



- (51) **International Patent Classification:**
H04W 72/04 (2009.01) *H04W 72/12* (2009.01)
- (21) **International Application Number:**
PCT/KR2016/014861
- (22) **International Filing Date:**
19 December 2016 (19.12.2016)
- (25) **Filing Language:** English
- (26) **Publication Language:** English
- (30) **Priority Data:**
62/269,106 18 December 2015 (18.12.2015) US
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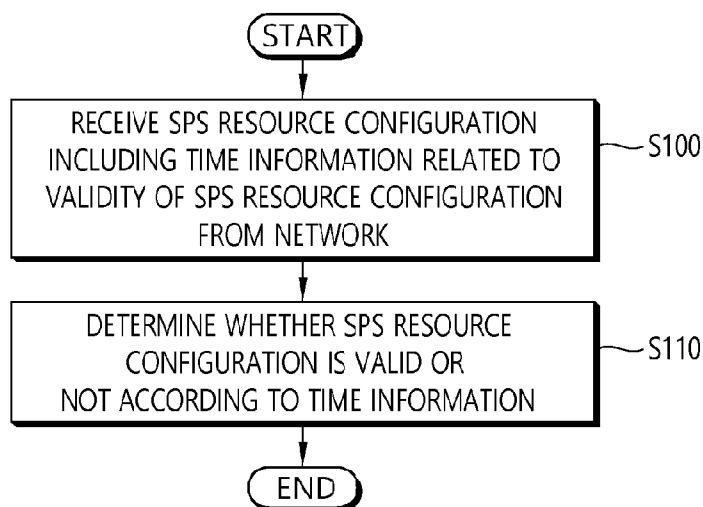
(81) **Designated States** (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) **Designated States** (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— with international search report (Art. 21(3))

(54) **Title:** METHOD AND APPARATUS FOR ALLOCATING COMMON SPS RESOURCE ACROSS MULTIPLE CELLS IN WIRELESS COMMUNICATION SYSTEM



(57) **Abstract:** A method and apparatus for determining validity of a semi-persistent scheduling (SPS) resource across multiple cells in a wireless communication system is provided. A user equipment (UE) receives a SPS resource configuration including time information related to validity of the SPS resource configuration from a network, and determines whether the SPS resource configuration is valid or not according to the time information.

Description

Title of Invention: METHOD AND APPARATUS FOR ALLOCATING COMMON SPS RESOURCE ACROSS MULTIPLE CELLS IN WIRELESS COMMUNICATION SYSTEM

Technical Field

- [1] The present invention relates to wireless communications, and more particularly, to a method and apparatus for allocating a common semi-persistent scheduling (SPS) resource across multiple cells in a wireless communication system.

Background Art

- [2] 3rd generation partnership project (3GPP) long-term evolution (LTE) is a technology for enabling high-speed packet communications. Many schemes have been proposed for the LTE objective including those that aim to reduce user and provider costs, improve service quality, and expand and improve coverage and system capacity. The 3GPP LTE requires reduced cost per bit, increased service availability, flexible use of a frequency band, a simple structure, an open interface, and adequate power consumption of a terminal as an upper-level requirement.
- [3] The pace of LTE network deployment is accelerating all over the world, which enables more and more advanced services and Internet applications making use of the inherent benefits of LTE, such as higher data rate, lower latency and enhanced coverage. Widely deployed LTE-based network provides the opportunity for the vehicle industry to realize the concept of 'connected cars'. By providing a vehicle with an access to the LTE network, a vehicle can be connected to the Internet and other vehicles so that a broad range of existing or new services can be envisaged. Vehicle manufacturers and cellular network operators show strong interests in vehicle wireless communications for proximity safety services as well as commercial applications. LTE-based vehicle-to-everything (V2X) study is urgently desired from market requirement, and the market for vehicle-to-vehicle (V2V) communication in particular is time sensitive. There are many research projects and field tests of connected vehicles in some countries or regions, such as US/Europe/Japan/Korea.
- [4] V2X includes a vehicle-to-vehicle (V2V), covering LTE-based communication between vehicles, vehicle-to-pedestrian (V2P), covering LTE-based communication between a vehicle and a device carried by an individual (e.g. handheld terminal carried by a pedestrian, cyclist, driver or passenger), and vehicle-to-infrastructure/network (V2I), covering LTE-based communication between a vehicle and a roadside unit (RSU)/network. A RSU is a transportation infrastructure entity (e.g. an entity transmitting speed notifications) implemented in an eNodeB (eNB) or a stationary UE.

- [5] In V2X communication, a frequent handover is expected due to fast speed of vehicle UE. However, currently it is impossible for the UE to continue using a resource across cells during/after handover. This may lead to latency in data transfer. Accordingly, a method for using a common semi-persistent scheduling (SPS) resource across multiple cells for V2X communication may be required.

Disclosure of Invention

Technical Problem

- [6] The present invention provides a method and apparatus for allocating a common semi-persistent scheduling (SPS) resource across multiple cells in a wireless communication system. The present invention provides a method and apparatus for configuring a common SPS resource that can be used across at least one cell for a pre-defined time duration.

Solution to Problem

- [7] In an aspect, a method for determining validity of a semi-persistent scheduling (SPS) resource across multiple cells, by a user equipment (UE), in a wireless communication system is provided. The method includes receiving a SPS resource configuration including time information related to validity of the SPS resource configuration from a network, and determining whether the SPS resource configuration is valid or not according to the time information.
- [8] In another aspect, a user equipment (UE) in a wireless communication system is provided. The UE includes a memory, a transceiver, and a processor, coupled to the memory and the transceiver, that controls the transceiver to receive a semi-persistent scheduling (SPS) resource configuration including time information related to validity of the SPS resource configuration from a network, and determines whether the SPS resource configuration is valid or not according to the time information.

Advantageous Effects of Invention

- [9] A common SPS resource can be used continuously during/after handover so that latency does not occur due to handover, especially in case of V2X communication.

Brief Description of Drawings

- [10] FIG. 1 shows LTE system architecture.
- [11] FIG. 2 shows a block diagram of architecture of a typical E-UTRAN and a typical EPC.
- [12] FIG. 3 shows a block diagram of a user plane protocol stack of an LTE system.
- [13] FIG. 4 shows a block diagram of a control plane protocol stack of an LTE system.
- [14] FIG. 5 shows an example of a physical channel structure.
- [15] FIG. 6 shows a method for allocating a common SPS resources according to an embodiment of the present invention.

[16] FIG. 7 shows another method for allocating a common SPS resources according to an embodiment of the present invention.

[17] FIG. 8 shows a wireless communication system to implement an embodiment of the present invention.

Mode for the Invention

[18] The technology described below can be used in various wireless communication 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. The CDMA can be implemented with a radio technology such as universal terrestrial radio access (UTRA) or CDMA-2000. The TDMA can be implemented with a radio technology such as global system for mobile communications (GSM)/general packet radio service (GPRS)/enhanced data rate for GSM evolution (EDGE). The OFDMA can be implemented with a radio technology such as institute of electrical and electronics engineers (IEEE) 802.11 (Wi-Fi), IEEE 802.16 (WiMAX), IEEE 802-20, evolved UTRA (E-UTRA), etc. IEEE 802.16m is an evolution of IEEE 802.16e, and provides backward compatibility with an IEEE 802.16-based system. The UTRA is a part of a universal mobile telecommunication system (UMTS). 3rd generation partnership project (3GPP) long term evolution (LTE) is a part of an evolved UMTS (E-UMTS) using the E-UTRA. The 3GPP LTE uses the OFDMA in downlink and uses the SC-FDMA in uplink. LTE-advance (LTE-A) is an evolution of the 3GPP LTE.

[19] For clarity, the following description will focus on the LTE-A. However, technical features of the present invention are not limited thereto.

[20] FIG. 1 shows LTE system architecture. The communication network is widely deployed to provide a variety of communication services such as voice over internet protocol (VoIP) through IMS and packet data.

[21] Referring to FIG. 1, the LTE system architecture includes one or more user equipment (UE; 10), an evolved-UMTS terrestrial radio access network (E-UTRAN) and an evolved packet core (EPC). The UE 10 refers to a communication equipment carried by a user. The UE 10 may be fixed or mobile, and may be referred to as another terminology, such as a mobile station (MS), a user terminal (UT), a subscriber station (SS), a wireless device, etc.

[22] The E-UTRAN includes one or more evolved node-B (eNB) 20, and a plurality of UEs may be located in one cell. The eNB 20 provides an end point of a control plane and a user plane to the UE 10. The eNB 20 is generally a fixed station that communicates with the UE 10 and may be referred to as another terminology, such as a

base station (BS), an access point, etc. One eNB 20 may be deployed per cell.

- [23] Hereinafter, a downlink (DL) denotes communication from the eNB 20 to the UE 10, and an uplink (UL) denotes communication from the UE 10 to the eNB 20. In the DL, a transmitter may be a part of the eNB 20, and a receiver may be a part of the UE 10. In the UL, the transmitter may be a part of the UE 10, and the receiver may be a part of the eNB 20.
- [24] The EPC includes a mobility management entity (MME) and a system architecture evolution (SAE) gateway (S-GW). The MME/S-GW 30 may be positioned at the end of the network and connected to an external network. For clarity, MME/S-GW 30 will be referred to herein simply as a "gateway," but it is understood that this entity includes both the MME and S-GW.
- [25] The MME provides various functions including non-access stratum (NAS) signaling to eNBs 20, NAS signaling security, access stratum (AS) security control, inter core network (CN) node signaling for mobility between 3GPP access networks, idle mode UE reachability (including control and execution of paging retransmission), tracking area list management (for UE in idle and active mode), packet data network (PDN) gateway (P-GW) and S-GW selection, MME selection for handovers with MME change, serving GPRS support node (SGSN) selection for handovers to 2G or 3G 3GPP access networks, roaming, authentication, bearer management functions including dedicated bearer establishment, support for public warning system (PWS) (which includes earthquake and tsunami warning system (ETWS) and commercial mobile alert system (CMAS)) message transmission. The S-GW host provides assorted functions including per-user based packet filtering (by e.g., deep packet inspection), lawful interception, UE Internet protocol (IP) address allocation, transport level packet marking in the DL, UL and DL service level charging, gating and rate enforcement, DL rate enforcement based on access point name aggregate maximum bit rate (APN-AMBR).
- [26] Interfaces for transmitting user traffic or control traffic may be used. The UE 10 is connected to the eNB 20 via a Uu interface. The eNBs 20 are connected to each other via an X2 interface. Neighboring eNBs may have a meshed network structure that has the X2 interface. A plurality of nodes may be connected between the eNB 20 and the gateway 30 via an S1 interface.
- [27] FIG. 2 shows a block diagram of architecture of a typical E-UTRAN and a typical EPC. Referring to FIG. 2, the eNB 20 may perform functions of selection for gateway 30, routing toward the gateway 30 during a radio resource control (RRC) activation, scheduling and transmitting of paging messages, scheduling and transmitting of broadcast channel (BCH) information, dynamic allocation of resources to the UEs 10 in both UL and DL, configuration and provisioning of eNB measurements, radio bearer

control, radio admission control (RAC), and connection mobility control in LTE_ACTIVE state. In the EPC, and as noted above, gateway 30 may perform functions of paging origination, LTE_IDLE state management, ciphering of the user plane, SAE bearer control, and ciphering and integrity protection of NAS signaling.

- [28] FIG. 3 shows a block diagram of a user plane protocol stack of an LTE system. FIG. 4 shows a block diagram of a control plane protocol stack of an LTE system. Layers of a radio interface protocol between the UE and the E-UTRAN may be classified into a first layer (L1), a second layer (L2), and a third layer (L3) based on the lower three layers of the open system interconnection (OSI) model that is well-known in the communication system.
- [29] A physical (PHY) layer belongs to the L1. The PHY layer provides a higher layer with an information transfer service through a physical channel. The PHY layer is connected to a medium access control (MAC) layer, which is a higher layer of the PHY layer, through a transport channel. A physical channel is mapped to the transport channel. Data between the MAC layer and the PHY layer is transferred through the transport channel. Between different PHY layers, i.e., between a PHY layer of a transmission side and a PHY layer of a reception side, data is transferred via the physical channel.
- [30] A MAC layer, a radio link control (RLC) layer, and a packet data convergence protocol (PDCP) layer belong to the L2. The MAC layer provides services to the RLC layer, which is a higher layer of the MAC layer, via a logical channel. The MAC layer provides data transfer services on logical channels. The RLC layer supports the transmission of data with reliability. Meanwhile, a function of the RLC layer may be implemented with a functional block inside the MAC layer. In this case, the RLC layer may not exist. The PDCP layer provides a function of header compression function that reduces unnecessary control information such that data being transmitted by employing IP packets, such as IPv4 or Ipv6, can be efficiently transmitted over a radio interface that has a relatively small bandwidth.
- [31] A radio resource control (RRC) layer belongs to the L3. The RLC layer is located at the lowest portion of the L3, and is only defined in the control plane. The RRC layer controls logical channels, transport channels, and physical channels in relation to the configuration, reconfiguration, and release of radio bearers (RBs). The RB signifies a service provided the L2 for data transmission between the UE and E-UTRAN.
- [32] Referring to FIG. 3, the RLC and MAC layers (terminated in the eNB on the network side) may perform functions such as scheduling, automatic repeat request (ARQ), and hybrid ARQ (HARQ). The PDCP layer (terminated in the eNB on the network side) may perform the user plane functions such as header compression, integrity protection, and ciphering.

- [33] Referring to FIG. 4, the RLC and MAC layers (terminated in the eNB on the network side) may perform the same functions for the control plane. The RRC layer (terminated in the eNB on the network side) may perform functions such as broadcasting, paging, RRC connection management, RB control, mobility functions, and UE measurement reporting and controlling. The NAS control protocol (terminated in the MME of gateway on the network side) may perform functions such as a SAE bearer management, authentication, LTE_IDLE mobility handling, paging origination in LTE_IDLE, and security control for the signaling between the gateway and UE.
- [34] FIG. 5 shows an example of a physical channel structure. A physical channel transfers signaling and data between PHY layer of the UE and eNB with a radio resource. A physical channel consists of a plurality of subframes in time domain and a plurality of subcarriers in frequency domain. One subframe, which is 1ms, consists of a plurality of symbols in the time domain. Specific symbol(s) of the subframe, such as the first symbol of the subframe, may be used for a physical downlink control channel (PDCCH). The PDCCH carries dynamic allocated resources, such as a physical resource block (PRB) and modulation and coding scheme (MCS).
- [35] A DL transport channel includes a broadcast channel (BCH) used for transmitting system information, a paging channel (PCH) used for paging a UE, a downlink shared channel (DL-SCH) used for transmitting user traffic or control signals, a multicast channel (MCH) used for multicast or broadcast service transmission. The DL-SCH supports HARQ, dynamic link adaptation by varying the modulation, coding and transmit power, and both dynamic and semi-static resource allocation. The DL-SCH also may enable broadcast in the entire cell and the use of beamforming.
- [36] A UL transport channel includes a random access channel (RACH) normally used for initial access to a cell, an uplink shared channel (UL-SCH) for transmitting user traffic or control signals, etc. The UL-SCH supports HARQ and dynamic link adaptation by varying the transmit power and potentially modulation and coding. The UL-SCH also may enable the use of beamforming.
- [37] The logical channels are classified into control channels for transferring control plane information and traffic channels for transferring user plane information, according to a type of transmitted information. That is, a set of logical channel types is defined for different data transfer services offered by the MAC layer.
- [38] The control channels are used for transfer of control plane information only. The control channels provided by the MAC layer include a broadcast control channel (BCCH), a paging control channel (PCCH), a common control channel (CCCH), a multicast control channel (MCCH) and a dedicated control channel (DCCH). The BCCH is a downlink channel for broadcasting system control information. The PCCH is a downlink channel that transfers paging information and is used when the network

does not know the location cell of a UE. The CCCH is used by UEs having no RRC connection with the network. The MCCH is a point-to-multipoint downlink channel used for transmitting multimedia broadcast multicast services (MBMS) control information from the network to a UE. The DCCH is a point-to-point bi-directional channel used by UEs having an RRC connection that transmits dedicated control information between a UE and the network.

- [39] Traffic channels are used for the transfer of user plane information only. The traffic channels provided by the MAC layer include a dedicated traffic channel (DTCH) and a multicast traffic channel (MTCH). The DTCH is a point-to-point channel, dedicated to one UE for the transfer of user information and can exist in both uplink and downlink. The MTCH is a point-to-multipoint downlink channel for transmitting traffic data from the network to the UE.
- [40] Uplink connections between logical channels and transport channels include the DCCH that can be mapped to the UL-SCH, the DTCH that can be mapped to the UL-SCH and the CCCH that can be mapped to the UL-SCH. Downlink connections between logical channels and transport channels include the BCCH that can be mapped to the BCH or DL-SCH, the PCCH that can be mapped to the PCH, the DCCH that can be mapped to the DL-SCH, and the DTCH that can be mapped to the DL-SCH, the MCCH that can be mapped to the MCH, and the MTCH that can be mapped to the MCH.
- [41] An RRC state indicates whether an RRC layer of the UE is logically connected to an RRC layer of the E-UTRAN. The RRC state may be divided into two different states such as an RRC idle state (RRC_IDLE) and an RRC connected state (RRC_CONNECTED). In RRC_IDLE, the UE may receive broadcasts of system information and paging information while the UE specifies a discontinuous reception (DRX) configured by NAS, and the UE has been allocated an identification (ID) which uniquely identifies the UE in a tracking area and may perform public land mobile network (PLMN) selection and cell re-selection. Also, in RRC_IDLE, no RRC context is stored in the eNB.
- [42] In RRC_CONNECTED, the UE has an E-UTRAN RRC connection and a context in the E-UTRAN, such that transmitting and/or receiving data to/from the eNB becomes possible. Also, the UE can report channel quality information and feedback information to the eNB. In RRC_CONNECTED, the E-UTRAN knows the cell to which the UE belongs. Therefore, the network can transmit and/or receive data to/from UE, the network can control mobility (handover and inter-radio access technologies (RAT) cell change order to GSM EDGE radio access network (GERAN) with network assisted cell change (NACC)) of the UE, and the network can perform cell measurements for a neighboring cell.

- [43] In RRC_IDLE, the UE specifies the paging DRX cycle. Specifically, the UE monitors a paging signal at a specific paging occasion of every UE specific paging DRX cycle. The paging occasion is a time interval during which a paging signal is transmitted. The UE has its own paging occasion. A paging message is transmitted over all cells belonging to the same tracking area. If the UE moves from one tracking area (TA) to another TA, the UE will send a tracking area update (TAU) message to the network to update its location.
- [44] Semi-persistent scheduling (SPS) is described. E-UTRAN can allocate semi-persistent DL resources for the first HARQ transmissions to UEs. RRC defines the periodicity of the semi-persistent DL grant. PDCCH indicates whether the DL grant is a semi-persistent one, i.e. whether it can be implicitly reused in the following TTIs according to the periodicity defined by RRC.
- [45] When required, retransmissions are explicitly signaled via the PDCCH(s). In the subframes where the UE has semi-persistent DL resource, if the UE cannot find its cell radio network temporary identity (C-RNTI) on the PDCCH(s), a DL transmission according to the semi-persistent allocation that the UE has been assigned in the TTI is assumed. Otherwise, in the subframes where the UE has semi-persistent DL resource, if the UE finds its C-RNTI on the PDCCH(s), the PDCCH allocation overrides the semi-persistent allocation for that TTI and the UE does not decode the semi-persistent resources.
- [46] When carrier aggregation (CA) is configured, semi-persistent DL resources can only be configured for the primary cell (PCell) and only PDCCH allocations for the PCell can override the semi-persistent allocation. When dual connectivity (DC) is configured, semi-persistent DL resources can only be configured for the PCell or primary secondary cell (PSCell). Only PDCCH allocations for the PCell can override the semi-persistent allocation for PCell and only PDCCH allocations for the PSCell can override the semi-persistent allocation for PSCell.
- [47] In addition, E-UTRAN can allocate a semi-persistent UL resource for the first HARQ transmissions and potentially retransmissions to UEs. RRC defines the periodicity of the semi-persistent UL grant. PDCCH indicates whether the UL grant is a semi-persistent one, i.e. whether it can be implicitly reused in the following TTIs according to the periodicity defined by RRC.
- [48] In the subframes where the UE has semi-persistent UL resource, if the UE cannot find its C-RNTI on the PDCCH(s), a UL transmission according to the semi-persistent allocation that the UE has been assigned in the TTI can be made. The network performs decoding of the pre-defined PRBs according to the pre-defined MCS. Otherwise, in the subframes where the UE has semi-persistent UL resource, if the UE finds its C-RNTI on the PDCCH(s), the PDCCH allocation overrides the persistent al-

location for that TTI and the UE's transmission follows the PDCCH allocation, not the semi-persistent allocation. Retransmissions are either implicitly allocated in which case the UE uses the semi-persistent UL allocation, or explicitly allocated via PDCCH(s) in which case the UE does not follow the semi-persistent allocation.

- [49] Similarly as for the DL, semi-persistent UL resources can only be configured for the PCell and only PDCCH allocations for the PCell can override the semi-persistent allocation. When DC is configured, semi-persistent UL resources can only be configured for the PCell or PSCell. Only PDCCH allocations for the PCell can override the semi-persistent allocation for PCell and only PDCCH allocations for the PSCell can override the semi-persistent allocation for PSCell.
- [50] When SPS is enabled by RRC, the following information is provided:
- [51] - SPS C-RNTI;
- [52] - UL SPS interval *semiPersistSchedIntervalUL* and number of empty transmissions before implicit release *implicitReleaseAfter*, if SPS is enabled for the UL;
- [53] - Whether *twoIntervalsConfig* is enabled or disabled for UL, only for time division duplex (TDD);
- [54] - DL SPS interval *semiPersistSchedIntervalDL* and number of configured HARQ processes for SPS *numberOfConfSPS-Processes*, if SPS is enabled for the DL;
- [55] When SPS for UL or DL is disabled by RRC, the corresponding configured grant or configured assignment shall be discarded.
- [56] The above information may be carried in *SPS-Config* information element (IE). The IE *SPS-Config* is used to specify the SPS configuration. Table 1 shows the *SPS-Config* IE.
- [57] <Table 1>

[58]

```

-- ASN1START

SPS-Config ::= SEQUENCE {
    semiPersistSchedC-RNTI    C-RNTI                                OPTIONAL, -- Need OR
    sps-ConfigDL              SPS-ConfigDL                        OPTIONAL, -- Need ON
    sps-ConfigUL              SPS-ConfigUL                        OPTIONAL -- Need ON
}

SPS-ConfigDL ::= CHOICE{
    release    NULL,
    setup      SEQUENCE {
        semiPersistSchedIntervalDL    ENUMERATED {
            sf10, sf20, sf32, sf40, sf64, sf80,
            sf128, sf160, sf320, sf640, spare6,
            spare5, spare4, spare3, spare2,
            spare1},
        numberOfConfSPS-Processes    INTEGER (1..8),
        n1PUCCH-AN-PersistentList    N1PUCCH-AN-PersistentList,
        ...,
        [[ twoAntennaPortActivated-r10    CHOICE {
            release    NULL,
            setup      SEQUENCE {
                n1PUCCH-AN-PersistentListP1-r10    N1PUCCH-AN-PersistentList
            }
        }
    ]]
}
}
}

```

OPTIONAL -- Need ON

[59]

```

SPS-ConfigUL ::= CHOICE {
    release                NULL,
    setup                  SEQUENCE {
        semiPersistSchedIntervalUL    ENUMERATED {
            sf10, sf20, sf32, sf40, sf64, sf80,
            sf128, sf160, sf320, sf640, spare6,
            spare5, spare4, spare3, spare2,
            spare1},
        implicitReleaseAfter    ENUMERATED {e2, e3, e4, e8},
        p0-Persistent          SEQUENCE {
            p0-NominalPUSCH-Persistent    INTEGER (-126..24),
            p0-UE-PUSCH-Persistent    INTEGER (-8..7)
        }
        ,
        twoIntervalsConfig    ENUMERATED {true}
        ,
        ...
        ,
        [[ p0-PersistentSubframeSet2-r12    CHOICE {
            release                NULL,
            setup                  SEQUENCE {
                p0-NominalPUSCH-PersistentSubframeSet2-r12    INTEGER (-126..24),
                p0-UE-PUSCH-PersistentSubframeSet2-r12    INTEGER (-8..7)
            }
        }
        ] ]
    }
}

N1PUCCH-AN-PersistentList ::=
    SEQUENCE (SIZE (1..4)) OF INTEGER (0..2047)

-- ASN1STOP

```

[60]

As described above, the *SPS-Config* IE may include at least one of *SPS C-RNTI* (*semiPersistSchedC-RNTI*), *UL SPS interval* (*semiPersistSchedIntervalUL*) and number of empty transmissions before implicit release (*implicitReleaseAfter*), whether *twoIntervalsConfig* is enabled or disabled for *UL* (*twoIntervalsConfig*), and *DL SPS interval* (*semiPersistSchedIntervalDL*) and number of configured HARQ processes for *SPS* (*numberOfConfSPS-Processes*), if *SPS* is enabled for the *DL*.

[61]

The *SPS-Config* IE may be included in *RadioResourceConfigDedicated* IE. The IE *RadioResourceConfigDedicated* is used to setup/modify/release RBs, to modify the MAC main configuration, to modify the SPS configuration and to modify dedicated physical configuration. The *RadioResourceConfigDedicated* IE may be included in one of *RRCConnectionReconfiguration* message, *RRCConnectionReestablishment* message, or *RRCConnectionSetup* message. Table 2 shows The *RadioResourceConfigDedicated* IE.

[62]

<Table 2>

[63]

```

-- ASN1START

RadioResourceConfigDedicated ::= SEQUENCE {
    srb-ToAddModList      SRB-ToAddModList      OPTIONAL, -- Cond HO-Conn
    drb-ToAddModList      DRB-ToAddModList      OPTIONAL, -- Cond HO-toEUTRA
    drb-ToReleaseList     DRB-ToReleaseList     OPTIONAL, -- Need ON
    mac-MainConfig        CHOICE {
        explicitValue      MAC-MainConfig,
        defaultValue       NULL              OPTIONAL, -- Cond HO-toEUTRA2
    },
    sps-Config            SPS-Config            OPTIONAL, -- Need ON
    physicalConfigDedicated PhysicalConfigDedicated OPTIONAL, -- Need ON
    ...,
    [[ rlf-TimersAndConstants-r9      RLF-TimersAndConstants-r9      OPTIONAL -- Need ON
    ]],
    [[ measSubframePatternPCell-r10    MeasSubframePatternPCell-r10    OPTIONAL -- Need ON
    ]],
    [[ neighCellsCRS-Info-r11          NeighCellsCRS-Info-r11          OPTIONAL -- Need ON
    ]],
    [[ naics-Info-r12                  NAICS-AssistanceInfo-r12        OPTIONAL -- Need ON
    ]]}

RadioResourceConfigDedicatedPSCell-r12 ::= SEQUENCE {
    -- UE specific configuration extensions applicable for an PSCell
    physicalConfigDedicatedPSCell-r12 PhysicalConfigDedicated    OPTIONAL, -- Need ON
    sps-Config-r12                  SPS-Config            OPTIONAL, -- Need ON
    naics-Info-r12                  NAICS-AssistanceInfo-r12  OPTIONAL, -- Need ON
    ...
}

```

[64]

Referring to Table 2, the *RadioResourceConfigDedicated* IE may include The *SPS-Config* IE. Except for handover or releasing SPS for master cell group (MCG), E-UTRAN does not reconfigure *SPS-Config* for MCG when there is a configured DL assignment or a configured UL grant for MCG. Except for SCG change or releasing SPS for SCG, E-UTRAN does not reconfigure *SPS-Config* for SCG when there is a configured DL assignment or a configured UL grant for SCG.

[65]

Vehicle-to-everything (V2X) communication is described. V2X communication contains three different types, which are vehicle-to-vehicle (V2V) communications, vehicle-to-infrastructure (V2I) communications, and vehicle-to-pedestrian (V2P) communications. These three types of V2X can use “co-operative awareness” to provide more intelligent services for end-users. This means that transport entities, such as vehicles, roadside infrastructure, and pedestrians, can collect knowledge of their local environment (e.g. information received from other vehicles or sensor equipment in proximity) to process and share that knowledge in order to provide more intelligent services, such as cooperative collision warning or autonomous driving.

[66]

V2X service is a type of communication service that involves a transmitting or receiving UE using V2V application via 3GPP transport. Based on the other party involved in the communication, it can be further divided into V2V service, V2I

service, V2P service, and vehicle-to-network (V2N) service. V2V service is a type of V2X service, where both parties of the communication are UEs using V2V application. V2I service is a type of V2X Service, where one party is a UE and the other party is a road side unit (RSU) both using V2I application. The RSU is an entity supporting V2I service that can transmit to, and receive from a UE using V2I application. RSU is implemented in an eNB or a stationary UE. V2P service is a type of V2X service, where both parties of the communication are UEs using V2P application. V2N service is a type of V2X Service, where one party is a UE and the other party is a serving entity, both using V2N applications and communicating with each other via LTE network entities.

- [67] For V2V, E-UTRAN allows such UEs that are in proximity of each other to exchange V2V-related information using E-UTRA(N) when permission, authorization and proximity criteria are fulfilled. The proximity criteria can be configured by the mobile network operator (MNO). However, UEs supporting V2V service can exchange such information when served by or not served by E-UTRAN which supports V2X Service. The UE supporting V2V applications transmits application layer information (e.g. about its location, dynamics, and attributes as part of the V2V service). The V2V payload must be flexible in order to accommodate different information contents, and the information can be transmitted periodically according to a configuration provided by the MNO. V2V is predominantly broadcast-based. V2V includes the exchange of V2V-related application information between distinct UEs directly and/or, due to the limited direct communication range of V2V, the exchange of V2V-related application information between distinct UEs via infrastructure supporting V2X service, e.g., RSU, application server, etc.
- [68] For V2I, the UE supporting V2I applications sends application layer information to RSU. RSU sends application layer information to a group of UEs or a UE supporting V2I applications. V2N is also introduced where one party is a UE and the other party is a serving entity, both supporting V2N applications and communicating with each other via LTE network.
- [69] For V2P, E-UTRAN allows such UEs that are in proximity of each other to exchange V2P-related information using E-UTRAN when permission, authorization and proximity criteria are fulfilled. The proximity criteria can be configured by the MNO. However, UEs supporting V2P service can exchange such information even when not served by E-UTRAN which supports V2X Service. The UE supporting V2P applications transmits application layer information. Such information can be broadcast by a vehicle with UE supporting V2X service (e.g., warning to pedestrian), and/or by a pedestrian with UE supporting V2X service (e.g., warning to vehicle). V2P includes the exchange of V2P-related application information between distinct UEs (one for

vehicle and the other for pedestrian) directly and/or, due to the limited direct communication range of V2P, the exchange of V2P-related application information between distinct UEs via infrastructure supporting V2X service, e.g., RSU, application server, etc.

- [70] According to prior art, upon handover, RRC is reconfigured and SPS configuration is either released or reconfigured. More specifically, when the UE receives an *RRC-ConnectionReconfiguration* message including the *mobilityControlInfo* (i.e. handover), MCG MAC and SCG MAC is reset, if configured. If the received *RRCConnectionReconfiguration* message includes *radioResourceConfigDedicated* and the *radioResourceConfigDedicated* includes *sps-Config*, SPS reconfiguration is performed. The UE shall reconfigure the SPS in accordance with the received *sps-Config*. Further, MAC is reset and all time alignment timer (TAT) expires, hence, all configured SPS resources are released. More specifically, upon handover, when MAC is reset, all *timeAlignmentTimers* are considered as expired. When a *timeAlignmentTimer* expires, if the *timeAlignmentTimer* is associated with the primary timing advance group (pTAG), any configured DL assignments and UL grants are cleared.
- [71] As described above, upon handover, all configured SPS resources are release and SPS configuration is either release or reconfigured. Thus, it is impossible for the UE to continue using a SPS resource across multiple cells during/after handover. This may lead to latency in data transfer.
- [72] However, in V2X communication, it is important to reduce the latency so that delay-critical data, e.g. decentralized environmental notification message (DENM) or co-operative awareness message (CAM), is transferred in time. Given that V2X communication is a data communication including at least one vehicle UE (i.e. moving car), it may need to take handover into account when designing resource allocation scheme for V2X communication. In this sense, it may seem to be required to have a mechanism that enables continuing use of the resources during/after handover so that latency due to handover can be minimized. Further, SPS resource may be considered as resources for V2X communication.
- [73] In order to solve the problem described above, a method for allocating a common SPS resource across multiple cells (e.g. contiguous cells) can be proposed according to the present invention. According to an embodiment of the presnet invention, the UE may be configured with SPS resources that can be used across at least one cell for a pre-defined time duration. For this, the UE may receive a SPS resource configuration (*SPS-Config*) which includes the pre-defined time duration. Further, the *SPS-Config* may further include a list of the at least one cell in which the SPS resources can be used. While using the SPS resources according to the received *SPS-Config*, the UE may suspend or resume use of SPS resources upon a specific event while keeping the

SPS-Config according to the received *SPS-Config*.

[74] FIG. 6 shows a method for allocating a common SPS resources according to an embodiment of the present invention.

[75] In step S100, the UE receives a SPS resource configuration from the network. The eNB may provide the SPS resource configuration (*SPS-Config*) to the UE by RRC signaling. The *SPS-Config* may include the following information.

[76] - Time/Frequency information of the SPS resources

[77] - Interval of the SPS resources

[78] - SPS C-RNTI

[79] - Time information related to validity of the SPS resource configuration.

[80] - List of at least one cell (*SPSCellList*)

[81] Among the above information included in the *SPS-Config*, the time/Frequency information of the SPS resources, the interval of the SPS resources and the SPS C-RNTI are information currently included in the *SPS-Config* (refer to Table 1). However, according to an embodiment of the present invention, the *SPS-Config* may further include the time information related to validity of the *SPS-Config* and the list of at least one cell in which the SPS resources can be used.

[82] In step S110, the UE determines whether the SPS resource configuration is valid or not. The UE may use the SPS resources according to the received SPS resource configuration (*SPS-Config*) only if the UE considers that the received *SPS-Config* as valid. In order to determine whether the *SPS-Config* is valid or not, the UE uses the time information related to validity of the *SPS-Config* and/or the list of at least one cell included in the *SPS-Config*.

[83] - The time information related to validity of the *SPS-Config* may be a validity duration (*SPSValidDuration*) during which the *SPS-Config* is valid. The validity duration may be a unit of subframes, radio frames, milliseconds, or seconds. That is, *SPSValidDuration* is a time period during which the UE considers that the received *SPS-Config* is valid. More specifically, after activating use of SPS resource according to the received *SPS-Config*, if *SPSValidDuration* has passed, the UE may consider that received *SPS-Config* is not valid any more even when the UE is on a serving cell which is included in the *SPSCellList*. Alternatively, the time information related to validity of the *SPS-Config* may be an end time which specifies until when the *SPS-Config* is valid.

[84] - The list of at least one cell (*SPSCellList*) is a list of at least one cell where the UE considers that the received *SPS-Config* is valid. More specifically, within *SPSValidDuration*, if the UE is on a serving cell identified by the cell identifier which is included in the *SPSCellList*, the UE may consider that the *SPS0config* is valid. Within *SPSValidDuration*, if the UE is on a serving cell identified by the cell identifier which

is *not* included in the *SPSCellList*, the UE may consider that the *SPS-Config* is not valid. In addition, if *SPSValidDuration* has passed, the UE may consider that the *SPS-Config* is not valid even when the UE is on a serving cell identified by the cell identifier which is included in the *SPSCellList*.

- [85] The detailed procedure for using SPS resources across at least one cell according to an embodiment of the present invention is as follows. The eNB may configure the *SPS-Config* to the UE. The *SPS-Config* may include the time information related to validity of the *SPS-Config* (e.g. *SPSValidDuration*) and/or the list of at least one cell included in the *SPS-Config*. The UE may activate use of SPS resources according to the *SPS-Config* by receiving an activation command, e.g. PDCCH addressed by SPS C-RNTI, from the eNB. After the UE activates use of the SPS resources, the UE may transmit and receives data on the SPS resources if data is available for transmission, while the UE considers the *SPS-Config* as valid. The data may only refer V2X data, e.g. DENM and/or CAM.
- [86] While the UE considers the *SPS-Config* as valid, the UE may continue transferring data on the SPS resources according to the *SPS-Config* in case of handover initiation, handover failure, or radio link failure (RLF). That is, while the UE considers the *SPS-Config* as valid, the UE may keep transmitting (periodical) V2X message, regardless of handover, handover failure or RLF, based on cell list until the eNB reconfigures SPS resources (and until a timer expires).
- [87] Alternatively, while the UE considers the *SPS-Config* as valid, the UE may suspend using the SPS resources while keeping the *SPS-Config* in case of handover initiation, handover failure, RLF, or reception of SPS suspension command from the eNB via L2 signaling. After suspending using SPS resources, the UE may resume using SPS resources according to the *SPS-Config* in case of handover completion (either handover failure or handover success), transmission of data from CCCH, scheduling request (SR), buffer status reporting (BSR), reception of SPS resumption command from the eNB via L2 signaling, or data transfer on a contention-based physical uplink shared channel (CB-PUSCH) resource, if configured. That is, SR or CB-PUSCH may be used to resume SPS configuration at a target cell. SR or CB-PUSCH may request the eNB to resume SPS configuration, e.g. by BSR.
- [88] Alternatively, while the UE considers the *SPS-Config* as valid, the UE may re-configure SPS resource configuration by receiving a new *SPS-Config* from the eNB. A serving cell may reconfigure SPS resources for the next cell list.
- [89] SPS C-RNTI is used for scheduling on the SPS resources while the *SPS-Config* is valid. In other words, the UE may keep using the same SPS C-RNTI for scheduling on the SPS resources across different cell while the *SPS-Config* is valid.
- [90] In order to allocate the same SPS resources to be used across at least one cell, when

the eNB provides the *SPS-Config* to the UE, the eNB may take the followings into account:

- [91] - the SPS resources available in the at least one cell, which may not be the current serving cell but other cell, or
- [92] - the UE mobility (speed), or
- [93] - cell size.

[94] When the UE considers that the *SPS-Config* is no longer valid, the UE may either release the *SPS-Config* by itself or keep the *SPS-Config* while not transfer data by using the SPS resources according to the *SPS-Config*.

[95] FIG. 7 shows another method for allocating a common SPS resources according to an embodiment of the present invention.

[96] In step S200, the UE is on cell #1 and receives *SPS-Config* #1 from the eNB. The *SPS-Config* #1 includes time information related to validity of the *SPS-Config* #1 (in this embodiment, the time information is *SPSValidDuration*) and *SPSCellList* which includes cell #1 and cell #2.

[97] In step S210, the UE activates use of the SPS resources according to the received *SPS-Config* #1 by receiving an activation command from the eNB. The UE starts to count *SPSValidDuration* upon activation of using the SPS resources according to the *SPS-Config* #1.

[98] In step S220, the UE performs data transfer using the SPS resources according to the *SPS-Config* #1 on cell #1.

[99] In step S230, the UE initiates handover from cell #1 to cell #2. Accordingly, the UE suspends using SPS resources according to *SPS-Config* #1.

[100] In step S240, after completion of handover to cell #2, the UE resumes using the SPS resource according to *SPS-Config* #1, since cell #2 is included in the *SPSCellList* and *SPSValidDuration* has not passed yet.

[101] In step S250, the UE initiates handover from cell #2 to cell #3. Accordingly, the UE suspends using SPS resources according to *SPS-Config* #1.

[102] In step S260, after completion of handover to cell #3, even though *SPSValidDuration* has not passed yet, the UE considers that *SPS-Config* #1 is not valid because cell #3 is not included in the *SPSCellList*. Accordingly, the UE does not use the SPS resource according to *SPS-Config* #1. However, the UE may keep the *SPS-Config* #1.

[103] In step S270, the UE initiates handover from cell #3 to cell #1.

[104] In step S280, after completion of handover to cell #1, the UE resumes using the SPS resource according to *SPS-Config* #1, since cell #1 is included in the *SPSCellList* and *SPSValidDuration* has not passed yet. However, when *SPSValidDuration* has passed, the UE considers the *SPS-Config* #1 not valid anymore and stops using the SPS resources according to the *SPS-Config* #1 even though cell #1 is included in the *SPS-*

CellList.

- [105] FIG. 8 shows a wireless communication system to implement an embodiment of the present invention.
- [106] An eNB 800 may include a processor 810, a memory 820 and a transceiver 830. The processor 810 may be configured to implement proposed functions, procedures and/or methods described in this description. Layers of the radio interface protocol may be implemented in the processor 810. The memory 820 is operatively coupled with the processor 810 and stores a variety of information to operate the processor 810. The transceiver 830 is operatively coupled with the processor 810, and transmits and/or receives a radio signal.
- [107] A UE 900 may include a processor 910, a memory 920 and a transceiver 930. The processor 910 may be configured to implement proposed functions, procedures and/or methods described in this description. Layers of the radio interface protocol may be implemented in the processor 910. The memory 920 is operatively coupled with the processor 910 and stores a variety of information to operate the processor 910. The transceiver 930 is operatively coupled with the processor 910, and transmits and/or receives a radio signal.
- [108] The processors 810, 910 may include application-specific integrated circuit (ASIC), other chipset, logic circuit and/or data processing device. The memories 820, 920 may include read-only memory (ROM), random access memory (RAM), flash memory, memory card, storage medium and/or other storage device. The transceivers 830, 930 may include baseband circuitry to process radio frequency signals. When the embodiments are implemented in software, the techniques described herein can be implemented with modules (e.g., procedures, functions, and so on) that perform the functions described herein. The modules can be stored in memories 820, 920 and executed by processors 810, 910. The memories 820, 920 can be implemented within the processors 810, 910 or external to the processors 810, 910 in which case those can be communicatively coupled to the processors 810, 910 via various means as is known in the art.
- [109] In view of the exemplary systems described herein, methodologies that may be implemented in accordance with the disclosed subject matter have been described with reference to several flow diagrams. While for purposed of simplicity, the methodologies are shown and described as a series of steps or blocks, it is to be understood and appreciated that the claimed subject matter is not limited by the order of the steps or blocks, as some steps may occur in different orders or concurrently with other steps from what is depicted and described herein. Moreover, one skilled in the art would understand that the steps illustrated in the flow diagram are not exclusive and other steps may be included or one or more of the steps in the example flow diagram

may be deleted without affecting the scope and spirit of the present disclosure.

Claims

- [Claim 1] A method for determining validity of a semi-persistent scheduling (SPS) resource across multiple cells, by a user equipment (UE), in a wireless communication system, the method comprising:
receiving a SPS resource configuration including time information related to validity of the SPS resource configuration from a network;
and
determining whether the SPS resource configuration is valid or not according to the time information.
- [Claim 2] The method of claim 1, wherein the time information is a validity duration which indicates a time period during which the SPS resource configuration is valid.
- [Claim 3] The method of claim 2, wherein the validity duration is a unit of one of subframes, radio frames, milliseconds, or seconds.
- [Claim 4] The method of claim 1, wherein the time information is an end time which specifies until when the SPS resource configuration is valid.
- [Claim 5] The method of claim 1, wherein the SPS resource configuration further includes a SPS cell list which indicates a list of at least one cell where the SPS resource configuration is valid.
- [Claim 6] The method of claim 5, wherein whether the SPS resource configuration is valid or not is determined according to the time information and the SPS cell list.
- [Claim 7] The method of claim 6, wherein the SPS resource configuration is determined to be valid in a cell when the cell is included in the SPS cell list within the time information.
- [Claim 8] The method of claim 1, when the SPS resource configuration is determined to be valid, further comprising continuing transferring data by using SPS resources according to the SPS resource configuration.
- [Claim 9] The method of claim 1, when the data is vehicle-to-everything (V2X) data.
- [Claim 10] The method of claim 1, when the V2X data is one of a decentralized environmental notification message (DENM) or a cooperative awareness message (CAM).
- [Claim 11] The method of claim 1, when the SPS resource configuration is determined to be valid, further comprising suspending using SPS resources while keeping the SPS resource configuration.
- [Claim 12] The method of claim 11, further comprising resuming using the SPS

resources according to the SPS resource configuration.

[Claim 13]

The method of claim 1, when the SPS resource configuration is determined to be valid, further comprising reconfiguring the SPS resource configuration.

[Claim 14]

A user equipment (UE) in a wireless communication system, the UE comprising:

a memory;

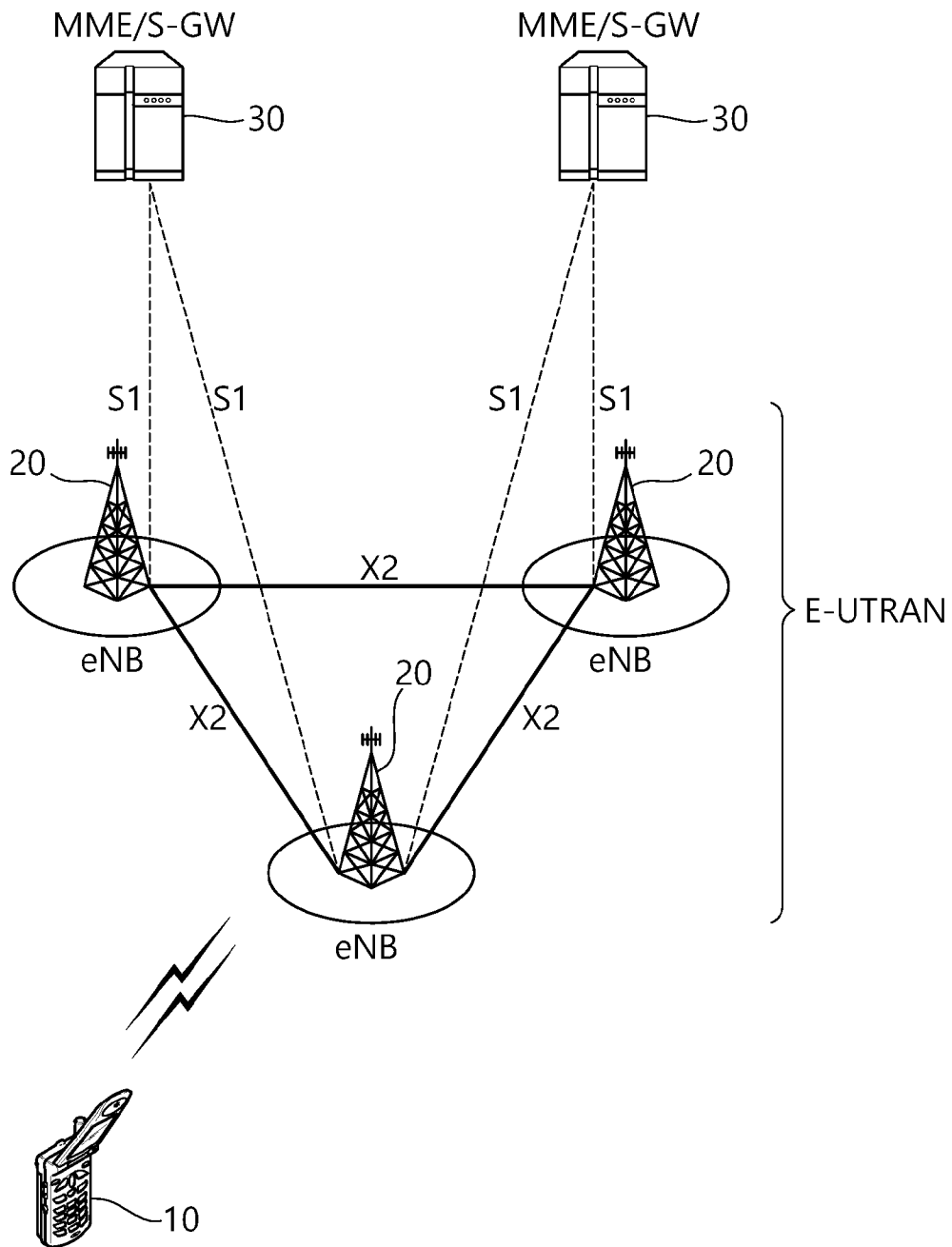
a transceiver; and

a processor, coupled to the memory and the transceiver, that:

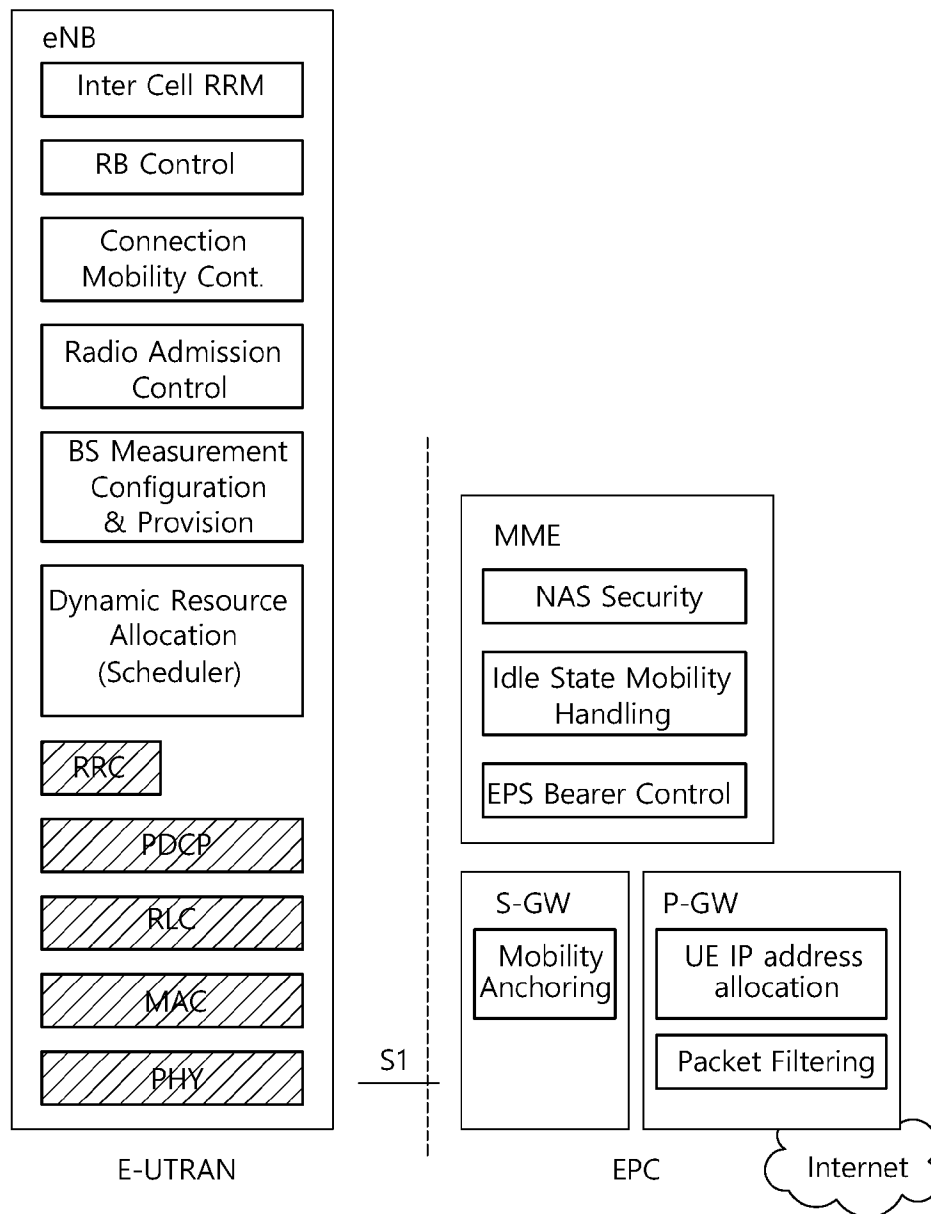
controls the transceiver to receive a semi-persistent scheduling (SPS) resource configuration including time information related to validity of the SPS resource configuration from a network, and

determines whether the SPS resource configuration is valid or not according to the time information.

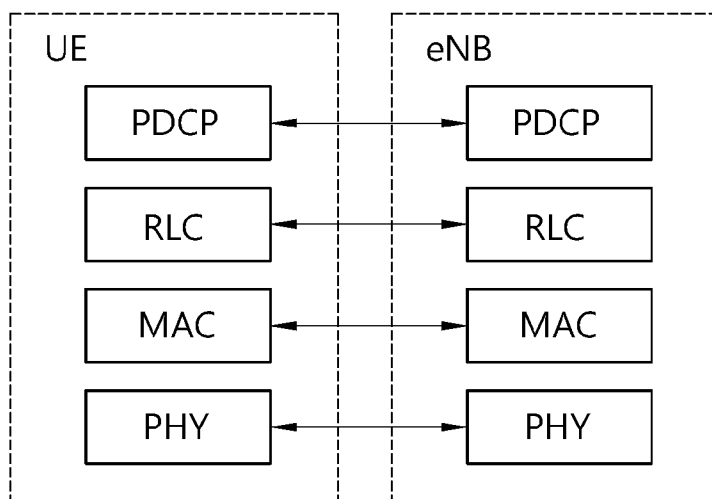
[Fig. 1]



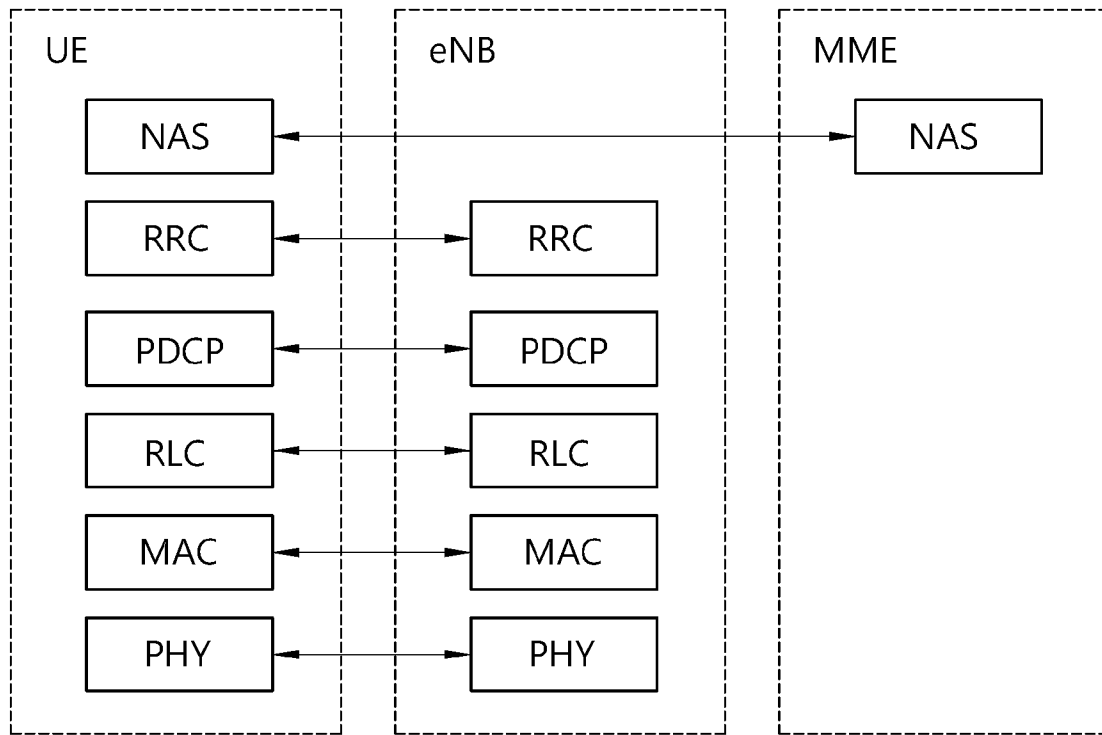
[Fig. 2]



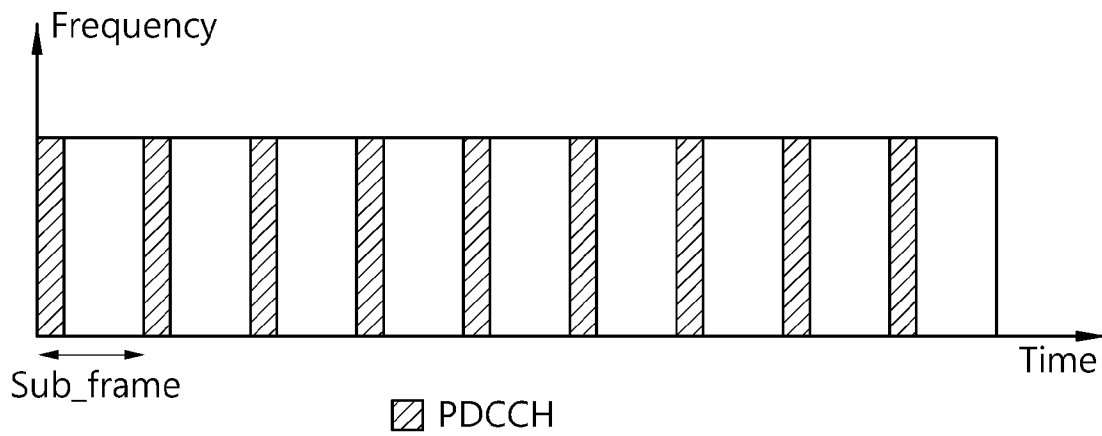
[Fig. 3]



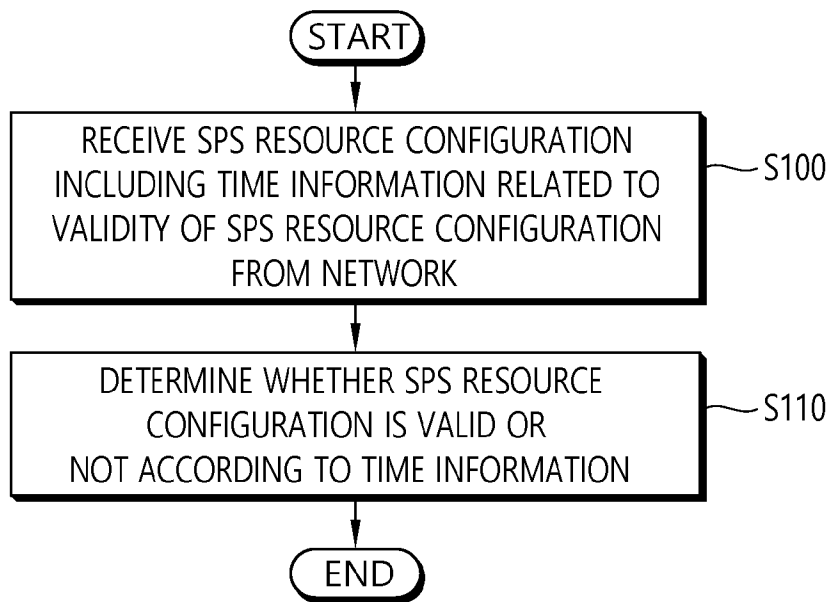
[Fig. 4]



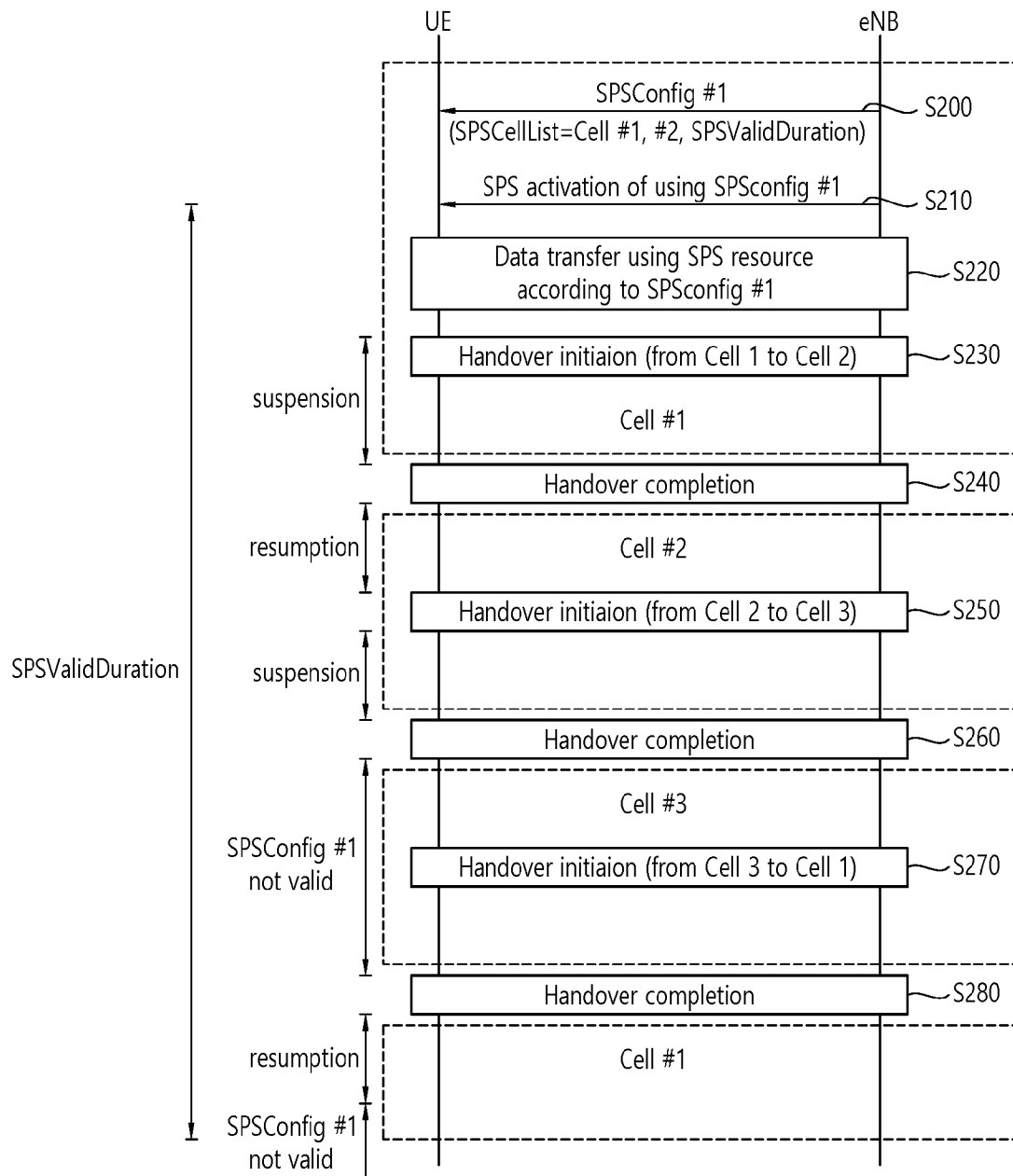
[Fig. 5]



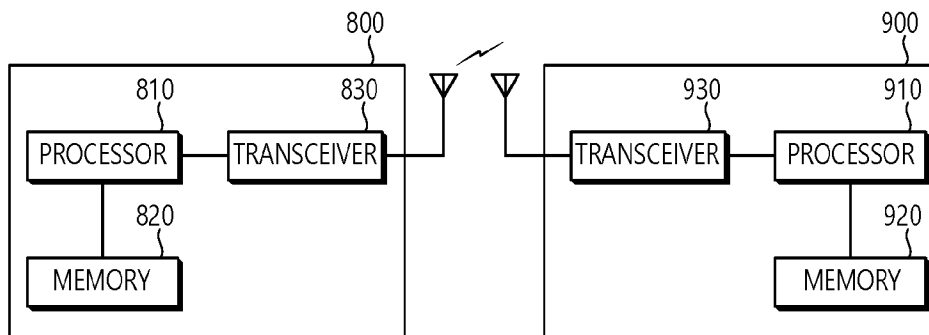
[Fig. 6]



[Fig. 7]



[Fig. 8]



INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2016/014861**A. CLASSIFICATION OF SUBJECT MATTER****H04W 72/04(2009.01)i, H04W 72/12(2009.01)i**

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H04W 72/04; H04W 24/10; H04W 36/00; H04W 72/12

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

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

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

eKOMPASS(KIPO internal) & Keywords: SPS resource configuration, valid, time information

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2015-020356 A1 (KT CORPORATION) 12 February 2015 See paragraphs [392]–[417]; and figs. 22–25.	1–4, 14
Y		8–10, 13
A		5–7, 11, 12
Y	ZTE, 'Discussion on Uu-based V2V and PC5/Uu-based V2I/N/P', R1-156662, 3GPP TSG RAN WG1 Meeting #83, Anaheim, USA, 07 November 2015 See section 2.1.	8, 9, 13
Y	CATT, 'Further discussion on resource allocation mechanism in PC5-based V2V', R1-157449, 3GPP TSG RAN WG1 Meeting #83, Anaheim, USA, 13 November 2015 See sections 2–2.3.	10
A	SONY, 'PC5 enhancements on resource allocation for V2V Services', R1-156709, 3GPP TSG RAN WG1 Meeting #83, Anaheim, USA, 07 November 2015 See section 3.	1–14
A	US 2014-0241319 A1 (LG ELECTRONICS INC.) 28 August 2014 See paragraphs [0055], [0086]–[0123]; figs. 6, 8; and claims 1–3, 8.	1–14



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

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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

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"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

24 March 2017 (24.03.2017)

Date of mailing of the international search report

24 March 2017 (24.03.2017)

Name and mailing address of the ISA/KR

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/KR2016/014861

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2015-020356 A1	12/02/2015	CN 105474684 A CN 105682137 A KR 10-1648251 B1 KR 10-1655513 B1 KR 10-2015-0051128 A US 2016-0183239 A1 US 2016-0183241 A1	06/04/2016 15/06/2016 12/08/2016 07/09/2016 11/05/2015 23/06/2016 23/06/2016
US 2014-0241319 A1	28/08/2014	CN 103875201 A EP 2763338 A1 EP 2763338 A4 US 9420572 B2 WO 2013-048056 A1	18/06/2014 06/08/2014 22/07/2015 16/08/2016 04/04/2013