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**Draft Report
of
3GPP TSG SA workshop on UE in idle mode
7 – 8 February 2001**

Chairman & Secretary: Niels Peter Skov Andersen, Motorola A/S

# 1	Opening of the meeting

The workshop was held to review and address PLMN selection, cell selection and handovers from a requirements and functional point of view. The meeting was hosted by Nokia in Helsinki and chaired by the 3GPP TSG SA chairman Niels Peter Skov Andersen, Motorola.

# 2	Approval of the Agenda

Tdoc SAHI-010001: Draft Agenda

The chairman introduced the draft agenda, which was approved.

# 3	Review of PLMN selection and Initial Cell selection

## 3.1	Review of existing requirements and functionality

Tdoc SAHI-010009: LS on PLMN Selection and Re-selection Issues

In this liaison statement from 3GPP TSG CN WG1 (CN1) to 3GPP RAN WG2 (RAN2), CN1 indicates that CN1 share's RAN2's concerns on the amount of time it may take the mobile to search through several technologies before finding the HPLMN or other PLMNs. Therefore, CN1 suggests that some of the issues listed by RAN2 in their original liaison statement ought to be left open to implementation, thus allowing for innovative methods of searching for PLMNs. The liaison statement further provides answers to a number of detailed questions raised by RAN2.

In relation to answer number 2 in the liaison statement, it was remarked that the requirement in 3GPP TS 23.122 for the case where no preferred RAT for the last registered PLMN is available, that GSM bands

shall be searched first, seemed to be in contradiction with the "stored list principles" for, e.g., BA list and BA range. It was noted that Tdoc SAHI-010012 dealt with this requirement and the issue was handled together with Tdoc SAHI-010012 later in the meeting.

Further the status for the specification of the "high signal quality" criteria used in the Automatic PLMN selection procedure (3GPP TS 23.122 section 4.4.3.1.1) was questioned. It was explained that 3GPP TSG CN WG1 at their last meeting had been informed that TSG RAN did not expect to be able to differentiate between PLMNs with suitable cells and PLMNs with "high signal quality" cells. On this background 3GPP TSG CN WG1 had elaborated a change request to 3GPP TS 23.122 section 4.4.3.1.1, so this the "high signal quality" criteria only is applicable to the GSM access technology and the criteria always fulfilled for the case of UTRA, ie. step v) in 3GPP TS 23.122 only applicable to GSM.

The meeting understood the difficulties in using, e.g., Ec/Io or signal strength as criteria for a CDMA system. However, it was remarked that having this difference between the Radio Access Technologies could lead to an undesired preference for PLMNs with UTRA, even in cases where the UTRA cells where hardly usable and other PLMNs providing good GSM coverage. On this background it was recommended that the same concept was used for all Radio Access Technologies in the case of multi-mode. It was noted, that the usage of "high signal quality" (GSM RXLEV >– 85 dBm) originally was introduced to avoid networks increasing signal levels unnecessarily at airports, borders and other places where roamers where expected to enter the Country/PLMN. On this background a clear preference for maintaining this principle also for dual-mode was expressed. It was felt that with clarification of the background for the "high signal quality" criteria, TSG RAN might be able to find a usable criteria. If this still not is possible then for multi-mode the behaviour across Radio Access Technologies should be aligned, ie., the "high signal quality" disabled.

It was agreed that 3GPP TSG RAN WG2 and WG 4 should pursue the definition of a "high signal quality" criteria and 3GPP TSG CN WG1 should withdraw the elaborated changes to section 4.4.3.1.1 of 3GPP TS 23.122 and elaborate changes to item v) of the section removing the requirement for comparison across technologies. If it shows impossible for 3GPP TSG RAN to define the "high signal quality" criteria, then the action would be for multi-mode to fully disable the "high signal quality" criteria, e.g., by using a – 110 dBm limit for GSM instead of the –85 dBm limit.

Tdoc SAHI-010007: Discussion paper on PLMN selection times in UTRA

This paper briefly discusses some aspects of the current specification with regard to the total time to camp on a UTRA cell of the selected PLMN. It then describes some ways in which the UE may speed up its search time and some potential implications of such techniques, particularly with regard to border regions. The paper concludes, that in cases where a UE's last registered PLMN is not available, the UE has to do an exhaustive search across all UARFCNs in the band and this introduces a long delay in the time to register on a PLMN. It is possible to speed up the exhaustive search by making some assumptions about UARFCNs, but in some cases, particularly border regions, these assumptions could mean that the UE misses some available PLMNs. This paper attempts to provoke some discussion of what it is acceptable for a UE implementation to assume. Following discussion it is recommend that clarifying text is added to the specifications.

During the discussion it was not possible to find any specification of the subset of UARFCN which needs to be supported when a UE claims to support a given frequency band. This neither for the UARFCNs to scan nor or those where the RF specification is required to be met. Considering that it is important to have this specified, *it was agreed that the UARFCN to be supported for a given frequency band needs to be specified, e.g., in 3GPP TS 25.101, 3GPP TS 25.102, 3GPP TS 25.104 and 3GPP TS 25.105. Motorola volunteered to provide the necessary change requests to 3GPP TSG RAN WG4.*

The meeting felt that it is not possible for UE to make any assumption amount center frequencies by assuming, e.g., a 5 MHz carrier spacing as this can not be considered future proof and some countries might have slightly offset allocations within the bands.

On the question of whether the search for PLMN shall take more than the strongest cell into account, it was found that other carriers shall be taken into account. *In addition to the need for clarification of potential ambiguities it was also felt that references to other specifications needed to be checked. France Telecom volunteered to draft the necessary change requests.*

Generally, it was noted that the border case needs to be supported by the UE and therefore the implementation can not assume that if one PLMN is found on a frequency, no other plmn can be found on that frequency. Further it was discussed it there is a need to speed up the process for the UE to detect that the current registered PLMN is not available. It was the feeling of the meeting that any such attempt would not lead to better performance seen from the user perspective, as the search for HPLMN or alternative PLMN would require the full scan anyhow.

Finally, the storage of "BA_RANGE like" information was briefly discussed. The meeting felt that such information could be stored in the UE and future changes thus not requiring changes to the SIM/USIM.

3.2   Review of requirements and functionality for future release

Tdoc SAHI-010008: LS on Enhancement of CPHS Network Operator Name Feature for 3G R4

This liaison statement from 3GPP TSG T to 3GPP TSG S1 raises a number of question in relation to potential control of the name displayed on ME/UE while registered to a network. The liaison statement had been seen by 3GPP TSG CN WG1 and was provided to the meeting as background information for the answer from 3GPP TSG CN WG1 in Tdoc SAHI-010010.

Tdoc SAHI-010010: Response to LS "Enhancement of CPHS Network Operator Name Feature for 3G R4"

This liaison from 3GPP TSG CN WG1 to 3GPP TSG SA WG1 and 3GPP TSG T WG3 provides comments to the liaison statement in SAHI-010008. The liaison statement provides a first analysis of the proposals compatibility with the 3GPP TSG CN WG1 specifications. The main concern is related to the consequences if HPLMN is stored on the SIM/USIM with multiple MCC+MNC codes as the GMM/MM specifications clearly considers a HPLMN as being identified by a unique MCC+MNC.

THe meeting noted the liaison statement. It was remarked that most of the functionality proposed by 3GPP TSG T WG3 probably already could be provided by the NITZ service. Further, it was noted that changes in this area ought to cover both the case of traditional service provision as well as of virtual network operators with their own MCC+MNC. Finally, it was noted that it seemed important to maintain some kind of indication of the actual country to the user, as this might impact the numbering plan, emergency calls and charging.

Tdoc SAHI-010002: Periodic Scan for preferred PLMNs

The contribution indicates, that the current methods for ensuring a subscriber attains service with a preferred PLMN as determined by the subscriber or the home operator if such service is available are not very effective. The contribution suggests modifying the periodic search procedures for the HPLMN, which

occur when the UE is in idle mode on a VPLMN in the home country. These periodic searches are proposed to occur whereever a higher priority PLMN may be available and should include a search for any such higher priority service provider.

The contribution was presented together with Tdoc SAHI-010005, Tdoc SAHI-010006 and Tdoc SAHI-010011. The discussion is reported after Tdoc SAHI-010011.

Tdoc SAHI-010005: PLMN selection

The contribution states that even though basic PLMN selection requirements and procedures had been agreed at the Workshop on Handover and Cell Selection on 9th and 10th of June 1999, discussions in this area have been going on ever since. The contribution identifies a number of scenarios, which subsequently is analysed in relation to the current specifications. Further the document proposes to introduce a function, which allows the operator to instruct the UE to regard multiple MCC/MNC combinations as a single PLMN for idle mode purposes.

The contribution was presented together with Tdoc SAHI-010002, Tdoc SAHI-010006 and Tdoc SAHI-010011. The discussion is reported after Tdoc SAHI-010011.

Tdoc SAHI-010006: Support of multiple HPLMN codes for PLMN selection

This contribution indicates that the specifications for GSM and for GSM/UMTS R99 support only a single HPLMN code for PLMN selection, i.e. only a network that broadcasts a PLMN identity identical to the PLMN code included in the IMSI is regarded by the UE as an HPLMN. The HPLMN is treated in a special way by the UE during PLMN selection. The HPLMN has highest priority and if the UE is in a VPLMN of its home country (MCC of current cell is the same as the MCC of IMSI), the UE will search periodically for the HPLMN code. Further the contribution states that this was relevant for the licensing and operator situation when GSM was designed at the end of the eighties. Today the licensing and operator situation is completely different. Therefore the contribution suggests that a HPLMN can be identified by multiple PLMN codes (MCC+MNC).

The contribution was presented together with Tdoc SAHI-010002, Tdoc SAHI-010005 and Tdoc SAHI-010011. The discussion is reported after Tdoc SAHI-010011.

Tdoc SAHI-010011: PLMN selection

This contribution aims of summarising scenarios and solutions identified, in relation to PLMN selection, either in other contributions to the 3GPP TSG SA workshop on UE in idle mode or in various E-mail debates in the period leading up to the workshop. In addition reference to some of the background for the choices in the current solutions are made where felt helpful.

The contribution was presented together with Tdoc SAHI-010002, Tdoc SAHI-010005 and Tdoc SAHI-010006.

First the proposals for introduction of a background search for preferred PLMN of higher priority was discussed. There was a general agreement in the meeting that currently the preferred list did not work in an optimum way and a background search for PLMNs of higher priority could be done as in the same way as currently specified for HPLMN search and based on the same timer. Further, it was found that due to the potential border problems especially in Europe, it was suggested and agreed to limit the background

scan to PLMNs of the same country as the current registered to and received PLMN. Here it was noted that the requirement should be the same country and not the same MCC as some countries have more than one MCC allocated. Also it was agreed that for the purpose of the background scan only PLMN code on the preferred list is to be taken into account not the RAT. Moreover it was noted that this was a lower priority task, ie. the UE should give priority to paging etc. During the discussion it was noted that a UE might stay connected in URA_PCH state and CELL_PCH state for very long time and thus these condition could be considered as comparable to idle mode. It was agreed that the concept of the background scan is that it is to be perform when the UE has no other important task to perform. *3GPP TSG RAN WG2 was asked to check if the situations where the UE is connected in URA_PCH State and CELL_PCH state can be included in the cases where the background scan for HPLMN or higher priority preferred PLMN are performed. Nokia volunteered to draft the necessary changes to introduce the background scan for higher priority preferred PLMNs.*

The discussion continued with the proposals for handling the problems related to case where more than one MCC+MNC has been allocated to networks which towards the user is to look as one network, e.g., the case with a common 3G network and two independent 2G, where the subscribers are belonging to either of the 2G network operators. It was concluded that the solution based on at location update to download a list of MCC+MNCs, which are to be considered the PLMN with respect to PLMN selection, cell (re-)selection etc., seemed to resolved the problems and provided more functionality end the solution with multiple MCC+MNCs for the HPLMN and also avoided some of the problems identified by 3GPP TSG CN WG1 for that case.

It was agreed, that the downloaded list of MCC+MNCs for the PLMN was to be stored in the UE until next location update, which then overwrites the information. In the case of a location update not providing any information, that should count as deletion of the list. The information should also be stored at switch off and thus count in the search for the last registered PLMN. It was noted that the number of entries in the list do not need to be very large as only other PLMN codes used in the close vicinity of the Location areas needs to be downloaded.

It was clarified that to obtain the interworking between two networks, e.g., cell re-selection, not only the download of PLMN codes needs to be implemented, but the rest of the networks needs to be coordinated as the case for one PLMN, e.g., neighbour list, colour and scrambling codes etc.

It was clarified that in the case of user re-selection of PLMN the individual PLMN-codes still counts as individual PLMNs. However, when the PLMN is selected downloaded list is used irrespectively of whether manual or automatic PLMN selection is in use.

Further, it was clarified that the normal roaming restriction would still work, as cells in another PLMN (different MCC+MNC) would be seen as belonging to a different location area and thus a location update will be performed. At the location update the UE could be rejected with the usual rejection causes, e.g., PLMN not allowed in which case the the PLMN is put on the forbidden list and removed by the UE from the downloaded list of MCC+MNCs. It was noted that generally any MCC+MNC on the forbidden PLMN list should be removed by the UE from the downloaded list immediately at reception before storage in the UE. It was noted that some care was needed when making the specification to ensure correct handling of partial rejection causes such as the case where, e.g., only CS service are allowed. Also it was noted that proper error handling be specified for the case where the function is only made optional in Release 99. Finally, it was noted that preconfigurations need to considered and the NITZ service might need a review to ensure proper interworking.

It was agreed to suggest the multiple MCC+MNC changes as for Release 99 as an essential correction for the work item GSM-UMTS interworking. This because some operators would request this feature implemented in all mobiles they purchase and the fact, that dual-mode operation does not work in the scenarios of two 2G operators sharing a 3G network, two 3G networks sharing a 2G network and the case of an operator which for regulatory reasons have been allocated different PLMN codes for the 2G and 3G access.

In order to rapidly progress the elaboration of the necessary changes it was agree that a stage 2 description should be elaborated and reviewed over the reflectors as quickly as possible. Also it was noted that the most important was to cover the Um interface and the UE behaviour, as more sophisticated network functions for utilization of the concept could always be included later versions of the standard.

It was found that the main part of the work would be related to 3GPP TSG CN and especially WG1 hereof, as clearly 3GPP TS 24.008 and 3GPP TS 23.122 would need to be modified. But also TSG SA WG1, TSG RAN WG2 and WG3 and TSG GERAN will be involved as most likely 3GPP TS 22.011 and 3GPP TS 22.101 would be impacted and 3GPP TS 45.008 (05.08 in Release 99) and 3GP TS 25.304 needs to be checked and potentially updated. It was agreed to try to find an overall coordinator/rapporteur to ensure that all areas are covered.

Finally the issue of RAT dependent rejection was discussed. It was noted that even if two RAT was separated by Location Area, it would still not provide the correct solution if, e.g., roaming was only allowed to the one RAT of the network. This because the two possible rejection causes #12 and #13 would either make UE stay in the location area without service or make the UE perform a PLMN selection. However, if the earlier discussed solution for the problems of using different PLMN codes for different RATs in one network is adopted, then for a operator wanting to be able to have differentiated access rights to different RATs, the solution could be to use different PLMN codes for the different RATs. On the other hand it would provide a better flexibility, if new reject causes allowing to reject the access to one RAT. It was agreed that it was not essential that the meeting found a recommendation on this issue as it seemed only to impact on 3GPP TSG CN specifications. However, it was noted that if new reject cause values are introduced proper care to cover all combinations needs to be taken, to avoid situations similar to those recently discovered in relation to GPRS roaming.

Tdoc SAHI-010012: PLMN selection procedure

This contribution questions the requirement in 3GPP TS 23.122 version 3.5.0 section, that *at switch on, the MS selects the registered PLMN (if it is available) using all access technologies that the MS is capable of and attempts to perform a Location Registration. The MS shall start its search using the access technology type stored in the "RPLMN Last Used Access Technology" data field on the SIM. If the "RPLMN Last Used Access Technology" is not available then an MS capable of GSM access technology shall start its search using GSM access technology.*

After a short discussion it was found that it not in line with the ideas of the 3GPP TSG RAN and #GPP TSG GERAN specifications to specify that the UE shall start searching for the last registered PLMN using a specific radio access technology, e.g., the one stored in the "RPLMN Last USED Access Technology" data field on the SIM/USIM. This as the radio access network specification makes provision for more intelligent searches based on neighbour list and ranges for BCCH etc. provided during the usage of the PLMN. *It was therefore agreed to in 3GPP TS 23.122 delete requirement on the order the UE shall search the radio access technologies, when searching for the last registered PLMN at switch on or return from lack of coverage. It was agreed to keep the specification, that GSM Compact is only required to be performed, if indicated GSM Compact is indicated as last used access technology. It was noted that it did not look like 3GPP TS 22.011 needed to be updated but a detailed check should be performed. Further, it was agreed that in the SIM and USIM specifications from 3GPP TSG T WG3 it should be indicated that the data field "RPLMN Last USED Access Technology" only had relevance in the case of GSM compact. Samsung volunteered to draft the necessary changes and perform the required checking.*

Tdoc SAHI-010013: Brief summary of PLMN selection principles

The document was covered by the discussions of other documents.

4 Review of Cell selection and re-selection

4.1 Review of existing requirements and functionality

Tdoc SAHI-010003: Correction in behaviour of the UE when cell reselection fails in UTRAN

This contribution indicates that there might be missing specification of the behaviour for the case that the serving cell and all the cells in the neighbour list becomes not suitable. The contribution suggests specifying that in this case the full frequencies and all radio access technologies are searched.

The meeting agreed that this should be the correct behaviour, however it was the feeling that this already was covered as this is to considered as a case of return from lack of coverage. Which are specified and results in exact the desired behaviour. It was concluded that the specification should not be duplicated, but instead checked to ensure it is clear that this situation corresponds lack of coverage.

During the discussion it was noted that in there was an error in the definition of suitable cell in 3GPP TS 25.301, as it does not reference the correct list of forbidden Las for National Roaming. Vodafone volunteered to correct this.

Tdoc SAHI-010004: Correction in Any Cell Selection State

This contribution suggests that in the Any Cell Selection State should not be separated in a case for UTRA and a case for GSM. It suggests to have a common description based on the current specification for UTRA.

The meeting found the proposal acceptable, but due to the fact that emergency calls might be performed in this stated, agreed to add a requirement that preference should be given to "high signal quality" cells. France Telecom volunteered to draft the required change.

Tdoc SAHI-010014: Open issues on Idle Mode and Cell Selection

This contribution identifies a number of open issues on the handling of Idle Mode and Cell Selection, which is described across the following specifications:

43.022 - Functions related to Mobile Station (MS) in idle mode

45.008 - Radio subsystem link control

22.011- 3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Service accessibility

23.122 - NAS Functions related to Mobile Station (MS) in idle mode

25.304 - UE procedures in Idle Mode and Procedures for Cell Reselection in Connected Mode

31.102 - Characteristics of the USIM Application

The first open issue is on how the last used radio access technology field on the SIM/USIM is set. Considering the earlier discussion showing that the field only should have significance in the case of GSM compact, the issue was considered solved.

The next open issue raised is that in 31.102 v3.4.0 there is a parameter EFnetpar (clause 4.2.57) which is stated is used for optimisation of cell selection. THe paper question where this information is used and whether it is still required given the introduction of the IE Rplmn information (25.331 v3.5.0 (clause 10.3.8.15) offering BA_Range like functionality into the RRC messages. *The meeting found not need for the information and 3GPP TSG RAN WG2 was asked to double checked, and inform 3GPP TSG T WG3 that the information is not required or used.*

In the meeting it was question if there is a specific search order between FDD and TDD. The meeting recommended not to specify this.

The third open issue covers multiple PLMNs in general, and it was felt that this had already been dealt with in detailed and covered during the discussion of Tdoc SAHI-01005, Tdoc SAHI-01006, and Tdoc SAHI-010011.

The last item in the contribution is a request for maintaining the principle that the standards should continue to permit an operator to configure their network so that there is no signalling to the network just because a mobile has moved between GSM and UMTS cells. The meeting acknowledged the ned to maintain this principle.

4.2 Review of requirements and functionality for future release

No contributions were treated under this agenda item.

5 Review of Handover requirements and basic functionality

5.1 Review of existing requirements and functionality

No contributions were treated under this agenda item.

5.2 Review of requirements and functionality for future release

No contributions were treated under this agenda item.

6 AoB

The chairman close the meeting by thanking Nokia for hosting the meeting and the participants for the participation.

List of documents

Tdoc	Title	Source	Agenda Item
SAHI-010001	Draft Agenda	TSG SA chairman	2
SAHI-010002	Periodic Scan for preferred PLMNs	AT&T Wireless Services	3.2
SAHI-010003	Correction in behaviour of the UE when cell reselection fails in UTRAN	France Telecom	4.1
SAHI-010004	Correction in Any Cell Selection State	France Telecom	4.1
SAHI-010005	PLMN selection	T-Mobil	3.2
SAHI-010006	Support of multiple HPLMN codes for PLMN selection	Telia	3.2
SAHI-010007	Discussion paper on PLMN selection times in UTRA	Motorola	3.1
SAHI-010008	LS on Enhancement of CPHS Network Operator Name Feature for 3G R4	3GPP TSG CN WG1	3.2
SAHI-010009	LS on PLMN Selection and Re-selection Issues	3GPP TSG CN WG1	3.1
SAHI-010010	Response to LS "Enhancement of CPHS Network Operator Name Feature for 3G R4	3GPP TSG CN WG1	3.2
SAHI-010011	PLMN Selection	Motorola	3.2
SAHI-010012	PLMN Selection procedure	Samsung Electronics	3.2
SAHI-010013	Brief summary of PLMN selection principles	Vodafone	3.1
SAHI-010014	Open issues on idle mode and Cell Selection	Vodafone	4.1s

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