Title: **Problem with GPRS and National Roaming**

Source: **Motorola, Nokia**

GPRS is now being deployed in numerous networks and the following operational scenario has been experienced, which causes some problems in the field. A quick check of the specifications seems to indicate that to resolve the problem would require modifications of the specifications.

The scenario is as follows:

Operator A has a National Roaming agreement with operator B, but only for Circuit Switched services not for GPRS (both networks supporting GPRS).

The customer moves from operator A's coverage to operator B's coverage. Operator B accept that customer attaches/register on network B for circuit switched services, but rejects the GPRS attach.

Then the customer returns to the coverage of operator A, the mobile attaches to operator A's network for Circuit Switched services, but does not attempt to attach to GPRS services before the mobile has been switched off and on.

The behavior at the return to operator A's network is evidently not satisfactory for operator A and his subscribers.

The problem is caused by the fact, that the only rejection cause value #7, which allows selectively only to deny GPRS service, invalidate the SIM for GPRS services until switch off. For convenience of the reader the available cause values and their descriptions are attached in Annex I.

It should be noted that the problems associated with the usage of cause value #7, also would appear in the case of "international roaming", if the roaming is only allowed for circuit switched services, e.g., in cases where an agreement on billing for GPRS roaming is not yet in place between the two operators in question.

Different possibilities to resolve the problem exist, e.g.:

- It could be considered to change the mobile station behavior upon receipt of Cause Value #7, e.g., only making the invalidation of the SIM for GPRS valid when registered on the same PLMN or something similar. But this solution would remove the existing behavior from the specification. The existing behavior seems useful for cases where the subscriber do not have a GPRS subscription.

- If the National Roaming problem on circuit switched/packet basis is to be solved generally, then it probably would be better to copy each of the cause value #11, #12,and #13 into an additional case for GPRS only and one for Circuit switched only and keep the current value for the combined case. Even though this solution seems straightforward, proper care needs to be taken

to ensure that no undesired PLMN selections are invoked. In addition, this solution might require introduction of additional "forbidden lists" in the mobile.

TSG CN is invited to consider the identified problem and discuss the following issues:

- Is the identified behavior a correct interpretation of the specifications ?

- Does TSG CN agree that the identified behavior is undesirable ?

- Does TSG CN consider that it should be possible to accept/reject (national) roaming on a circuit switched and packet switched basis ? Is this a new requirement or a part of the original intention of the specification ?

- Does TSG CN consider the problem is sufficient to mandate a Release 97 or Release 99 Change Request or should the matter be left for Release 4 ?

- Is there any preference for the solution, e.g., modification of the exiting cause values or addition of new cause values ?

Annex I: Cause values for GPRS attach not accepted by the network (For information)

4.7.3.1.4 GPRS attach not accepted by the network

If the attach request cannot be accepted by the network, an ATTACH REJECT message is transferred to the MS. The MS receiving the ATTACH REJECT message stops timer T3310 and takes one of the following actions depending upon the reject cause:

#3(Illegal MS);or
6 (Illegal ME)

The MS shall set the GPRS update status to GU3 ROAMING NOT ALLOWED (and shall store it according to section 4.1.3.2) and shall delete any P-TMSI, P-TMSI signature, RAI and GPRS ciphering key sequence number. The new GMM state is GMM-DEREGISTERED. The SIM shall be considered as invalid for GPRS services until switching off or the SIM is removed. If the MS is IMSI attached via MM procedures, the MS shall in addition set the update status to U3 ROAMING NOT ALLOWED, shall delete any TMSI, LAI and ciphering key sequence number. The new
MM state is MM IDLE. The SIM shall be considered as invalid also for non-GPRS services until switching off or the SIM is removed.

7 (GPRS services not allowed)

The MS shall set the GPRS update status to GU3 ROAMING NOT ALLOWED (and shall store it according to section 4.1.3.2) and shall delete any P-TMSI, P-TMSI signature, RAI and GPRS ciphering key sequence number. The SIM shall be considered as invalid for GPRS services until switching off or the SIM is removed. The new state is GMM-DEREGISTERED.

8 (GPRS services and non-GPRS services not allowed)

The MS shall set the GPRS update status to GU3 ROAMING NOT ALLOWED (shall store it according to section 4.1.3.2) and shall delete any P-TMSI, P-TMSI signature, RAI and GPRS ciphering key sequence number. The new GMM state is GMM-DEREGISTERED. The new MM state is MM IDLE. The MS shall set the update status to U3 ROAMING NOT ALLOWED, shall delete any TMSI, LAI and ciphering key sequence number. The SIM shall be considered as invalid for GPRS and non-GPRS services until switching off or the SIM is removed.

11 (PLMN not allowed)
12 (Location area not allowed); or
13 (Roaming not allowed in this location area)

The MS shall delete any RAI, P-TMSI, P-TMSI signature, and GPRS ciphering key sequence number stored, shall set the GPRS update status to GU3 ROAMING NOT ALLOWED (and shall store it according to section 4.1.3.2), shall reset the GPRS attach attempt counter and shall change to state GMM-DEREGISTERED. If the MS is IMSI attached via MM procedures, the MS shall in addition set the update status to U3 ROAMING NOT ALLOWED, shall delete any TMSI, LAI and ciphering key sequence number and shall reset the location update attempt counter. The new MM state is MM IDLE. The MS shall store the LAI or the PLMN identity in the appropriate forbidden list, i.e. in the "forbidden PLMN list" for cause #11, in the list of "forbidden location areas for regional provision of service" for cause #12 or in the list of "forbidden location areas for roaming" for cause #13. If cause #11 or #13 was received, the MS shall perform a PLMN selection instead of a cell selection.

Other values are considered as abnormal cases. The specification of the MS behaviour in those cases is specified in section 4.7.3.1.5.