3GPP TSG-RAN Meeting #24 **RP-040243**

Seoul, South Korea, 2 - 4 June 2004

Source: Nokia

Title: Measurement rules

Agenda Item: 7.3.2

Document for: Discussion and decision

1 Introduction

This document discusses some of the implications of CRs [1] and [2] and consequences of the usage of $S_{intrasearch}$ parameter. It proposes a solution for the related problems.

In addition, the HCS case is clarified and a proposal for clarification is made.

2 Discussion

In the CRs [1] and [2] RAN2 agreed the following changes to the measurements rules of a non-HCS network, which were originally defined for allowing UE battery savings in idle mode, CELL_PCH and URA_PCH states.

2.1 Impacts of New Cell Reselection Criteria

Measurement rules for cell re-selection when HCS is not used

If the system information broadcast in the serving cell indicates that HCS is not used, then for intra-frequency and inter-frequency measurements and inter-RAT measurements, the UE shall:

- *use Squal for FDD cells and Srxlev for TDD for Sx and apply the following rules.*

1. *If Sx > $S_{intrasearch}$, UE ~~need~~ may choose to not perform intra-frequency measurements.*
   If Sx <= $S_{intrasearch,}$ perform intra-frequency measurements.
   If $S_{intrasearch,}$ is not sent for serving cell, perform intra-frequency measurements.

2. *If Sx > $S_{intersearch}$, UE ~~need~~ may choose to not perform inter-frequency measurements. Inter-frequency measurements that may have been performed shall not be considered in the cell-reselection criteria.*
   If Sx <= $S_{intersearch}$, perform inter-frequency measurements.
   If $S_{intersearch}$, is not sent for serving cell, perform inter-frequency measurements.

3. *If Sx > $Ssearch_{RAT\ m}$, UE ~~need~~ may choose to not perform measurements on cells of RAT "m". Inter-RAT measurements that may have been performed shall not be considered in the cell-reselection criteria.*
   If Sx <= $Ssearch_{RAT\ m}$, perform measurements on cells of RAT "m".
   If $Ssearch_{RAT\ m}$, is not sent for serving cell, perform measurements on cells of RAT "m".

Now these measurement rules are also new cell reselection rules, which should be applied in all RRC states including CELL_FACH in order to have the same UE cell reselection behaviour in all RRC states. This means relaxation to the UE neighbour measurement requirements in TS25.133. Currently TS25.133 requires that the UE continuously measures neighbour cells in CELL_FACH state but due to this change in TS25.304, neighbour cells measurements would no longer be required unless the measurement rules define so. As the wording above determines, UE shall not use measurements for re-selection, it is obvious that these will change current UE behaviour to worse in CELL-FACH state. This naturally allows worse performance for neighbour cell identification and level measures without giving any clear benefit in terms of battery saving since the UE anyway has to continuously receive S-CCPCH.

Some networks would like to set $S_{intrasearch}$ to maximise battery saving although the additional power saving of the intra-frequency measurement rules compared to inter-frequency measurements or inter-RAT measurements is minimal. The consequence is that the UE may not be in the optimum cell in terms of radio propagation conditions, especially if $S_{intrasearch}$ is set so that intra-frequency measurements are initiated too close to the edge of the cell. Therefore, in CELL_FACH the RACH transmissions may cause additional UL interference on neighbouring cells.

One simple solution would be to clarify that this parameter is not applicable in CELL_FACH. However, this would mean that during CELL_PCH-CELL_FACH state transitions, the UE could move from a non-optimum cell to the optimum cell (depending on reselection parameters) and perform cell re-selection before completing the Cell Update procedure, thus causing unnecessary delays to the state transition.

2.1.1 Usage of $S_{intrasearch}$

As a compromise, we could agree that the best solution is to keep this minor additional power saving feature for Idle mode, but avoid delays in state transition and the UL interference problems, by not making it applicable to connected mode. This naturally implies that the limitation is also applicable to URA_PCH state, where it is not needed. However, we believe that significant power saving is achieved from the inter-frequency and inter-RAT measurements rules and therefore the limitation would be acceptable. Considering that this would be a departure from the current specification, we would suggest solving this case by only allowing the setting of this parameter in SIB 3 (i.e. not in SIB4). This could be simply noted as an advisory note in the meeting minutes.

2.2 Alternative to New Cell Reselection Criteria

It is not clear from [1] and [2] whether RAN2 analysed all the consequences that these agreed CRs may have to the RAN4 requirements and whether some alternative solutions using the existing cell reselection criteria would exist to avoid the ping-pong problem between different frequencies or RATs. Originally the $Qoffset_{s,n}$ parameter was defined to avoid unnecessary cell reselections by favouring certain cells. Typically the same $Qoffset_{s,n}$ value should be given for all the cells on a certain frequency or inter-RAT since the UE should be camped on a cell, which is the best in terms of radio conditions, on a given frequency layer. Therefore, it should not be necessary to set cell specific Qoffset parameters but instead only one per measurement type (i.e. intra-frequency, inter-frequency and inter-RAT). It is of our understanding that this alternative wasn't fully exploited during the discussion in RAN2

2.3 HCS

Additionally, the HCS case is not fully covered in the CR. The intention of the HCS measurement rules has also been to allow power saving in the UE. However, for the intra-frequency and inter-frequency HCS measurement rules it has not been clarified in the CRs that the UE may measure more than what is the minimum requirement by the measurement rule. For instance the following clarification should be made:

1. *For intra-frequency and inter-frequency threshold-based measurement rules*

   use Squal for FDD cells and Srxlev for TDD cells for Sx and apply the following rules.

   IF ($Srxlev_s$ <= $Ssearch_{HCS}$) or (if FDD and S_x <= $S_{intersearch}$) THEN

   the UE shall measure on all intra-frequency and inter-frequency cells

   ELSE

   IF (S_x > $S_{intrasearch}$) THEN

   the UE shall measure at least on all intra-frequency and inter-frequency cells, which have higher HCS priority level than the serving cell unless measurement rules for fast-moving UEs are triggered

   ELSE

   the UE shall measure at least on all intra-frequency and inter-frequency cells, which have equal or higher HCS priority level than the serving cell unless measurement rules for fast-moving UEs are triggered

ENDIF

ENDIF

As defined from the $S_{limit,SearchRATm}$ of inter-RAT HCS measurement rules, the UE is not required to measure any Inter-RAT cells (not even higher priority), unlike in the measurement rules of intra/inter frequency HCS case. Therefore, for the scenario where cells on another RAT have the same HCS priority as the current serving UTRA cell, it is necessary to make the UE behaviour consistent with the non-HCS case. Hence, there is a slight difference between intra/inter-frequency HCS measurement rules and inter-RAT HCS measurement rules and cell reselection criteria.

The measurement rules clarification should still be made to the inter-RAT HCS measurement rules as well.

1. *Inter-RAT threshold-based measurement rules*

   use Squal for FDD cells and Srxlev for TDD cells for Sx and apply the following rules.

   IF ($Srxlev_s$ <= $S_{HCS,RATm}$) or (if FDD and S_{qual} <= $S_{SearchRATm}$) THEN

      UE shall measure on all inter-RATm cells

   ELSE

      IF (S_x > $S_{limit,SearchRATm}$) THEN

         UE ~~need~~ may choose to not measure neighbouring cells in RAT "m". ". Inter-RAT measurements that may have been performed shall not be considered in the cell-reselection criteria.

      ELSE

         UE shall measure at least on all neighbouring cells in RAT "m", which have equal or higher HCS priority level than the serving cell unless measurement rules for fast-moving UEs are triggered

      ENDIF

ENDIF

3 Conclusions

In order to avoid revising the approved CRs in the next meetings it would be good to consider all the related cell reselections issues at once. It should be understood and agreed on whether the impacts, that the CRs in [1] and [2] have on the RAN4 UE requirements, are acceptable. Furthermore, the HCS case should fully be covered in the 2 CRs to TS25.304 in order to ensure that the HCS cell reselection is not broken in the specifications.

The conclusions can be summarised as follows:

1) All changes to cell reselection criteria should be agreed in the same CR. The HCS case should be corrected as discussed above.
2) It should be understood that the CRs in [1] and [2] require changes to the UE requirements in 25.133 -> The corresponding CRs to 25.133 need to be made.
3) It should be recommended that $S_{intrasearch}$ is not used in connected mode.

4 References

[1] R2-041147
[2] R2-041148