RWS-210244

3GPP TSG RAN RAN Rel-18 workshop

Electronic Meeting, June 28 - July 2, 2021

Agenda Item: 4.2

Enhancement for sidelink operations

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Background and proposed scope

❑ Background

- Specification work for NR sidelink started in Rel-16 with its focus on V2X use cases and then WI for the sidelink enhancement is ongoing to cover V2X, public safety, and commercial use cases.

✓ Rel-16 defined basic features of NR sidelink for broadcast, groupcast, and unicast.

✓ Rel-17 is working on enhancements for power saving as well as reliability and latency improvement.

- There are several areas requiring further enhanced NR sidelink in order to address some issues in the deployment of the technology or to support the requirements better.

❑ Proposed Scope for NR sidelink enhancements in Rel-18

- Sidelink carrier aggregation
- Co-channel coexistence of LTE and NR sidelinks
- Sidelink beam management or multi-panel management
- Enhancements for sidelink operation in FR2

Sidelink carrier aggregation

❑ Motivation

- The more sidelink services a UE provides, the more sidelink spectrum is necessary.
- Different services can be mapped to different sidelink carriers in some cases. A UE interested in multiple services needs to operate sidelink over multiple carriers simultaneously.
  - ✓ A frequency band may be used for a certain type of services. For example, a frequency band dedicated to ITS services (like the 5.9 GHz band) can be used only for some V2X use cases, and other services not allowed in that band should use another frequency band like a licensed band. Note that two frequency bands (n38 and n47) were defined as V2X operating bands in Rel-16.
- A wideband NR sidelink carrier may not be ensured even in an ITS band as the band can be fragmented into several narrow band channels (typically 10 or 20 MHz bandwidth in 5.9 GHz).
  - ✓ Providing a wideband sidelink operation would be possible only by aggregating these fragmented channels.

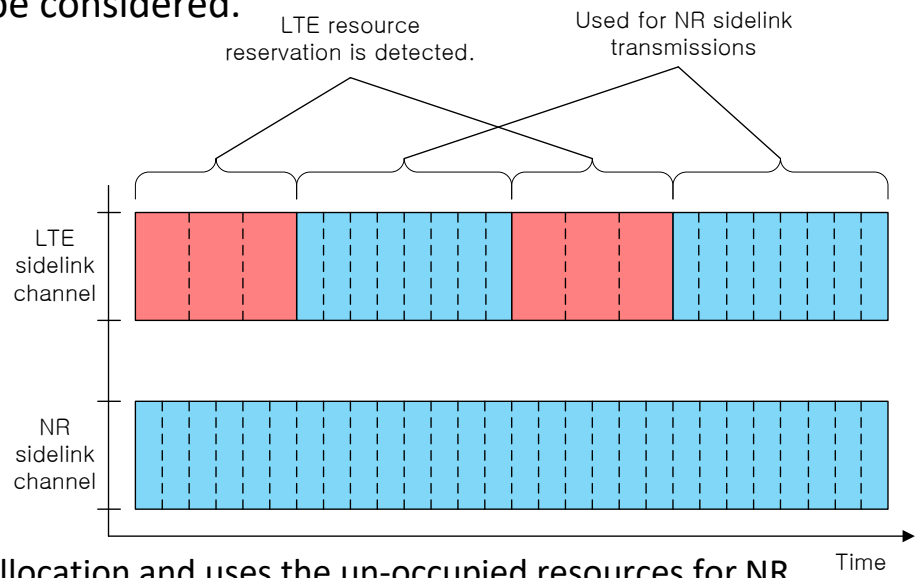
❑ Consideration

- Both intra-band and inter-band sidelink carrier aggregations are necessary.
- LTE supported sidelink carrier aggregation in Rel-15 for a similar motivation, thus it can be the baseline.

Co-channel coexistence of LTE and NR sidelinks

❑ Motivation

- In some regions, NR sidelink can be required to share a channel when it wants to use large spectrum.
  - ✓ In case of Europe for example, it is under discussion whether/how to share the ITS spectrum among different V2X technologies.
- Migration from LTE sidelink to NR sidelink needs to be considered.
  - ✓ Once the portion of LTE-only UEs reduces, smooth transition from LTE sidelink to NR sidelink would be possible if both can share the same channel.



❑ Consideration

- No change should be made to LTE sidelink.
  - ✓ For example, Rel-18 UEs can detect LTE sidelink resource allocation and uses the un-occupied resources for NR sidelink transmissions.
- It is preferable to consider such shared resources as supplementary ones by assuming that the UE also uses a channel dedicated to NR sidelink (e.g., the channel used by Rel-16/17 NR sidelink UEs).

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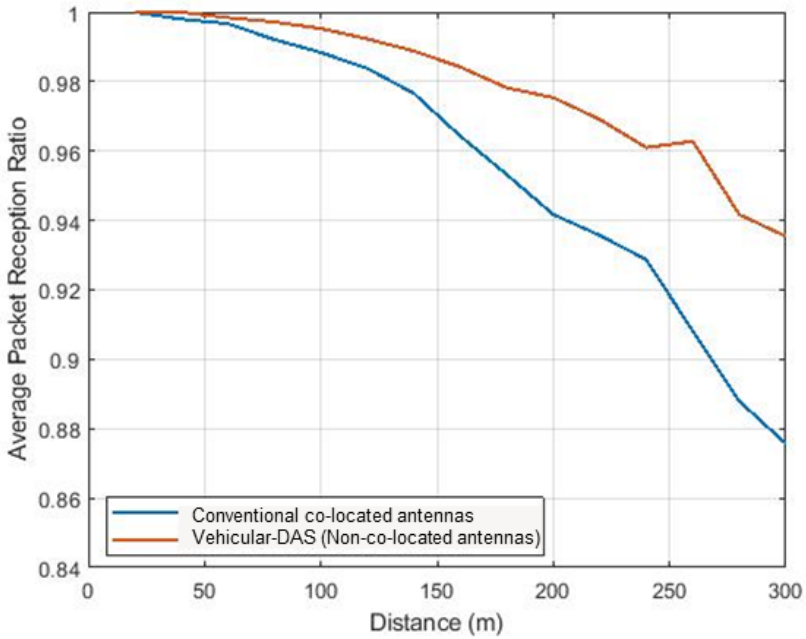
Sidelink beam management or multi-panel management

❑ Motivation

- Distributed antenna system (DAS), which means a UE is equipped with multiple antenna panels placed at different locations, has been included in V2X evaluation methodology.
  - ✓ This is to provide reliable coverage in all the directions in the presence of the blockage effect caused by the vehicle body.
  - ✓ DAS modeling is defined in vehicle UE antenna model option 2 in TR 37.885.
- Use of multiple panels provides performance benefit even in broadcast communications in FR1.
  - ✓ This motivates commercial deployment of DAS in vehicles supporting V2X.



Sidelink beam management or multi-panel management

- Rel-16/17 sidelink only considered omni-directional transmissions and do not provide a mechanism to manage multi-panel UE efficiently.
  - ✓ There is a room to further improve the system performance, e.g., by introducing a mechanism to select sidelink transmission beam or panel with the best channel quality to the target receiver.
- Introduction of sidelink beam or multi-panel management can facilitate the use of FR2 for sidelink operations as well.

❑ Consideration

- Multi-panel management may appear as a kind of beam management in the specifications.
- Specification work can focus on sidelink unicast with CSI reporting.

Enhancements for sidelink operation in FR2

❑ Motivation

- Some V2X and commercial use cases operated by sidelink require high data rate up to 1 ~ 10 Gbps which is not easily supported in FR1. For example,
  - ✓ Up to 1 Gbps for "Sensor information sharing between UEs supporting V2X application" in TS 22.186.
  - ✓ Up to 1 and 10 Gbps for "AR/VR" in TS 22.261 with the notes "Communication includes direct wireless links (UE to UE)." and "The performance requirement is valid for the direct wireless link between the tethered VR headset and its connected UE." Note that new PQI values are defined in ProSe for VR (S2-2100403).
- Use of FR2 for sidelink can address such high data rate requirements.
  - ✓ When sidelink operates in a licensed band, it is preferable to use a frequency band not busy for Uu traffic as sidelink operation should be TDMed with Uu. More resources may be available for sidelink in FR2 due to the relatively lower spectrum utilization for Uu.

❑ Consideration

- Enhancements for sidelink in FR2 can focus on unicast with CSI reporting.
  - ✓ To avoid complicated unicast session managements in FR2 where the connectivity can be interrupted, the work can assume that both TX and RX UEs can communicate via sidelink in FR1 as well.
- Assuming that beam management is covered by the previous objective, some study may be necessary to identify additional enhancement areas.
  - ✓ For example, the impact of relatively short CP can be considered.

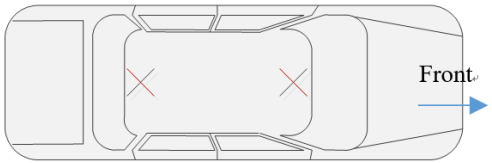
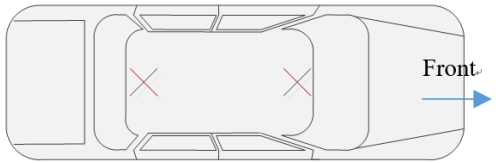
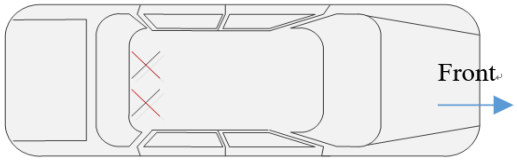
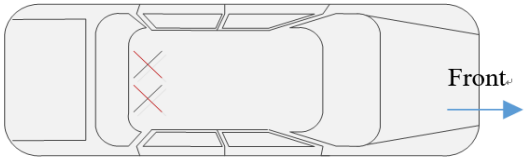
Annex1: Evaluation assumption for multi-panel sidelink (1)

❑ Baseline assumptions for SLS

Parameter		Value
Scenario		Highway
Carrier frequency		6 GHz
Bandwidth		20 MHz
Subcarrier number per PRB		12
Subcarrier spacing		15 kHz
Noise figure		9 dB
Polarization		Cross-pol (0 and 90 degree)
TTI duration		1ms
HARQ	Type	Blind HARQ
	Number of retransmissions	1
Traffic model	Type	Periodic traffic model with pattern {300 bytes, 190 bytes, 190 bytes, 190 bytes, 190 bytes}
Subchannel size		10 PRB
Resource allocation		Mode 1
gNB drop		gNBs are located along the highway 35m away with 1732 m ISD (2 BS total)
Vehicle drop		100% vehicle type 2, vehicle speed is 140 km/h in all the lanes, clustered dropping is not used
Geometry		Highway length – 3464m, 6 lanes total with 4m width
Location update		Object positions are updated every 100ms
Channel model		Channel models in TR 37.885 and TR 38.901 are used

Annex1: Evaluation assumption for multi-panel sidelink (2)

❑ Baseline assumptions for SLS

Antenna configuration for vehicles		
	vehicular-DAS	**co-located antenna system**
Antenna configuration	4Tx, 4Rx (with antenna element patterns reflecting the self-blockage effect in Table 6.1.4-10B and Table 6.1.4-10C in TR 37.885) DAS 4TX 4RX configuration (TX)  DAS 4TX 4RX configuration (RX)  	4Tx, 4Rx (with antenna element pattern reflecting the self-blockage effect in Table 6.1.4-10C in TR 37.885) CAS 4TX 4RX configuration (TX)  CAS 4TX 4RX configuration (RX) 

[Note 1] When we calculate path loss for vehicular-DAS, the actual location of each vehicular-DU is considered. The model for spatial correlation of shadow fading defined in TR 36.885 is used to calculate the shadowing of vehicular-DUs. It should be noted that the same formulas for the calculation of path loss/shadowing in TR 37.885 are used for both vehicular-DAS and co-located antenna system.

[Note 2] Regarding the blockage caused by other vehicles, geometry-based blockage modeling is used for both vehicular-DAS and co-located antenna system with the consideration of actual antenna location, which is based on the blockage model B in TR 38.901.