

Title: Reply to RAN2 LS on RACH Power Control Optimisation Use case

Release: Rel-8

Work Item: LTE

Response to: R1-080004 (R2-075463)

Source: RAN1

To: RAN WG2

Cc: RAN WG3, RAN WG4

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1. Overall Description

RAN 1 would like to thank RAN2 on their LS on RACH power control optimisation to support SON [1]. In particular, RAN2 inquires about necessary eNB or UE measurements required to optimize the RACH transmission power control configurations such as PRACH transmission power setting or power ramping step setting. In addition, RAN2 asks RAN1 to inform relevant WGs to define required signalling for measurements to be delivered over interfaces.

2. Questions/Answers

Question:

“RAN WG2 kindly requests RAN WG1 to study on the necessary eNB or UE measurements from RAN WG1 perspective to support this use case, particularly on the issue of RACH transmission power control, and standardise the necessary measurement definitions. RAN WG2 also requests RAN WG1 to inform the relevant WGs (e.g., RAN WG4 to define performance requirements and RAN WG2, WG3 and SA WG5 to define signalings for the measurements to be delivered over interfaces) about any decisions made.”

Answer:

Power control for PRACH was discussed in RAN1#51bis. It was agreed that open-loop power control is employed. UE computes the PRACH transmit power based on eNB signalled power control parameters. Path loss compensation is applied at the UE based on a measurement of the DL reference signal. The PRACH transmit power for N_{pre}'th transmission is computed as

$$P_{\text{preamble}}(N_{\text{pre}}) = \min(P_{\text{max}}, PL + P_{\text{o_pre}} + (N_{\text{pre}}-1)*dP_{\text{rampup}})$$

where PL is downlink pathloss, P_{o_pre} is the cell specific parameter that defines the desired target (received) power level at the eNB, N_{pre} is the number of preambles transmitted, and dP_{rampup} is the cell specific power step size for retransmission. Note that, in order for the UE higher layers not to have to deal with the pathloss estimate PL, PL should be applied at UE Layer 1. As a consequence, rather than providing Layer 1 with the desired preamble transmission power, higher layers should provide Layer 1 with the path-loss-normalized desired power P_{o_pre} + (N_{pre}-1)*dP_{rampup}.

eNB measurement: To determine the initial power control parameter, total received power on PRACH resource is needed. This can be an average quantity over the configured PRACH resources. Whether this measurement needs to be specified in the standard is FFS.

UE measurement: Downlink path loss estimate is needed at the UE. For initial access and uplink synchronization, path loss to the serving cell is estimated. For handover, the path loss to the target cell needs to be estimated.

Signalling: Table 1 below summarizes the RACH power control parameters and the required signalling methods. The power control parameters, ie preamble target power level Po_pre , and power step size for retransmission dP_rampup , need to be signalled to the UE. This may be done through DBCH in case of contention based RACH and through DBCH or dedicated signalling in case of non-contention based RACH. Additionally, to support handover with non-contention based RACH, signalling via X2 between the serving cell and the target cell is required. Dynamic range of these power control parameters are still under study.

Table 1: Summary of power control parameters and signalling method for RACH.

| RACH use case | Signalling method | Parameter |
|----------------------------------------------------------------------------------------------|-------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| All contention based RACH | DBCH | <ul style="list-style-type: none"> Preamble target power level Po_pre Power step size for retransmission dP_rampup |
| Non-contention based RACH: UL synchronization upon DL data arrival in RRC_CONNECTED state | DBCH or Dedicated signalling | <ul style="list-style-type: none"> Preamble target power level Po_pre Power step size for retransmission dP_rampup |
| Non-contention based RACH during handover | Dedicated signalling to UE Exchanged via X2 to serving cell | <ul style="list-style-type: none"> Preamble target power level Po_pre Power step size for retransmission dP_rampup |

3. Actions

Actions to RAN2

RAN1 kindly asks RAN2 to take into account the response in their further discussion.

Actions to RAN3

RAN1 kindly asks RAN3 to take into account the response in their further discussion.

Actions to RAN4

RAN1 kindly asks RAN4 to take into account the response in their further discussion.

4. Date of Next TSG-RAN WG1 Meetings

3GPP RAN1#52 11 – 15 Feb 2008 Sorrento, Italy

3GPP RAN1#52bis 31 Mar – 4 Apr 2008 Shenzhen, China

5. References

- [1] 3GPP R1-08004 (R2-075463), “LS on RACH power control optimisation use case”, RAN2.
- [2] 3GPP R1-080445, “Power control for RACH,” Alcatel-Lucent, RAN1#51bis, Sevilla, Spain, January 2008.
- [3] 3GPP R1-080357, “Power control for PRACH,” Ericsson, RAN1#51bis, Sevilla, Spain, January 2008.