TSG-RAN Working Group 1 meeting #7bis
Kyongju, South Korea
October 4 – October 5, 1999

TSGR1#7bis(99)e57

Agenda item:

Source: Ericsson

Title: Open loop power control

Document for: Decision

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1 Introduction

There has been some discussion on the reflector on open loop power control, used to initialise TX power at UE for RACH and DCH. In this paper we discuss the open loop power control, and the responsibility of specifying it.

2 Background

The current description found in 25.214 on setting the initial power of the RACH power ramping comes from ARIB volume 3. It is stated in section 5.1.1 that:

The transmitter power of UE shall be calculated by following equation:
$P_{RACH} = L_{Perch} + I_{BTS} +$ Constant value
where,
P_{RACH}: transmitter power level in dBm,
L_{Pearch}: measured path loss in dB,
I_{BTS}: interference signal power level at BTS in dBm, which is broadcast on BCH,
Constant value: This value shall be designated via Layer 3 message (operator matter).

In general, the idea is that the initial power should depend on:

- Path loss, the higher the path loss the higher the initial power. Path loss is derived from the RSCP measured on the CPICH, and an indication from the network what power that is used for transmission of the CPICH. Note that the power indicated may be different from the real power, this will bias the path loss estimate, but that can be taken care of by proper setting of the other parameters.
- The interference level at the UTRAN receiver, the higher the interference the higher initial power.
- Individual control. This provides the means to fine tune the performance of individual UEs, e.g. could one prioritise some users and let them start at higher power in the power ramping process to minimise delay.

3 Discussion and conclusion

In general, the formula to derive the initial power seems reasonable. Hence, we support the use of a formula similar to the current described. However, there are several parameters known by the higher layers needed to calculate the initial power: CPICH TX power, UL interference, constant value assigned by higher layers. Hence, instead of describing these parameters in the WG1 documentation, it is proposed to move the discussion and specification of the function to WG2, that has full knowledge of what parameters that are available via BCCH or dedicated signalling. Section 4 contains a text proposal to remove the parts related to open loop power control from 25.214. In section 5, a proposed liaison text is found, that can serve as a basis for informing WG2 of our decision and indicate that we think the final formula should be similar to the one currently described.

4 Text proposal for TS 25.214 V1.3.1

5.1.1 PRACH

~~*< Editor's note: This clause describes open loop power control scheme for PRACH. To be confirmed appropriate S documents for open loop power control, and moved this description to the appropriate S document.>*~~

~~The transmitter power of UE shall be calculated by following equation:~~

~~$P_{RACH} = L_{Perch} + I_{BTS} +$ Constant value~~

~~where,~~

~~P_{RACH}: transmitter power level in dBm,~~

~~L_{Pearch}: measured path loss in dB,~~

~~I_{BTS}: interference signal power level at BTS in dBm, which is broadcasted on BCH,~~

~~Constant value: This value shall be designated via Layer 3 message (operator matter).~~

Power control for PRACH is described in clause 6.

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5.1.2.2.1 General

The initial uplink transmit power ~~to use is decided using an open-loop power estimate, similar to the random access procedure.~~ ~~*< Editor's note: This needs to be elaborated, how is the estimate derived? >*~~is set by higher layers.

---- SNIP ----

6.1 RACH Random Access Procedure

Before the random-access procedure is executed, the UE should acquire the following information from the BCH :

- The preamble spreading code(s) / message scrambling code(s) used in the cell
- The available signatures , and sub RACH channel(s) groups for each ASC, where a sub-channel group is defined as a group of some of the sub-channels defined in **Error! Reference source not found.**, and is indicated by upper layer.
- The available spreading factors for the message part
- ~~The uplink interference level in the cell~~
- ~~The primary CCPCH transmit power level~~
- The AICH transmission timing parameter as defined in 25.211.
- The power offset ΔP_{p-m} between preamble and the message part.
- The power offsets ΔP_0 (power step when no acquisition indicator is received, step 7.3) and ΔP_1 (power step when negative acquisition is received, see step 8.3)

The random-access procedure is:

1. The UE randomly selects a preamble spreading code from the set of available spreading codes. The random function is TBD.
2. The UE sets the preamble transmit power to the initial power value Preamble_Initial_Power computed by higher layers. ~~P_{RACH} given in Section 5.1.1.~~ [~~*Editor's note: Here it is assumed that the initial power back-off is included in the "Constant Value" of 5.1.1*~~]
3. The UE implements the dynamic persistence algorithm by:

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6.2 CPCH Access Procedures

---- SNIP ----

1. N_AP_retrans_max = Maximum Number of allowed consecutive access attempts (retransmitted preambles) if there is no AICH response. This is a CPCH parameter and is equivalent to Preamble_Retrans_Max in RACH.

2. Higher layers supplies Preamble_Initial_Power which is the initial P_{RACH} = P_{CPCH} = Initial open loop power level for the first CPCH access preamble sent by the UE.

[RACH/CPCH parameter]

3. ΔP_0 = Power step size for each successive CPCH access preamble.

[RACH/CPCH parameter]

4. ΔP_1 = Power step size for each successive RACH/CPCH access preamble in case of negative AICH

[RACH/CPCH]

5. T_{cpch} = CPCH transmission timing parameter: The range of T_{cpch} values is TBD. This parameter is similar to PRACH/AICH transmission timing parameter.

The CPCH -access procedure in the physical layer is:

1. The UE sets the preamble transmit power to the value Preamble_Initial_Power P_{CPCH} which is supplied by the MAChigher layers for initial power level for this CPCH access attempt.
2. The UE sets the AP Retransmission Counter to N_AP_Retrans_Max (value TBD).
3. The UE transmits the AP using the MAC supplied uplink access slot, signature, and initial preamble transmission power.

---- SNIP ----

5 Proposed text for liaison to RAN WG2

At TSG RAN WG1#7bis the open loop power control for UTRA/FDD RACH was discussed, i.e. how to set the initial power for the preamble ramping process. The assumption up to now has been that the power is based on a path loss estimate (using information about the transmitted CPICH power, assumed to be broadcast on BCCH), an uplink interference estimate (also assumed to be broadcast on the BCCH), and a constant value that can be set by higher layer signalling.

RAN WG1 concluded that the assumed method and parameters are reasonable in general to give optimum performance on RACH with high degree of flexibility, but that the exact definition (and transportation to the UE) of the parameters included in the formula would need some elaboration by RAN WG2. Furthermore, it was concluded that instead of making all these parameters visible on L1, a clearer split of the layers is obtained if the actual calculation is done in the higher layers and that L1 is only informed about the final value of the initial power to use in the RACH procedure described in TS 25.214. Hence, RAN WG1 would like to ask RAN WG2 to specify the details of the open loop power estimate for RACH and CPCH access procedures. L1 is directly involved in this calculation only by reporting to higher layers the RSCP measured on the CPICH.

Following the decision in RAN WG1, TS 25.214 has been updated in sections 5.1.1 and 6. It is now assumed that higher layers computes the parameter Preamble_Initial_Power that is set as the power for the first preamble transmission.

A similar estimation is performed when uplink dedicated channels are setup. Also specifying this estimation would fall under WG2's responsibility.