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Agenda item: AH17
Title: Statement on the inclusion of TA-IPDL for support of LCS
Source: Motorola
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Motorola has carried out significant work over the last six weeks to try to align their IPDL simulation results with those submitted by Ericsson. We have analysed the comments from the last WG1 meeting, optimised the simulator for the IPDL method and also ironed out some problems in the simulator itself.

Through this work we have significantly improved on the standard IPDL results we submitted in November, although the performance of TA-IPDL is still noticeably better.

The results for the five environments using the agreed simulation parameters are listed in tables 1 and 2.

Environment	67% error	95% error
Rural	13 m	153 m
Suburban	11 m	330 m
UrbanA	138 m	353 m
UrbanB	73 m	289 m
BadUrban	199 m	553 m

Table 1 Network simulator results for IPDL

Environment	67% error	95% error
Rural	7 m	14 m
Suburban	5 m	10 m
UrbanA	61 m	170 m
UrbanB	30 m	84 m
BadUrban	136 m	320 m

Table 2 Network simulator results for TA-IPDL

Scenario	67% error	95% error
IPDL, UrbanA, no MPR, no weights.	154 m	377 m
TA-IPDL, UrbanA, no MPR, no weights.	102 m	246 m
IPDL, UrbanA indoor	168 m	362 m
TA-IPDL, UrbanA indoor	67 m	201 m
IPDL, UrbanA 1km cell radius	210 m	661 m
TA-IPDL, UrbanA 1km cell radius	97 m	321 m

Table 3 Network simulator results for other scenarios of interest

Also included are three further scenarios:

- UrbanA environment simulation run with no multipath rejection or weighting of TOA estimates in the fixing algorithm.
- UrbanA indoor, a scenario not yet investigated but of importance since such a high percentage of calls is made indoors.
- UrbanA BTS separation 2 km, an attempt to see what happens in a network which does not have such a densely packed population of BTSs.

There is no disagreement over the fact that the C/(I+N) ratio for signals received by a handset in a UMTS network during location measurement collection is higher for TA-IPDL than for IPDL. This has three important implications:

- TOA estimation is more accurate in better C/(I+N) conditions.
- More BTSs will be visible to a mobile if the C/(I+N) conditions are better.
- Multipath rejection is more effective in better C/(I+N) conditions.

All these factors contribute to TA-IPDL giving a higher accuracy than IPDL. This is visible in the results both for interference limited scenarios as well as in indoor locations.

The impact on handset complexity is another area where there is an advantage in using TA-IPDL. In TA-IPDL each BTS will transmit the pilot typically 30% of the time, during the idle period. If this is signaled to the mobile in advance, then the mobile will only need to perform 30% of the processing required by IPDL, regardless of what post collection processing is done. This will be especially important for operation in idle mode.

A possible additional reduction in handset complexity might be obtained if the approximate size of the cell is transmitted to the mobile, or if the range of the mobile from the BTS is known. It is the geographical uncertainty of the position of the mobile that defines the window over which correlation must be performed for the TOA estimation process. If the mobile does not know the cell size, then correlation must be performed over a time window that allows for the maximum cell size possible. The potential saving is large as the following example illustrates:

The largest cell size in a network may be 20km. Therefore, the search window used by the mobile in processing of location measurements must be approximately 65 microsecond and must be applied all of the time. If however, the mobile is signaled that the cell radius is 500m (or the range of the mobile is available from e.g. RTT) then the search window can be reduced to approximately 2 microseconds. This means that the processing required by the mobile can be reduced by a factor of 33.

As far as we are aware, part of the post processing of signals in IPDL requires that a large search window is used. Therefore, such a technique to reduce handset complexity as explained above could reduce the accuracy of IPDL.

In general, additional signalling is required when the TA configuration is activated by the network. However, the additional Iub and Iur signalling is low (a document discussing this aspect has been submitted to WG3). There is also some additional signalling to mobiles to account for knowledge of the timing of idle periods in TA mode.

In conclusion, the question of whether TA-IPDL should be included at all is still open. We believe that the level of improvement in positioning performance (including indoor environments), combined with reduction of handset complexity outweighs the small added complexity in the network, and qualifies TA-IPDL to be included as a specific configuration of IPDL. However, Motorola do not wish to delay the standardisation process for LCS in release 99, and therefore welcome further discussion to resolve this issue.