Faculty of Electrical Engineering & Computer Science
Master Degree Course Electronics Engineering, MSc EE

HSB
Hochschule Bremen
City University of Applied Sciences

Master 2018

Puneeth Jubba Honnaiah

Simulation and Performance Analysis of V2X Communication in Comparison to LTE-D2D Sidelink.

ABSTRACT - Masterthesis

In 3GPP Release-12, LTE standard has introduced a device-to-device (D2D) interface (PC5 and Uu) aimed primarily at allowing LTE to support public safety communication systems. Further, in release-14, 3GPP has released V2X communication to expand existing LTE platform to serve increasing needs for safety in cooperative driving use cases of the automotive industry. In release-14, to support V2X use case requirements, the PC5 interface have been introduced with new fundamental modifications. The significant modification is the addition of supplementary DMRS symbols to handle the high Doppler associated with relative speeds of up to 500kph and at high frequency. Another modification is in the arrangement of scheduling assignment (PSCCH) and data (PSSCH) resources. The thesis primarily focuses on a detailed theoretical study of release-12 D2D and release-14 V2X communication along with their use cases defining the progress in terms of latency, Doppler handling and system performance under high density. Besides, the revised scheduling technique that meets the latency requirements of V2X communication has also increased the collision probability. The possible scenarios for collisions are simulated to analyze limitations and drawbacks in current technique. Further, based on the results an enhanced algorithm is proposed to reduce collision probability for future releases of LTE or 5G communications. Added purpose of the thesis involves simulation of Sidelink processing techniques (Physical layer channel) to study the impact on V2X systems in comparison to D2D systems with the focus on block error rate (BLER), signal-to-noise ratio (SNR), complementary cumulative distribution function (CCDF) due to the introduction of additional DMRS. Furthermore, the secondary peaks in the composite transmit signal due to the addition of DMRS has been discussed. An enhanced avoidance scheme is proposed to reduce the induced secondary peaks. Finally, the currently used internal software(by Rohde&Schwarz) known as Sidelink-analyzer to validate release-12 D2D sidelink signals generated by R&S CMW, is upgraded to validate release-14 V2X sidelink signals.