3GPP TSG-RAN WG Meeting #90-e
e-Meeting, December 7th–11th, 2020
Agenda Item: 9.7.5
Document for: Discussion & Decision

RP-202642

Performance issues with supporting 2Rx for wearables in FR1

Background

- The performance impact due to introduction of 1Rx RedCap UEs in the network has been extensively studied
  - The following were observed from all three companies following the RAN1 agreed traffic model (FTP model 3 for eMBB and IM model for RedCap) and scheduling BW assumption (100MHz for eMBB and 20MHz for RedCap)

For burst traffic evaluation with IM traffic model for RedCap users:

- **3 sources (Ericsson, Vivo, Qualcomm) observed that the RedCap users have minor or no impact on spectral efficiency and capacity, and little impact to the performance of co-existing eMBB users in the system**
- **It is further noted that the 1 Rx RedCap users do not make an appreciable change on the user throughput performance of the eMBB users compared to the 2 Rx RedCap users**

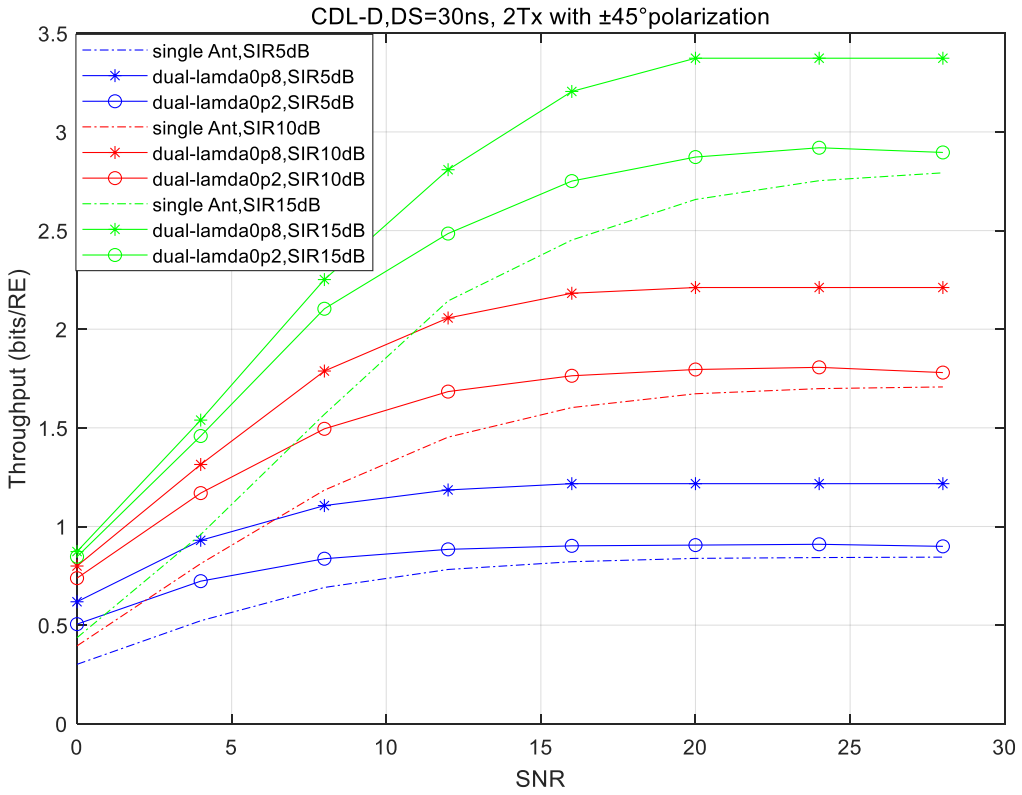
  - No coverage issue in FR1 for 1Rx UE at 4GHz with typical gNB PSD (33dBm/MHz) and any other FR1 TDD bands

Observations

vivo

- Supporting 1Rx is crucial to enable wearable use cases with form factor limitations.
  - Most of LTE based smart watches in the market are equipped with 1Rx due to implementation challenges, although the LTE specification does not support 1Rx. In addition to 4G, supporting 5G in smart watches will be even more challenging for RF design
  - To support 1Rx UE in specification will ensure the UE performance and consistency and provide a possibility for network/operator to identify the RedCap device (1Rx or 2Rx) according to the capability reporting.
- For smart wearables, the compact device form factor will result in high Rx antenna correlations in the case of multiple Rx antennas at the UE sides, thus large throughput degradation is expected compared to the ideal antenna assumption (low correlation ensured by sufficient antenna separation)
- Based on initial evaluation results:
  - Considering practical wearable implementations, 2Rx with high antenna correlations has dramatic throughput loss compared to typical antenna separation possible for cell phones (e.g. 0.8lamda).
  - For typical operation with SIR=5/10/15dB, at the range of mid to high SNR, the gain by 2Rx with high antenna correlations is marginal (less than 10%) compared to 1Rx.

Initial evaluations



Parameter	Value
Carrier frequency for evaluation	3 GHz
Channel model	CDL-D， delay spread: 30ns
UE speed	3 km/h
BS antenna configuration	2 Tx antenna ports configured with ±45° polarization in CDL-D
UE antenna configuration	2 Rx antenna ports configured with dual 90° polarization in CDL-D
PDSCH	8PRB ,12 symbols， SCS=15kHz
Transmission scheme	TypeI codebook with PRG4
CSI-RS	24PRB with 80ms period
Receiver assumption	Realistic channel estimation and adaptive MMSE-IRC equalizer
Adaptation function	AMC enabled, RI adaptation enabled, HARQ enabled

THANK YOU