

resource reservation for the next period which facilitates efficient resource allocation for periodic V2X traffic. However, even in the case of resource reservation, V2X transmissions in the next period may be absent e.g. due to congestion control by channel occupation ratio (CR)/channel busy ratio (CBR) measurements.

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In LTE V2X Release 14/15, sensing based resource (re)selection and reservation are applied in V2X sidelink mode 4 (i.e. UE autonomous resource selection mode) to avoid resource selection collisions as much as possible.

10 Once a UE has a packet to transmit and MAC instructs PHY layer to make candidate resource selection to report to MAC for resource selection, the UE performs the candidate resource subset selection procedure based on the channel sensing results, where the sensing UE decodes the PSCCH of the sensed UEs to acquire information such as packet priority, resource reservation information and control CRC bits (to determine DMRS of associated
15 PSSCH). The sensing UE performs the measurement of PSSCH reference signal received power (RSRP) to determine whether to exclude the candidate resource. The UE ranks the remaining resources based on the energy measurement (sidelink received signal strength indicator (S-RSSI)) and reports the candidate resources with least energy measurement.

20 The existing LTE V2X design of control/data channel structure and semi-persistent transmission (SPT) with channel sensing and reservation mechanism is tailored to periodic V2X traffic. However, in NR V2X, there may be more diverse V2X traffic types including both periodic V2X traffic and aperiodic V2X traffic.

25 For spectrum efficiency, periodic and aperiodic V2X traffic types may coexist in the same resource pool. The LTE V2X design of control/data channel structure and SPT mechanism may not work well for aperiodic V2X traffic because of the unpredictable interference due to the aperiodic nature.

30 The following aims to provide a new physical channel structure and mechanisms. In particular, unified sidelink physical channel structure and mechanisms may flexibly support aperiodic V2X traffic and periodic V2X traffic is provided.

Figure 5 shows a method which may be used to provide a unified sidelink physical channel
35 structure.

PSCCH-1 indicates the resource allocation of the associated PSSCH. With PSCCH-1 transmitted before the associated data which is conveyed by PSSCH, the UE which has higher priority data to transmit may use the PSCCH-1 to pre-empt the low priority data transmissions of other UEs and trigger them to make resource reselections or abandon their transmission.

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Figure 9 and Figure 10 illustrate an example of the proposed control channel structure used for aperiodic V2X traffic. When an aperiodic packet (e.g. an event-driven one-shot transmission packet) arrives from higher layer to MAC/PHY layers to be transmitted, based on the available channel sensing results and the latency requirement for the packet, the UE selects sidelink resource(s) for transmission of the packet (i.e. the packet denoted by the grey rectangle). In order to prevent other UEs (with periodic or aperiodic traffic) from using this resource, the UE will transmit PSCCH-1 ahead of the selected resource to indicate the resource reservation. Note that PSCCH-1 also carries the packet QoS-relevant information, which may be taken into account by other UEs in their resource selection/pre-emption related operations.

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The PSCCH-1 indicates that the packet type of aperiodic traffic which will determine the interpretation of the information field of resource reservation in time as specified in table 1.

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In Figure 9, the SCI information is exclusively distributed to SCI-1 and SCI-2 (i.e. they contain different control information) carried by PSCCH-1 and PSCCH-2 respectively. In this case, the resource corresponding to PSCCH-1 position in the TTI of PSSCH could be kept unused as shown in the figure. This may facilitate other PSCCH-1 transmissions from other UEs.

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In Figure 10, PSCCH-2 conveys SCI-1 as well as SCI-2. That is, PSCCH-2 conveys all the sidelink control information including at least the resource reservation information and transmission format information. The benefit of this configuration is that the receivers could still decode the PSSCH based on PSCCH-2 even if they miss the transmission of PSCCH-1.

An example of the configuration of the resource reservation in time is shown in Table 1. Note that TU denotes time unit e.g. slot, TTI or subframe.

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Resource reservation in time (4 bits)	Reservation period for periodic traffic	Time offset between PSCCH-1 and PSSCH for one-shot aperiodic traffic
0000	No reservation	0 (i.e. same TTI for PSCCH-1/PSCCH-2/PSSCH)
0001	10ms	1 TU