3GPP TSG RAN #81
Gold Coast, Australia, September 10 - 13, 2018
Agenda Item 9.2.1

**RP-181709**

# EN-DC power control

Qualcomm

# Alt.1 RAN1 Proposal (Ericsson)

- MPR/A-MPR applies to combined power
  - LTE power is determined independent of NR (i.e. with assuming no NR transmission)
  - LTE power is not changed if a later NR grant is received
    - UE is expected to adjust NR power to take advantage of relaxation provided by MPR

Note: Alt.1 requires no RAN1 specification changes

Note: Alt.1. depends on adoption by RAN4

Note: Alt.1 does not depend on timeline constraints

Note: Whether Alt.1 needs new MPR/A-MPR values is up to RAN4

# Alt.2 RAN1 Proposal (Sprint, Nokia, MediaTek)

- Delayed NR
  - LTE power is determined with taking into account NR scheduling information received 'in time'
  - FFS handling of NR scheduling information received not in time
  - FFS Optional/Mandatory
  - FFS if Delayed NR method is configurable

Note: NR scheduling information includes DCI scheduling UL, DCI scheduling DL for which HARQ-ACK is sent, power control, etc.

Note: Alt.2. depends on adoption by RAN4

# Alt.3 RAN1 Proposal (Qualcomm)

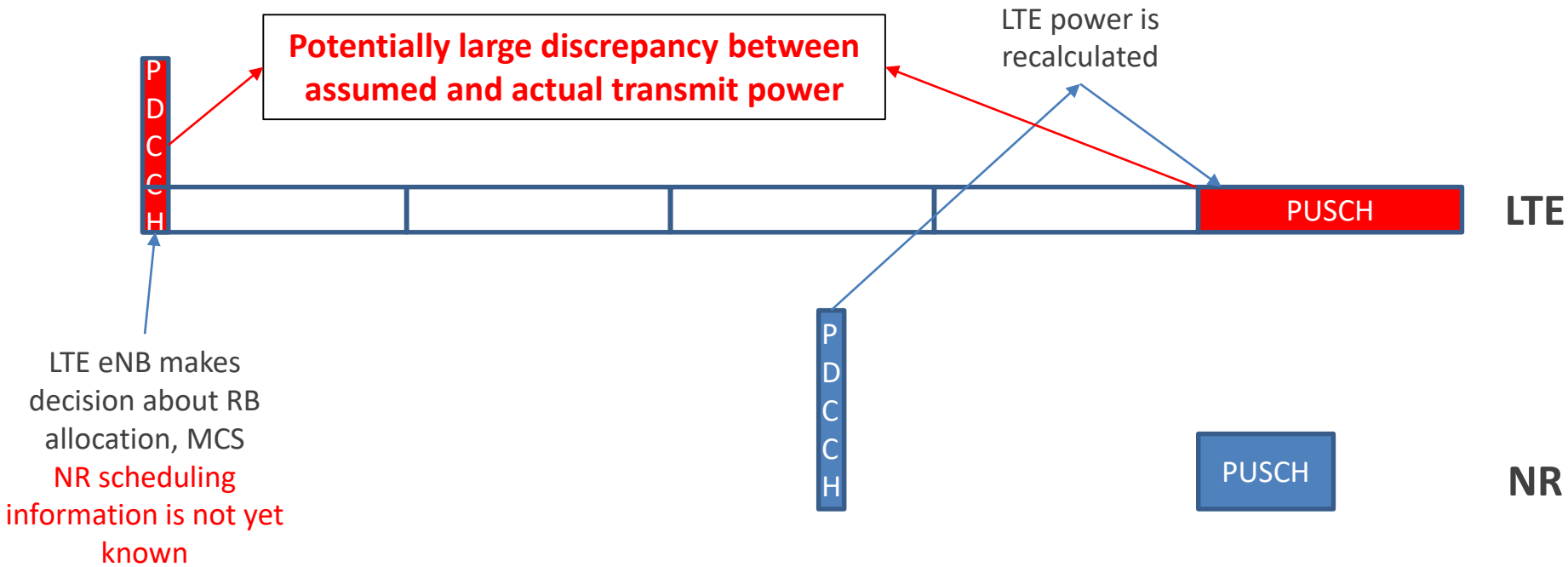
- Change in power dropping rule
  - (1) the UE calculates LTE power (P_LTE_only) considering no NR Tx
  - (2) the UE calculates NR power (P_NR_only) considering no LTE Tx
  - (3) the UE calculates the LTE power (P_L) and NR power (P_N) according to the dynamic power sharing rule and RAN4 MPR/A-MPR definition
  - (4) the UE performs the following
    - If both P_LTE_only == P_L && P_NR_only == P_N
      - UE transmits LTE and NR at powers P_L and P_N, respectively
    - Else
      - UE chooses a new P_N' power within the bounds 0 <= P_N' < P_N
      - UE determines LTE power P_L' based on P_N'
        - If P_N' == 0, P_L' = P_LTE_only
        - Elseif P_N' == P_N, P_L' = P_L
        - Else P_L < P_L' < P_LTE_only
      - UE transmits LTE and NR at powers P_L' and P_N', respectively

# Other Proposals (Nokia, MediaTek, Sprint)

- Capability signaling for faster LTE processing time
  - Doesn’t change LTE HARQ timeline
  - FFS values
  - FFS PHR impact

# Issues with the 'fast LTE' proposal

- Not reasonable to expect that significant development effort should go to LTE timeline improvements to support EN-DC power control
- <u>Fast LTE approach results in degraded UL grant accuracy, degraded MCS control and inaccurate PHR</u>



# Compromise proposal (I)

- In case the decision is that a RAN1 solution should be adopted:
  - Adopt Alt.3

# Compromise proposal (II)

- In case the decision is that a RAN4 solution should be adopted:
  - Adopt Alt.1 with the following modification
    - UE is allowed to drop NR if the MPR related NR power scaling is more than XdB or if the LTE-NR PSD difference is more than XdB
      - X is up to RAN4
    - Alternatively, dropping depends on explicit configuration
  - Potentially adopt Alt.2 if FFS can be resolved
    - New signaling for
      - ‘1-bit’ to configure Alt.2 mode
      - ‘1-bit’ for Alt.2 UE capability
  - No new signaling for LTE processing time capability