

Motivation for new WI: Enhancements for High Capacity Stationary Wireless Link and Introduction of 1024 QAM for LTE

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High Capacity Wireless Link: Overview

- ❑ **A high capacity wireless connection from a LTE eNB to a stationary/low mobility/nomadic mobility UE**
 - E.g., from LTE eNB to above-rooftop/indoor CPE then to indoor UEs
 - E.g., from LTE eNB to stationary laptops, docked smartphones, etc.
 - E.g., from LTE eNB to faraway “super UE” then to scattered rural UEs
 - E.g., fiber/copper replacement
 - (Link between the super UE and the end-user, if exists, is not within the scope of this proposal and can be a non-3GPP link)
- ❑ **Distinctive characteristics of the high capacity link include stationary channel conditions, high DL SINR, very low mobility UEs, very high capability and high demand UEs/CPE**
- ❑ **The high capacity link requires new features and enhancements to be customized, standardized, and developed for very high efficiency**
- ❑ **Technical components considered:**
 - Higher-order modulations for DL channels (1024 QAM for PDSCH, 16 QAM for DL control channels)
 - Control channel enhancements, including overhead reduction (e.g. joint DCI for multiple subframes and component carriers) and allowing coverage for indoor CPEs/UEs
 - As second priority, MIMO enhancements (e.g. high order MIMO for 16/32 Rx antennas in DL and/or 8 transmit antennas in UL, DMRS overhead reduction) and corresponding CSI enhancements for non-line-of-sight and line-of-sight stationary links
 - RRM procedure simplification (e.g. simplified RRM/RLM for stationary link)
 - Corresponding RRM and RF requirements

High Capacity Wireless Link: Motivations

- **A LTE-based solution and optimization for high capacity wireless links**
 - **A wireless connection from a LTE eNB to a high capacity UE**
 - E.g., from LTE eNB to above-rooftop CPE (LoS links) or to indoor CPE (NLoS links)
 - E.g., from LTE eNB to stationary laptops, docked smartphones, etc.
 - (Link between the super UE and the end-user is not within the scope of this proposal and can be non-3GPP link)
 - **High capacity stationary link with superior performance**
 - The commonalities of the considered scenarios and their distinctiveness from other scenarios can be exploited for best performance. This requires new features and enhancements to be customized, standardized, and developed for very high efficiency.
 - Estimates of high peak data rate with up to 1024QAM, up to 16/32 layers, up to ~13symbols/subframe, and multiple CCs in DL/UL:
 - For LoS:
 - » Support for each UE/CPE, up to 1024QAM + 2layers + ~13symbols/subframe + up multiple CCs in DL/UL; about 25% DL/UL SE gain or more
 - For NLoS, support up to 256QAM + 16layers + ~13symbols/subframe + up multiple CCs in DL/UL; can have up to >100% DL/UL SE gain

High Capacity Wireless Link: Scenarios

- Broadband connections to CPE
 - Homes
 - Offices, office buildings
 - Commercial buildings (Starbucks, restaurants, stores, ...)
 - Installed above-rooftop or indoor
- Stationary laptops and docked smartphones
 - For, e.g., videos, video conferencing, gaming, tethering, etc., with high data rate requirements
- Communications to LOON
- IoT aggregation point connections
- Backhaul links
 - For small cells in dense networks, lamp sites, ...
- Rural connections
 - To long-distance, scattered rural connection points
- Fiber/copper replacement
- Both FDD and TDD

High Capacity Wireless Link: Distinctive characteristics

- **Distinctive channel conditions**
 - Stationary channel conditions
 - May be with above rooftop antennas
 - LoS propagation
 - High DL SINR, low pathloss; small delay spread
- **Very low mobility UEs:** stationary CPEs, limited mobility or nomadic mobility UEs, etc.
- **Very high capability UEs**
 - May be capable of supporting a large number of Tx/Rx antennas, massive CA, high-order modulation, high-order MIMO, advanced receiver, complicated processing, etc., without stringent power consumption limitations
- **High demand UEs**
 - Very high data rate may be needed to support VR, gaming, video conferencing, multiple HD videos, tethering, etc.
 - High traffic demand can stably last for hours
 - Statistically predictable traffic demand pattern

High Capacity Wireless Link: Technical features

- **Key features**

- Higher-order modulations for DL channels [RAN1]
 - Introduce new MCS table, signalling and CQI feedback to support 1024QAM for PDSCH
 - Introduce high-order modulations (e.g. 16QAM) for DL control channels
- Control channel enhancements, including overhead reduction (e.g. joint DCI for multiple subframes and component carriers) and allowing coverage for indoor CPEs/UEs [RAN1]
- As second priority, MIMO enhancements (e.g. high order MIMO for 16/32 Rx antennas in DL and/or 8 transmit antennas in UL, DMRS overhead reduction) and corresponding CSI enhancements for non-line-of-sight and line-of-sight stationary links
- RRM procedure simplification (e.g. simplified RRM/RLM for stationary link) [RAN2, RAN1]
- Define applicable RRC signalling, UE capability and potential new UE categories [RAN2, RAN1]
- Corresponding higher-layer procedures and signalling [RAN2]
- Corresponding RRM and RF requirements [RAN4]
- Applicable to component carriers in licensed and unlicensed spectrum

Conclusions

- **High Capacity Wireless Link is a key scenario for future LTE network**
 - Enhancements in LTE should be considered
- **Approve a WI for Rel-15**