3GPP TSG-RAN WG4 Meeting #100-e R4-21xxxxx

Electronic Meeting, Aug. 16 – Aug. 27, 2021

Agenda Item: 9.4.3 and 9.4.6.3

Source: Apple

Title: WF on FR2 enhancement part 2: UL gaps

Document for: Discussion

# 1 Tx power management: RF aspect

Summary of 1st round email discussion is captured in [1]. Some observations are captured below:

* On phantom or blocking be introduced in UL gap testing.
  + No feasible in R17: oppo, Apple, HW, Sony, vivo, Intel.
  + Phantom should be introduced: QC
* Metric:
  + Option 1: Delta P-MPR: Apple, ZTE, Sony, vivo, Intel, DCM, Ericsson.
  + Option 2: Peak EIRP: Oppo,
  + Option 1 and option 2 without phantom: Nokia, Ericsson
  + Option 1 and option 2 with phantom: QC

Proposed agreement:

* *No phantom is introduced in R17 UL gap testing.*

Proposed agreement:

* *Option 1: “P-MPR report without phantom” based, X dB P-MPR enhancement should be achieved.*
  + *X is defined as one of the options below*
    - *6dB*
    - *A value between 6dB and 3dB, which is typical in the field*
    - *A value below 3dB*
  + *FFS on the impact of P-MPR report granularity*
  + *FFS on the implementation margin*
* *Option 2: “P-MPR report+peak EIRP without phantom”, X dB EIRP gain and P-MPR<YdB should be achieved.*
  + *X is defined as one of the options below*
    - *6dB*
    - *A value between 6dB and 3dB, which is typical in the field*
    - *A value below 3dB*
  + *Y is defined as*
    - *A value below 3dB*
    - *0dB*
  + *FFS on the implementation margin*

# 2 UL Tx power management: RRM aspect

Summary of 1st round email discussion is captured in [1]. Some observations are captured below:

* On UL gap activation:
  + Option 1: implicitly activated by P-MPR reporting from UE. The activation criteria is determined and signaled by the NW (apple)
  + Option 2: explicitly activated by NW (apple, Huawei, ZTE, qualcomm, sony, nokia, DCM, vivo, Ericsson, intel)
* On UL gap deactivation
  + Option 1: implicitly deactivated by [TBD] reporting from UE. The deactivation criteria is determined and signaled by the NW (apple)
  + Option 2: explicitly deactivated by NW (apple, Huawei, ZTE, qualcomm, sony, nokia, DCM, vivo, Ericsson, intel)
* In case of explicit activation/deactivation, UL gap should be
  + Option 1: MAC CE (Apple, Huawei, ZTE, Qualcomm, Sony, DCM, vivo, Ericsson, Intel )
  + Option 2: DCI (DCM)
  + Option 3: RRC (Nokia, Ericsson)
* Candidate gap configurations: UGL (UL gap length), UGRP (UL gap repetition periodicity)
  + UGL: 0.5ms, UGRP: 20ms (Huawei)
  + UGL: 1ms, UGRP:20ms (Huawei, apple)
  + UGL: 1.25ms, UGRP: 20ms (apple)
  + UGL: 0.5ms, UGRP:40ms (Huawei)
  + UGL: 1ms, UGRP:40ms (Huawei)
  + UGL: 0.125ms, UGRP:5ms (Qualcomm)
  + UGL: 0.125ms, UGRP:10ms (Qualcomm)
  + UGL: 0.125ms, UGRP:20ms (Qualcomm)
  + UGRP: 160ms (Sony, vivo, Ericsson, intel)
  + UGRP: 320ms (Sony, vivo, Ericsson, intel)

Proposed agreement:

* UL gap should be explicitly activated by NW via signaling
  + How can UE indicate the NW UL gap activation is needed?
    - Option 1: UE explicitly indicates to NW by signaling
    - Option 2: UE implicitly indicate to NW by P-MPR reporting. The exact P-MPR value is FFS.
* UL gap should be explicitly deactivated by NW via signaling
  + How can UE indicate the NW UL gap deactivation is needed?
    - Option 1: UE explicitly indicates to NW by signaling
    - Option 2: UE implicitly indicate to NW by [TBD] reporting.
* UL gap should be explicitly activated and deactivated by MAC CE
* Send LS to RAN2 for above agreement.
* Further discussion on down-selection of gap configurations.

# 3 UL coherent MIMO

Summary of 1st round email discussion is captured in [1].

**Proposed WF on performance gain evaluation:**

* The gain of UL MIMO with UL gap configured has been shown.
* Observations:
  + In R4-2111383, it shows 20.3% mean throughput gain and maximum 40.7% throughput gain with 40 degree phase error.
  + In R4-2114492, it shows further 8% throughput gain can be reached by further improve relative phase error requirement.
* The metric of the performance gain for further discussion:
  + - Option 1: By removing side conditions of coherent UL MIMO requirement, the requirement for relative phase/power keep the same, i.e. 40 degree/4dB
    - Option 2: By improving the requirement for relative phase/power, e.g. 30 degree for relative phase
* New requirement if identified can be discussed in phase II
* Companies are encouraged to provide analysis based on gap pattern examples
  + Other gap pattern is not precluded

# References

[1] R4-2114730, “Email discussion summary for [100-e][130] NR\_RF\_FR2\_req\_enh2\_Part\_2”, Apple