TSG-RAN WG1 meeting #20 **R1-010481**
Pusan, Korea
May 21 – 25, 2001

Agenda item: **9.2**
Source: **Rapporteur, Golden Bridge Technology**
Title: **Email Discussion Report on DL Probe Procedure for Open Loop Power Control for FACH**
Document for: **Information**

Introduction

At RAN1#19, Golden Bridge Technology briefly presented R1-010322 which is a LS from RAN2 to RAN1 asking RAN1 to discuss a new proposed Layer 1 DL Probe procedure and to provide responses to a short list of questions. The DL Probe Procedure provides timely DL channel path loss estimates just prior to FACH transmission and decreases the required FACH transmit power.

Due to lack of meeting time, RAN1 did not consider the details of the DL Probe Procedure and did not respond the the RAN2 LS. It was decided to begin the discussion of the DL Probe procedure on the email reflector. GBT agreed to kick off the discussion and to act as rapporteur.

Report:

On March 21, GBT kicked off the email discussion by circulating the RAN2 LS and explicitly listing the questions RAN2 is asking RAN1 to discuss. The RAN2 LS contains R2-010341 which is a tdoc describing the DL Probe procedure and its usefulness for improved OLPC FACH.

On April 12, Antti Toskala started the discussion by circulating several relevant questions concerning DL Probe procedure. Antti further noted that tdoc R2A010007 which was referenced in R2-010341 was not available to RAN1.

On April 20, Joe Kwak responded to Antti's questions. The questions and summary answers are listed here. The complete transcript of the discussion is included here as Annex A.

Q1. What is perfect open loop power control (OLPC) for FACH?
A1: Perfect OLPC assumes that the Node B has correct information about the DL channel condition to the intended UE just prior to selecting an OLPC level for the FACH. In this way, FACH power level may be set to minimum required for DL channel condition, without power margin for old channel information or inaccuracies in channel information.

Q2. What is imperfect OLPC for FACH?
A2. Imperfect OLPC is implemented in real-world systems where the Node B has old or inaccurate information about the DL channel condition when selecting the OLPC level for transmission to the target UE. In imperfect control situations, the Node B must add power margin to the OLPC level for FACH to compensate for drift in channel condition (due to delay) and measurement inaccuracy.

Q3. How is the 2-3 frame DL Probe procedure delay derived?
A3. The 2-3 frame period is a reasonable target for delay. Actual delay is a function of the Delta P parameters in the DL Probe procedure.

Q4. What is the variance of the expected DL Probe procedure delays?
A4. The expected variance has not been analyzed, but it is related to the Delta P parameters used for the DL Probe procedure.

ANNEX A: Transcript of Email Discussion of DL Probe Procedure

1. . March 21, Discussion Kick-off:

Hello all,

Because we ran out of time at the last RAN1 meeting in Las Vegas, we were not able to discuss the attached LS (R1-010322) from RAN2 which asks RAN1 opinion on a new proposed Layer 1 procedure which probes DL to determine minimum transmit power. The RAN2 proposal (R2-010341) is embedded in the LS and contains a more detailed description of this DL Probe procedure.

Overview of DL Probe procedure:
Signalling messages coordinate the use of reserved RACH codes and signatures between Node B and selected UE. UE uses a normal RACH preamble ramp up with signature#1 until it detects an AICH_ack from the Node B. When the NODE B detects the RACH preamble, it responds with an AICH_ack at broadcast power level. Then the Node B continues to transmit a sequence of AICH_acks (in every third or fourth slot), but steps down the power of the AICH_ack at each transmission. When the UE detects each AICH_ack, it responds by sending a RACH preamble with signature#2 with a smaller power step increase. When the UE does not detect an AICH_ack in the expected slot, the UE sends a RACH preamble with signature#1, again with the smaller power step increase. As the Node B steps down the tranmsit power of the AICH_ack, it receives confirmation of UE detection of each AICH_ack by means of signature#2 used by the UE in the following preamble. When the UE cannot detect the AICH_ack (tranmsit power level is below the minimum needed for detection), UE signals this to Node B by using signature#1. At this point Node B begins ramping up the AICH_ack power level with a smaller step size until the AICH_ack is again detected by the UE. The procedure ends when the Node B transmits an AICH_nak to the UE or after a maximum number of preamble/AICH cycles.

The Layer 1 DL Probe procedure is described further in Figures 3 and 4 in R2-0101341 which is included in the attached LS.

Specifically RAN2 would like to ask RAN1 opinions:
1. Is there a benefit in using such a DL probe procedure to decrease the transmit power of an OLPC FACH message?
2. Are there system capacity or interference reduction or other benefits to be gained by using this proposed DL probe procedure?
3. For what RF channel conditions, i.e. channel fading rates, would these benefits be expected?
4. Is the described DL probe procedure feasible from RAN1 perspective?
5. Are there any negative impacts of the proposed DL probe procedure?

Please use this email discussion to clarify understanding of this procedure and to circulate views concerning responses to the RAN2 questions above. To participate, please start subject line with [DL Probe for OLPC FACH].

2. **April 12, Antti Toskala circulated some relevant questions.**
3. **April 20, Joe Kwak provided responses to Antti's questions**
   Joe Kwak's responses including Antti's questions are listed here.

Dear Antti and other RAN1 colleagues,

Thank you for the questions concerning the proposed Downlink Probe procedure which is for email discussion in RAN1. This new Layer 1 procedure is proposed for consideration as part of the Study Item for Improved Common Downlink for Cell-FACH state.

My responses are included below.

Best regards,
Joe Kwak

At 02:27 PM 4/12/01 +0300, Toskala Antti wrote:
>Dear Joe,
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>Thanks for initiating the email discussions:
>
>I have a few questions that would help understanding the proposal and
>comparison.
>
>1. What is your definition of
>a) Perfect OLPC for FACH

In the R2-010341 tdoc under discussion, perfect OLPC for FACH is based on the ideal assumption that the Node B and RNC have accurate and correct knowledge of the downlink channel condition at the point in time when the DL OLPC level is chosen for FACH transmission. In this way a fixed FACH power level may be chosen to provide the intended QOS without extra power margin.

>b) Imperfect OLPC for FACH

Imperfect OLPC does not have this perfect knowledge of the downlink channel condition when the FACH OLPC level is selected. In a practical system, the UE measurements of CPICH RSCP provide imperfect information about the downlink channel condition. The measurements may not be accurate (+/- 6-9 db) and the reported measurement may be upto 1.4 seconds old (600 msec measurement period in UE + upto 800 msec reporting delay). As a result, RNC/NodeB must add power margin to the OLPC level for FACH to compensate for drift in channel condition (due to delay) and measurement inaccuracy.
>
>2. How is the probe procedure delay (2-3 frames?) derived? What is the
>expected variance of that?
>(Min and Max actually)

The 2-3 frame period for execution of the Downlink Probe procedure is felt to be a reasonable target range. The example presented in R2-010341 is 4 frames long based on a 3-slot AP cycle. The duration of the procedure is dependant on the power level starting points for the AP and AICH ramps and on the power step parameters, Delta P1 through Delta P4. I have no calculations for expected variance of this period. The variance for intitial AP reception can be minimized by selecting larger power step sizes for Delta P1. The variance for intial loss of AICH reception can be minized by selecting larger steps for Delta P3. The variance for recapture of AICH reception would be [Delta P3/Delta P4] in units of AP cycles. RAN1 should consider this aspect when responding to the RAN2 questions.

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>BR: Antti Toskala
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>PS. I would be beneficial propably to have the cited reference from some WG2
>Ad Hoc on the performance results to be provided for the next WG1 meeting so
>that we have all the refenced papers available.

Good point. I have attached the referenced adhoc paper, R2A010007, with this message.