and the like occurs. A size of the DENM may be less than 3000 bytes. The CAM message shall be broadcast and the latency shall be less than 100 ms. The DENM may correspond to a message which is generated when an accidental status such as malfunction of a vehicle, an accident, and the like occurs. A size of the DENM may be less than 3000 bytes. All vehicles located within a transmission range of the DENM can receive the DENM. In this case, the DENM may have a priority higher than a priority of the CAM. In this case, in the aspect of a single UE, the higher priority means that a UE preferentially transmits a message of a higher priority when messages are transmitted at the same time. Or, the higher priority means that a UE intends to preferentially transmit a message of a higher priority in time among a plurality of messages. In the aspect of a plurality of UEs, since a message of a higher priority receives less interference compared to a message of a lower priority, it may be able to lower a reception error rate. If security overhead is included in the CAM, the CAM may have a bigger message size.

[0102] Hereinafter, an efficient feedback method for transmitting and receiving a side link signal of a terminal such as D2D and V2X, specifically, transmission of a side link signal (e.g., CAM, DENM, etc.) will be described.

Embodiment

[0103] A first UE according to the embodiment of the present invention may select a first resource which will transmit a message, and may determine a second resource which is determined to be dependent on a position of the selected first resource and will perform a feedback. The first UE may transmit the message and feedback information on the second resource.

[0104] The second resource which will perform a feedback may be a set of specific available units (for example, a resource unit of a combination of any one unit of subframe, slot and TTI on a time axis and any one unit of RB and subcarrier on a frequency axis). Also, feedback information may be feedback information on a broadcast message which is received through at least a part of the second resource. That is, after receiving a broadcast message such as CAM and DENM, the first UE may transmit feedback information on the broadcast message, wherein the first UE transmits feedback information on a broadcast message selectively received in a specific resource region in addition to transmission/reporting of feedback information on all the received broadcast messages. At this time, the second resource to be fed back and selected by the UE may be the case that a broadcast message is received from all resource units constituting the second resource, or may be the case that a broadcast message is received from some resource units. Also, the second resource to be fed back by the UE as described above may be determined to be dependent on a resource to be transmitted by the UE.

[0105] The feedback information may be acknowledgement/negative acknowledgement for the broadcast message transmitted through at least a part of the second resource, or may be information as to collision of resources in each part constituting the second resource. Information as to collision of resources may be determined through a detected energy level and reception of a message. Although information as to collision of resources may be signaled by binary bits, SINR per resource and energy measurement result may directly be signaled. The first UE may determine that collision has occurred if the energy level is a previously set value and message reception is failed. As another example, the first UE may determine whether collision has occurred, in view of SINR (Signal-to-Interference-plus-Noise Ratio). For example, the first UE may determine that collision has occurred if a received power is a previously set value and SINR is a previously set value or less.

[0106] Detailed methods for determination of a resource to be fed back, that is, a resource for a target of a feedback are shown in FIGS. 10 to 12.

[0107] FIG. 10 illustrates that a second resource is included in a resource region between subframe n-a and subframe n-b if a first resource is included in subframe n, wherein b is a processing time for feedback information, and a is greater than b. This considers that a sufficient time should be ensured between a transmission resource and a resource to be fed back so that the UE may ensure a sufficient processing time in configuring a mapping rule of the transmission resource and the resource to be fed back. The processing time may be a time required to reflect sensed result in encoding when the UE has performed sensing/monitoring.

[0108] FIG. 11 illustrates that a UE performs a feedback for M ($M < N$) resources existing in a specific position from a resource which is currently used by the UE in accordance with a previously mapped rule. At this time, M, a feedback resource relation per resource may previously be determined, or may be signaled by a network through a signal of a physical layer or higher layer. That is, as shown in FIG. 11, when the UE has selected a specific resource, the UE may signal feedback information to a previously determined resource near the specific resource. After identifying feedback information transmitted together with a message A while receiving the message A, a receiving UE may identify feedback information for M resources near a resource A in accordance with a previously mapped rule, whereby the UE may identify whether collision has occurred in the corresponding resources. A mapping rule between a transmission resource and a feedback resource may previously be determined. When a resource of an nth subframe is selected as a transmission resource, a feedback may be performed for resources included in [n+a, n+b] subframe (where a and b are values previously determined or signaled by a network).

[0109] FIG. 12 illustrates a method for solving a problem that a feedback for a specific receiving UE B may not exist in accordance with the method of FIG. 11. This problem may occur when the number of peripheral UEs is small. FIG. 12(a) illustrates that a hash function is not used, and FIGS. 12(b) and 12(c) illustrate that a hash function is used. In detail, a resource number is shifted to generate a new feedback region. A UE A cannot listen to a resource (that is, another resource where all/some of a time domain are constant) arranged at the same time when a resource for transmitting a message, due to a half duplex problem, and

cannot provide feedback information. Therefore, all resource regions that may be fed back by the UE A may be represented as shown in FIG. 12(d). In FIG. 12(d), feedback regions are displayed as shades when a hash function is not used. This may be regarded as a value which is logically fixed without being changed even though the hash function is used. When all resource numbers are shifted as much as a given input factor, a set of resource numbers included in the shaded regions may be defined as a new feedback region. As shown, it is noted that a feedback region is changed depending on a case that an input factor 1 is applied to the existing feedback resource region and a case that an input factor 7 is applied to the existing feedback resource region. An input factor used for a hash function may be a value, such as a system frame number, shared within the system, or a value designated from the network may be used as the input factor. Also, the hash function described as above is only exemplary, and the embodiment of the present invention is not limited to the hash function illustrated in FIG. 12.

[0110] Meanwhile, the feedback information described as above may not only be performed by the UE but also be transmitted by a fixed node (for example, eNB, RSU, etc.). For example, after monitoring a resource region where resources are transmitted or received between UEs, RSUs may signal information as to collision of the resources in the resource region, to the UEs through a signal of a physical layer or higher layer.

[0111] As described above, the UE may not only transmit feedback information on some regions of resources received by the UE in a broadcast manner but also transmit feedback information on all of the previously configured resource region. For example, it is assumed that a feedback resource region of all resource regions is divided into N grids. In this case, the UE may display information as to collision of all resources as a binary bitmap and signal the information through a signal of a physical layer or higher layer. For example, information as to collision of resources may be signaled by a bitmap of maximum N bits. When transmitting its message, the UE may transmit its message by including N-bit information in the message. At this time, since the UE cannot perform sensing/monitoring for resources of a subframe selected by itself (reception may be impossible simultaneously with transmission due to half duplex constraint), information as to collision of the corresponding resources may not be signaled, or may be fixed to a previously determined specific state. Alternatively, a rule may be determined such that information as to collision of resources included in time resources selected for transmission by the UE are not used by the receiving UEs.

[0112] The aforementioned feedback information may be used for determination or coordination of one or more of resource reselection, MCS, RB size, retransmission times, and transmission power of the UE which has received the feedback information. For example, when several UEs signal a measurement to a specific resource, a transmitting UE may configure MCS by targeting a measurement of X % of a lower level. If the feedback information is directed to information as to collision, the UE knows a mapping relation between a position of a resource of a received message and feedback information, the UE may determine a resource which is fed back, by using only collision information of M bits included in the feedback information. Also, the UE may determine whether there is a resource used by itself, among the resources which are fed back.

[0113] The UE which receives a feedback may receive a feedback for a resource currently used by itself from several UEs. Information indicating collision in a feedback may not be constant. This is because that resource collision is changed depending on the position of the transmitting UE which has transmitted a feedback. Alternatively, this is because of a temporary error due to channel effect such as fading. Therefore, the UE needs a function for evaluating collision by accumulating the feedback for a certain period or a certain number of times. At this time, previously defined values or values provided from the network may be used as a length and the number of times of the accumulated period.

[0114] For example, when the UE A is fed back information as to collision in a position of a resource A from a peripheral UE, the UE A may perform resource reselection by determining that collision has occurred in the corresponding resource only if X UEs of M UEs indicate collision. At this time, X may be a value which is previously determined or signaled by the network.

[0115] Since the examples in the above-described suggestions may be included in the methods for implementing the present invention, it is apparent that the examples may be regarded as the suggested methods. Also, although the above-described suggestions may be implemented independently, the above-described suggestions may be implemented in the form of combination (or corporation) of some of the suggestions. A rule may be defined such that information (or information on rules of the suggested methods) as to application of the suggested methods may be notified by the eNB to the UE through a previously defined signal (for example, a physical layer signal or a higher layer signal), or may be signaled from the transmitting UE to the receiving UE or requested from the receiving UE to the transmitting UE.

[0116] Device Configurations According to Embodiments of the Present Invention

[0117] FIG. 13 is a diagram illustrating configurations of a transmission point device and a UE device according to an embodiment of the present invention.

[0118] Referring to FIG. 13, a transmission point device 10 may include a receiving module 11, a transmitting module 12, a processor 13, a memory 14, and a plurality of antennas 15. The plurality of the antennas 15 may mean that the transmission point device supports MIMO transmission and reception. The receiving module 11 may receive various signals, data and information from a UE in uplink. The transmitting module 12 may transmit various signals, data and information to the UE in downlink. The processor 13 may control overall operation of the transmission point device 10.

[0119] The processor 13 of the transmission point device 10 according to an embodiment of the present invention may perform the processes required in the above-described embodiments.

[0120] In addition, the processor 13 of the transmission point device 10 may perform a function of processing information received by the transmission point device 10, information to be transmitted by the transmission point device 10, and the like. The memory 14 may store the processed information during a prescribed time period and be substituted with a component such as a buffer (not shown in the drawing) or the like.

[0121] Referring to FIG. 13, a UE device 20 may include a receiving module 21, a transmitting module 22, a proces-

sor 23, a memory 24, and a plurality of antennas 25. The plurality of antennas 25 may mean that the UE device supports MIMO transmission and reception. The receiving module 21 may receive various signals, data and information from an eNB in downlink. The transmitting module 22 may transmit various signals, data and information to the eNB in uplink. The processor 23 may control overall operation of the UE device 20.

[0122] The processor 23 of the UE device 20 according to one embodiment of the present invention may process matters required for the above-described embodiments. In detail, the processor may select a first resource which will transmit a message, determine a second resource which is determined to be dependent on a position of the selected first resource and will perform a feedback, and transmit the message and feedback information, wherein the feedback information may be feedback information on a broadcast message which is received through at least a part of the second resource.

[0123] In addition, the processor 23 of the UE device 20 may perform a function of processing information received by the UE device 20, information to be transmitted by the UE device 20, and the like. The memory 24 may store the processed information during a prescribed time period and be substituted with a component such as a buffer (not shown in the drawing) or the like.

[0124] The configurations of the transmission point device and the UE device may be implemented such that the above-described embodiments can be independently applied or two or more thereof can be simultaneously applied, and redundant description is omitted for clarity.

[0125] The description of the transmission point device 10 in FIG. 13 may be equally applied to a relay as a downlink transmission entity or an uplink reception entity, and the description of the UE device 20 in FIG. 13 may be equally applied to a relay as a downlink reception entity or an uplink transmission entity.

[0126] The embodiments according to the present invention may be implemented by various means, for example, hardware, firmware, software, or their combination.

[0127] In a hardware configuration, the embodiments of the present disclosure may be achieved by 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, microcontrollers, microprocessors, etc.

[0128] In a firmware or software configuration, a method according to embodiments of the present disclosure may be implemented in the form of a module, a procedure, a function, etc. Software code may be stored in a memory unit and executed by a processor. The memory unit is located at the interior or exterior of the processor and may transmit and receive data to and from the processor via various known means.

[0129] As described before, a detailed description has been given of preferred embodiments of the present disclosure so that those skilled in the art may implement and perform the present disclosure. While reference has been made above to the preferred embodiments of the present disclosure, those skilled in the art will understand that various modifications and alterations may be made to the present disclosure within the scope of the present disclosure. For example, those skilled in the art may use the components

described in the foregoing embodiments in combination. The above embodiments are therefore to be construed in all aspects as illustrative and not restrictive. The scope of the disclosure should be determined by the appended claims and their legal equivalents, not by the above description, and all changes coming within the meaning and equivalency range of the appended claims are intended to be embraced therein. [0130] Those skilled in the art will appreciate that the present disclosure may be carried out in other specific ways than those set forth herein without departing from the spirit and essential characteristics of the present disclosure. The above embodiments are therefore to be construed in all aspects as illustrative and not restrictive. The scope of the disclosure should be determined by the appended claims and their legal equivalents, not by the above description, and all changes coming within the meaning and equivalency range of the appended claims are intended to be embraced therein. It is obvious to those skilled in the art that claims that are not explicitly cited in each other in the appended claims may be presented in combination as an embodiment of the present disclosure or included as a new claim by a subsequent amendment after the application is filed.

Industrial Applicability

[0131] The above-described embodiments of the present disclosure are applicable to various mobile communication systems.

1. A method for transmitting or receiving a side link signal by a first UE in a wireless communication system, the method comprising the steps of:

- selecting a first resource to which the first UE will transmit a message;
 - determining a second resource, which is determined to be dependent on the position of the selected first resource and is to be used for performing a feedback; and
 - transmitting the message and feedback information on the second resource,
- wherein the feedback information is feedback information on a broadcast message received through at least a part of the second resource.

2. The method of claim 1, wherein the broadcast message is a Cooperative Awareness Message (CAM).

3. The method of claim 1, wherein the feedback information is an acknowledgement/negative acknowledgement for the broadcast message transmitted through at least a part of the second resource.

4. The method of claim 1, wherein the feedback information is information as to collision of resources in each part constituting the second resource.

5. The method of claim 4, wherein the information as to collision is determined through a detected energy level and message reception.

6. The method of claim 5, wherein the first UE determines that collision has occurred if the energy level is a previously set value or more and message reception has been failed.

7. The method of claim 5, wherein the first UE determines that collision has occurred if a received power is a previously set value or more and SINR is a previously set value or less.

8. The method of claim 1, wherein the second resource is included in a resource region between subframe n-a and subframe n-b if the first resource is included in subframe n, where b is a processing time for the feedback information, and a is greater than b.

9. The method of claim 8, wherein the processing time for the feedback information is a time required by the first UE to reflect a sensed result of the second resource in encoding.

10. The method of claim 1, wherein the feedback information is used for determination of one or more of resource reselection, MCS, RB size, retransmission times, and transmission power of the UE which has received the feedback information.

11. The method of claim 1, wherein the first UE is a vehicle to everything (V2X) UE.

12. The method of claim 1, wherein the first resource is repeated periodically for a previously set time if selected once.

13. A first UE for transmitting or receiving a side link signal in a wireless communication system, the first UE comprising:

- a transmitting module and a receiving module; and
- a processor,

wherein the processor selects a first resource to which the first UE will transmit a message, determines a second resource, which is determined to be dependent on the position of the selected first resource and is to be used for performing a feedback, and transmits the message and feedback information on the second resource, wherein the feedback information is feedback information on a broadcast message received through at least a part of the second resource.

* * * * *