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Qualcomm

Agenda Item: 9.3.5

Qualcomm Incorporated

Views on UE power saving WI



Draft WID (v7)

UE adaptation to the traffic for power saving

- Identify power saving techniques with UE adaptation with focus in RRC_CONNECTED mode [RAN1, RAN4]
 - Specify the power saving techniques with power saving signal/channel as the wakeup signal/channel in triggering UE adaptation to the DRX operation in RRC_CONNECTED mode
 - Specify the PDCCH-based power saving signal/channel as the wakeup signal/channel
 - Specify DCI-based mechanism in skipping PDCCH monitoring or switching PDCCH monitoring periodicity, including when DRX is not configured
 - Specify the procedure of cross-slot scheduling power saving techniques
 - Specify the power saving techniques of UE adaptation to the BWP/SCell operation
 - Specify the power saving techniques of UE dynamic adaptation to the maximum number of MIMO layers
 - Specify the UE assistance information for the associated power saving techniques.

Draft WID (v7)

RRM measurements power saving

- Specify the power saving techniques in RRM measurements in synchronous and asynchronous network deployment [RAN4, RAN1]
 - a) Specify the relaxation and adaptation of RRM measurement period
 - b) Specify additional resources for RRM in RRC_IDLE/RRC_INACTIVE [RAN1, RAN4]

QC Views

C-DRX enhancements

- View on WUS

- **Very high priority**
- Support PDCCH-based WUS
 - Design considerations
 - Performance, resource overhead
 - Payload content and size
 - Multiplexing with other channels; Multiplexing with other users
 - CORESET/search space/aggregation levels/number of candidates configuration
 - Time offset to earliest schedulable PDSCH
 - Support for UE group signaling
 - Control channel capacity, blocking probability
 - DMRS detection can be UE implementation (wideband DMRS has to be configured)

- View on PDCCH-skipping DCI (works also when DRX is not configured)
 - **Very high priority**
 - Design considerations
 - New DCI with indication of number of slots to skip PDCCH monitoring, or leverage SFI design
 - Dynamic (“one-shot” skipping) vs semi-persistent
 - Interaction with periodic signals
- View on switching PDCCH monitoring periodicity by DCI
 - **Low priority**
 - Can already be supported with Rel-15 BWP
 - Design considerations
 - Need to ensure robustness (more stringent requirement than PDCCH skipping)
 - Need to show benefits over Rel-15 BWP scheme
 - Need to show clear advantage over other signaling scheme (e.g. MAC-CE)

QC Views

Adaptation in time / in number of antennas

- View on cross-slot scheduling

- **Very high priority**
- Rel-15 supports cross-slot scheduling for power saving with TDRA configuration of implicit “minimum k0”, but there are drawbacks and issues
- The following should be the design objectives for Rel-16 enhancements
 - Adaptation of the number of slots for cross-scheduling
 - How to work with A-CSI triggering offset
 - Could be independent of BWP switching
 - Determine usage for larger minimum k0 value
 - Works for cross-carrier scheduling
 - Works with antenna adaptation

- View on reduced max number of MIMO layers

- **High priority**
- Low spec impact
- Example use case:
 - Low power BWP configured with fewer max number of MIMO layers, large minimum k0
 - High performance BWP configured with more max number of MIMO layers, low minimum k0 (e.g. k0=0)
 - Low power BWP is active during low traffic activity or low traffic requirement (e.g. VoIP)
 - High performance BWP is active during heavy traffic
 - UE may operate with fewer Rx antenna when low power BWP is active, based on UE implementation transparent to the NW

QC Views

Power saving for BWP/SCell operation

- SCell power saving

- Highest priority
- Fast SCell activation
 - Addresses slower time scale adaptation
 - Can also be done in MR-DC/CA enhancement WI
 - Make sure this doesn't "fall through the cracks"
- Dormant BWP (+bundled SCell adaptation)
 - No PDCCH monitoring on SCell
 - New design needed to "re-enable" PDCCH monitoring on SCell
 - Reduced CSI measurement / reporting
 - Addresses faster time scale adaptation
- Cross-carrier scheduling enhancements
 - Ensure cross-slot scheduling and adaptation work seamlessly with xCC scheduling

- BWP enhancements

- Very high priority
- Triggering of A-CSI with BWP switch DCI
 - Switching without data scheduling
- Faster BWP switching
 - E.g. same BW, center freq, SCS → faster switching time
 - Potential framework for power saving parameters adaptation (e.g. PDCCH monitoring periodicity)

QC Views

Other schemes

- UE assistance information
 - Moderate priority
- RRM power saving
 - Low priority
 - Additional resource for RRM in RRC_IDLE/RRC_INACTIVE shows significant gain
 - Our understanding is that there may not be significant RAN1 work for RRM power saving unless above is in the scope
 - Relaxation and adaptation of RRM measurement period should be done by RAN4/RAN2
- Other major adaptation schemes not currently captured in draft WID (v4)
 - Dynamic DRX parameters/configuration
 - CORESET / search space configurations
 - Blind decoding limit reduction
 - QC agrees that these schemes may be deprioritized because of one or multiple of the following reasons
 - They do not offer clear advantage over existing solutions
 - The gain over existing solutions may be disputable (e.g. if baseline is fully optimized)
 - They can be part or overlapping with other schemes already included in the draft WID
 - Or, if additional study by RAN2 is recommended (e.g. dynamic DRX configuration)

QC Views

Additional comments on RRM measurements power saving

- Additional comments on RAN4/RAN2/RAN1 involvement:
 - For 2-a, it is mainly RAN4 / RAN2 work
 - Rapporteur will add RAN2 the scope after RAN2 SI concludes
 - For 2-b, RAN1 work can be significant



Thank you!

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