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3.0.0	May 12th, 2003	Approved by EMC
3.1.0	February, 2004	Structural changes and clarifications to IR.50
3.1.1	April, 2004	Reference to BARG, TADIG and general AA PRD's included

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1. Introduction

1.1. Scope of document

This document produces an inventory of all the roaming-aspects of roaming between 2G-, 2.5G- and 3G-networks and is also meant as an reference to operators and their roaming partners to define the international roaming service in the 2/2.5/3G environment.
Note: Roaming between 2G- and/or 2.5G-networks is also analyzed in this document, although this is already reflected in existing IREG PRD's.

1.2. Document Structure

After an overview of the roaming aspects of 2/2.5/3G-roaming (chapter 2), several roaming scenario's will be analyzed based on an overview of possible bearer services (Annex 4). Chapter 3 includes technical 2/2.5/3G international roaming guidelines.
Roaming agreement ,and IOT issues or TAP procedures are out of the scope of this document. They are described in BARG, TADIG and General AA PRDs.

National Roaming scenarios are as well out of the scope of this document.

1.3. Glossary

The purpose of this chapter is to introduce some terminology and explain some heavily used abbreviations. More detailed information can be found in GSM and 3GPP specification mentioned in the text.

2G Network	PLMN with all cells of GSM radio bearer type. The network supports classic GSM services, i.e. GSM Services except GPRS. (see e.g. GSM TS 02.02 and 02.03)
2.5G Network	PLMN with all cells of GSM radio bearer type extended to support GPRS.
3G Network	PLMN with all cells of UMTS radio bearer type.
2.5G/3G Network	PLMN with cells of type GSM and cells of type UMTS
3GPP	3rd Generation Partnership Project (for further information see http://www.3gpp.org)
Barring [of roaming]	Means to control where - and where not - roaming is possible. Usually only complete LAs may be barred for roaming. Barred Area Complete set of all barred LAs
CAMEL	Customised Applications for Mobile network Enhanced Logic (for further information see)
CS	Circuit Switched in the GSM context it means, that a service uses exclusively a

	dedicated resource (e.g. a circuit, or a radio bearer). Compare with →PS
CDR	Call Detailed [billing] Record
EPLMN	Equivalent PLMN A PLMN contained in the stored list of equivalent PLMNs. These PLMNs are considered equivalent to the selected PLMN regarding PLMN selection, cell selection, cell re-selection and handover (see 3GPP TS 23.122). EPLMN lists are [optionally] sent to a MS when it performs a LU or RA.
GGSN	Gateway GSN (see 03.60), The PLMN element which interfaces to the “outside-world”, e.g. the Internet.
GPRS	General Packet Radio Service (see 03.60)
GRX	GPRS Roaming Exchange, an IP backbone [network] connecting the PLMNs. By this it is possible e.g. for the SGSN of the vPLMN to exchange information with a GGSN in the hPLMN of a mobile subscriber.
GSM	Global System for Mobile Communication?
GSM 900	GSM working in radio frequency range 890.. 915 MHz (uplink) and 935..960 MHz (downlink).
GSM 1800	GSM working in radio frequency range 1710..1785 MHz (uplink) and 1805..1880 MHz (downlink).
GSM 1900	[also PCS 1900] GSM in North America, frequency range 1850..1910 MHz (uplink) and 1930..1990 MHz (downlink).
GSN	GPRS Support Node (see 03.60)
HSCSD	High Speed Circuit Switched Data, an extension of GSM radio to allow higher transmission speeds up to ...
HLR	Home Location Register, a PLMN element which stores subscriber data (subscribed services) and subscriber’s location information (VLR numbers and/or SGSN address).
hPLMN	Home PLMN, a mobile subscriber’s home network (→IMSI)
IMSI	International Mobile Subscriber Identity The IMSI is a number uniquely identifying a mobile subscriber. The IMSI is assigned to the mobile subscriber by a subscription PLMN, also named the home PLMN of the subscriber. The IMSI is stored on the SIM. [The IMSI is not known by the subscriber, it is used internally by PLMNs.] For further details concerning the IMSI see GSM 03.03
International Roaming	The →vPLMN and the →hPLMN have different →MCCs. See also →Roaming

IOT	Inter Operator Tariff
LA	Location Area, a set of cells of a PLMN grouped together may for a LA. A LA is identified by a LAC. A LA the smallest area where a MS can be paged. A LA is also the smallest area, which can be barred for roaming.
LAC	Location Area Code, see LA
LU	Location Update A MS which moves end enters a new LA must inform the network (using the LU procedure) of it's new location.
MAP	Mobile Application Part, set of standards describing the signalling between PLMN elements
MCC	Mobile Country Code. The MCC is a three digit number uniquely identifying a country. For further details (and values) see ...
MM	Mobility Management, set of functions to support mobility of mobile stations (MS'). MM information is exchanged between the MS and the MSC or the MS and the SGSN.
MMS	Multi-Media Messaging Service (see ...)
MNC	Mobile Network Code A two or three digit number identifying a PLMN within a country.
Mobile user	same as →mobile subscriber
Mobility	The ability to change the geographical location without loosing service
MS	Mobile Station usually the mobile phone. It may be however a data-only phone, or a handset connected to a computer.
MSC	Mobile Service Switching Centre, PLMN element to handle CS services
National Roaming	The →vPLMN and the →hPLMN have the same →MCC. However, the MNCs are different.
NE	Network Element
PS	Packet Switched, in the GSM context it means GPRS transmission. Compare to →CS.
PLMN	Public Land Mobile Network. A network offering mobile services, e.g. Telephony, or SMS, or ... , to the public. A PLMN is uniquely identified by a MCC and a MNC.
PLMN code	The combination of MCC and MNC uniquely identifying the PLMN.

PRD	Permanent Reference Document
RA	Routeing Area, a set of cells of a PLMN grouped together may form a RA. A RA is identified by a RAC. In GSM a RA is always a sub-division of a LA.
RAC	Routing Area Code
RNC	Radio Network Controller
Roamer	An MS from a foreign PLMN looking for or getting service in a visited PLMN.
Roaming	Use of mobile services in a PLMN different from the home PLMN. The network used is called the visited PLMN
Roaming Agreement	Set of statements regulating roaming between two PLMNs.
RP	Roaming Partner
SGSN	Serving GSN (see 03.60),
SIM	Subscriber Identity Module The chip card which personalizes the MS. The SIM stored e.g. the IMSI, and other subscriber related information SMS Short Message service (see GSM 03.40)
SMS-MT	SMS mobile terminated
SMS-MO	SMS mobile originated
SS7	[also SS#7] Signalling System Nr 7
Subscriber	(also: mobile subscriber) Customer of a PLMN, a subscriber comes into existence by creating new SIM card and a corresponding new HLR entry. The world-wide unique IMSI identifies the subscriber.
UMTS	Universal Mobile Telecommunication System
USIM	UMTS SIM, 3rd generation SIM card.
Visitor	In the context of roaming a MS from a foreign PLMN. See also →Roamer
VLR	Visitor Location Register, a PLMN element which stores temporary subscriber's allowed services and location information.
vPLMN	visited PLMN

2. Roaming aspects in 2/2.5/3G

2.1. Roaming Scenarios

2.1.1. Introduction

In the roaming scenario we can distinguish two types of roaming, the “standard” inter-PLMN roaming (or basic roaming) and the more sophisticated level of national roaming in which networks can reach such a level of integration that the roaming subscribers experience those networks as one.

2.1.2. Basic (inter-PLMN) Roaming

In this type of roaming, the interconnection is based on only three interconnection-systems between the involved networks:

- SS7-MAP to link the HLR of the home-network to the VLR’s/SGSN’s of the visited network
- International circuit switched interconnection for transport of speech or circuit switched data between the involved networks
- International packet switched interconnection (based upon the GRX-operators as IP-carriers)

The services, offered to the roaming subscriber, are determined only by the technical constraints for roamers at the visited network and the transferred subcriber-data from the HLR of the home network.
Due to this limitations, the following constraints do apply based on this type of roaming:

- No handover between the involved networks
- Subscriber services are determined by capabilities of the visited network and HLR information.

2.1.3. Regional National roaming

In the case of national roaming, i.e. when the Visited and the Home PLMNs belong to the same country, specific mechanisms may be required in order to allow the access to only a part of the visited network (regional roaming). This kind of features is out of scope of this document.

2.2. Assumptions and constraints on mobile equipment

Looking into the future of 3G, it’s likely that operators will provide multi-mode GSM/GPRS/UMTS handsets. So 3G-only-mobiles will not offer a serious market opportunity to mobile vendors and multi-standard (2/2.5G/3G) mobile will be common for the future.

Therefore, in the investigation of the roaming scenario’s, new 3G-mobile equipment is considered multi-mode (they can operate in both GSM, GPRS and UMTS networks).

Analyzing the 2/2.5/3G-roaming scenario’s, thus only the following types of mobile’s will be around in the world of international roaming:

Network Capability **Type of Mobile Equipment**	**2G**	**2.5G**	**3G**
"MS" (GSM-legacy)	Yes	No	No
"GPRS-MS" (GSM+GPRS)	Yes	Yes	No
"UE" (GSM+GPRS+UMTS)	Yes	Yes	Yes

- From a technical point of view (within the scope of this document) the user of a certain type of mobile will have access to all the services supported by that type of network , with the restriction of his subscription in the HLR.
- In the analysis of the roaming scenario, it is assumed that all types of networks (2/2.5/3G) offer all possible services (e.g. 2G (GSM) offers circuit-switched speech and data and SMS, 2.5G offers packet-switched data and SMS, 3G offer both circuit- and packet-switch services, etc.). Whether these services are actually available depends on the involved operators and can be described in the International Roaming Agreement (PRD AA.14) and/or in new information fields of the IR.21-database

2.3. USIM –next generation SIM-card application

- 3G Authentication

The main reason to use USIM is to offer enhanced security to your customers, because USIM is the only one supporting 3G Authentication. This is an enhanced method compared to 2G Authentication.

The main difference is that the network also has to authenticate itself towards the USIM. The old functionality (authentication of the SIM towards the network) has remained also with the USIM.

- Selection of network- and access-mode by network and subscriber

The USIM also offers extended possibilities of the preference list technology. In a SIM-card only an operator controlled preference list is determining the favourite networks/operators at international roaming. In the USIM, there are two preferred PLMN (PLMN selector) lists: one configurable by the user, the second by the operator. In addition, there is a Radio Access Technology (RAT), i.e. GSM or UMTS, associated to each PLMN in the preferred PLMN lists.

The automatic PLMN selection procedure is performed by the MS based on information existing in SIM/USIM and the information sent by the VPLMN. The mobile terminal has no information on inter-PLMN roaming agreements; therefore this is not taken into account during the PLMN selection process in the mobile.

Note that the RAT flag in USIM is relevant only to the initial network selection, but not during higher priority network background scan. PLMN selection is defined in TS 3GPP 23.122.

Example: with USIM it is possible to define in the PLMN selector lists which network of which technology should be preferred during the PLMN selection:

1. PLMN A, RAT=3G
2. PLMN A, RAT=2G,

3. PLMN B, RAT=3G
4. PLMN B, RAT=2G
5. PLMN C, RAT=3G
6. PLMN C, RAT=2G

Or

1. PLMN A, RAT=3G
2. PLMN B, RAT=3G,
3. PLMN C, RAT=3G
4. PLMN 2, RAT=2G
5. PLMN B, RAT=2G,
6. PLMN C, RAT=2G

2.4. One or two PLMN-codes (MCC+MNC) for 2/2.5/3G and roaming control

Depending on operators' strategy, 2/2.5 and 3G networks belonging to the same operator may share the same common PLMN-code (MCC+MNC), or separated codes can be used. This may have an impact on the ability to perform a separate roaming control for the GSM/GPRS and the UMTS part of the network, and on the possibility to perform different roaming authorisation depending on the subscriber's type, i.e. 2G or 3G. These issues are further analysed in § 3.2.

2.5. Use of EPLMN-feature

The Equivalent PLMN (EPLMN) is a list of PLMNs which should be considered by the mobile as equivalent to the visited PLMN for cell reselection and network selection. This list is sent to the mobile station by the visited PLMN during Location/Routing Area Update and GPRS Attach. It should also be noted that all UMTS terminals might not support EPLMN feature. For example, this feature may be used by an operator using different PLMN codes for his 2G and 3G networks, to enable cell reselection between them.

These feature is further analysed in §3.

2.6. Available bearer services at international roaming

Services available while roaming can be found from Annex 4.

2.6.1. Only bearer services to be analyzed

This document will only look at availability of the bearer services, both packet- and circuit switched when analyzing the roaming scenario's. Thus looking at the applications is out of scope of the document.

2.6.2. Packet switched services

2.6.2.1.IP-connectivity back to HPLMN (HGGSN-roaming)
Using the GRX-operators as an IP-carrier, the 2.5/3G-networks will offer the roaming IP-connectivity back to the GGSN's of their home-network as if they were at their home network. However, depending on the VPLMN-capabilities and the delay of concatenated GRX-operators, the QoS actually provided to a subscriber in roaming situation may be different compared to the non-roaming situation.

Refer to IR.33 and IR.34 for further information

2.6.2.2.Local packet-service access (VGGSN-roaming)
If authorised by the VPLMN and HPLMN –operators, a GPRS subscriber may access to local packet-services via a Visited GGSN (VGGSN roaming).

Refer to IR.33 and IR.34 for further information

2.6.3. Circuit switched services

Both synchronous as asynchronous services (as described in the PRD IR.27)are available in the 2G, 2.5G and 3G environment like:

- Speech services
- General bearer data services asynchronous
- General bearer data services synchronous

3. Technical 2G/2.5G/3G roaming analysis

3.1. Network access for 2G and 3G subscribers

This chapter provides technical analysis on 2G/3G roaming.
Following facts have to be considered:

- There is no 3GPP defined solution for distinguishing 2G and 3G subscribers in the HLR, VLR and SGSN.

- According to 3GPP specifications, it is possible to restrict roaming per LACs using "regional" rejection causes. However, the decision process, e.g. per IMSI, is not specified, and is therefore available depending on vendor implementation.

- 3G UEs are supposed to have the capability of using both the GSM BSS (2G access) and the UTRAN (3G access).

- 3G UEs are supposed to accept both SIM and USIM cards. So it is not possible to differentiate between 2G and 3G customer relaying on his mobile station type.

There are several potential solutions for the **VPMLN** to restrict the 3G coverage access for 2G subscribers:

1. Usage of IMSI analysis in (3G)MSCs and (3G)SGSNs. There are two cases:
    a. If the HPLMN uses two separate PLMN codes for his 2G and 3G subscribers, this solution can be easilyused.
    b. If the HPLMN uses one common PLMN code for his 2G and 3G subscribers but distinct IMSI ranges for 2G and 3G subscribers, in theory, and depending on VPLMN vendors' implementation, it is possible to perform a deeper IMSI analysis. However this solution is not practically feasible from operational point of view. Therefore HPLMN should not assume that the VPLMN is capable to distinguish 2G and 3G subscribers based on IMSI analysis of more than the MCC-MNC, in order to perform distinct roaming restriction.

    Therefore, due to different HPLMN choices, from VPLMN point of view, there is no generally applicable IMSI analysis based solution.

2. Distinction based on authentication vectors. However this is not a standardised solution, and therefore depends on vendor implementation.

3. There may be some proprietary solutions from some vendors for marking 3G subscriptions in the HLR, but these are not valid as soon as the customer is roaming in multi-vendor environment. These proprietary solutions cannot be used in GSMA roaming framework..

3.2. Distinct network access on 2G and 3G coverage

There are two cases to be considered: the VPLMN has two separate PLMN codes for his 2G and 3G networks, or he has one common PLMN code for both.

- VPLMN uses two separate PLMN codes: in this casethere is no problem to apply different roaming authorizations for the 2G and the 3G coverage, since they are seen as separate networks by the mobile terminals. If the Equivalent PLMN feature is used, the two networks may be considered equivalent for cell selection/reselection and PLMN selection, but will still be seen as two separate networks. In particular, it will be always possible to forbid roaming on one of them, while authorising it on the other, by using the usual "PLMN not allowed" rejection cause. In this case the MCC-MNC of the network which rejected the user will be added to the "Forbidden PLMN" list, and registration to this PLMN will no more be attempted by the terminal until the user performs a manual selection of this network.

- VPLMN uses one common PLMN code: The usual way to keep a roamer out of a network is just not implementing his IMSI range (MCC+MNC) in the VLR/SGSN. However, as soon as there are 2G and 3G LA in a network having a common PLMN code for 2G and 3G access, and if an IMSI range is authorised in e.g. the 2G LA only, the “PLMN not allowed” reject cause should not be send to the roamer when accessing a 3G LA. Indeed this would imply that the PLMN code will be added to the "Forbidden PLMN" list, and access to the whole network, i.e. both to 2G and 3G LAs, will be forbidden. In addition the UE of the customer will start the search for a completely new network. The same would happen if the IMSI range is opened in the 3G LAs but not in the 2G LAs.
  Therefore, the "PLMN not allowed" rejection code should not be used in only part of the network.

  Also it has to be noted that if the operator wants to apply different roaming authorisations on his 2G and 3G coverage, **2G and 3G cells have to belong to separated LAC/RAC areas**,. Thus different sets of operators (IMSI ranges) can be authorised for 2G and 3G access depending on the LA. This is however subject to availability in vendors' equipment (no standardised solution).

  Regional restriction (i.e. only on some LACs) is typically achieved using a geographical reject cause, for example cause cause #15 "No Suitable Cells in this LA"..

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If you decide to open your 3G network to your old 2G RP´s, you will have the risk that some day they upgrade to 3G. Since that moment, their customers using 3G terminals might be able to use 3G services in your network that have not been tested (GTPv.1/QoS, Video Telephony, 3g Authentication).

This means, some problems might be faced in controlling the functionality and billing before “going live”.

a)

4. 3G roaming tests

Note: all references that are made in the next paragraphs to TADIG and BARG issues are just for the clarifications of the possible scenarios . Fore more exact info refer to the BARG, TADIG and General AA PRDs.

4.1. Test Requirements for 3G

4.1.1. 3G Authentication

When a PLMN plans to give access to their 3G network via a USIM, it is normally because they would like to offer 3G Authentication to their customers.

3G Authentication makes use of Quintuplets instead of Triplets in the MAP v3 message “Send Authentication Info”. These Quintuplets are created by the AuC of the 3G HLR.

In the case that a Visited network´s MSC sends this message in MAPv3 towards the HLR/AuC, it also should be able to cope with Quintuplets.
If the visited MSC is not able to cope with Quintuplets, it should send a MAPv2 “Send Authentication Info” or a MAP v1 “Send Parameters”. In this case, the HLR/AuC will make a conversion from Quintuplets to Triplets.

4.1.2. QoS and its measurement

The IREG Tester is not able to test the Quality of Service offered by his Inter PLMN Backbone while testing IR35. The only thing that he can do is to check which has been the Negotiated QoS between the network and the UE.
This can be done entering a special AT command in a Terminal window. The terminal will send the command to the UE, that should be aware of this Negociated QoS.

4.1.3. Videotelephony

In order the Videotelephony services to work properly, UDI lines need to be available between both networks.
So the Videotelephony tests will only give a snapshot of the functionality at the given time, taking into account that nowadays the speech carriers between networks are changed from one day to another.

If two PLMNs are interested in having a steady Videotelephony service between their networks, they will need to look for speech carriers that are able offer end to end UDI lines.

4.1.4. Other Services

4.1.4.1.CAMEL:

If you already offer Prepaid Roaming services based on CAMEL in your 2G network to a special RP, the prepaid roamers of this RP using a UE will be able to register to your 3G elements as soon as you open them to this RP.
In this case, it is recommended that you open also the Prepaid service in your 3G NE (open the CAMEL trigger per RP in the gsmSSP), after doing the relevant tests (see § 7.1 and §7.2.2). Otherwise a prepaid roamer using a UE, will have the possibility to make calls only when he is attached to 2G NEs. When he moves around and gets attached to a 3G NE, he will not be able to make calls anymore.

Make sure that your 3G NEs support also the old CAMEL phases (1 and 2!).

4.1.4.2.USSD:

If you offer UCB (USSD Call back) to your prepaid customers, make sure that the MAP Application Context Version used by all your NEs (2G and 3G) is compatible with the one supported in your UCB gsmSCP.

In the rest of the document, a "live roaming partner" is an operator with whom there is already a 2G roaming agreement, and which deploys also a 3G network.

4.2. Inbound tests performed by 2G/3G VPLMN

When a 2G operator upgrades his network to 3G, depending on his strategy and on the features available in his network, he will have two types of incoming roamers (see §5.1):

- 2G roamers
- 3G roamers.

Therefore he will have to perform 2G→3G and 3G→3G incoming roaming test.
Two different strategies may apply for those two cases.

4.2.1. 2G→3G inbound roaming tests

If the 3G backbone of your PLMN is from a new Vendor (not available before in the network) it will mean that you have a completely new infrastructure for 3G. In principle it is like a completely new network. The only thing in common with your 2G network may be the MCC and MNC. Therefore it is recommended to perform the usual (not limited) test suit.

If the Vendor of your 3G network is the same as for 2G, performing a subset of the usual roaming tests may be sufficient, in order to see that the basic functionality is still working. These tests are called “Non Regression Tests”. This may be performed with a limited number of the existing roaming partners, e.g. 5 networks (to be decided by the Operator).

The "Non Regression Tests" set may include:

- A subset IR24 for a selected set of networks, in order to prove that the basic features and the billing are OK..
- A subset of CAMEL Prepaid tests with all the live CAMEL RP´s, even if the SSP functionality of the UMSC has not changed.
- A subset of GPRS tests. In order to tests the USGSN functionality towards your live GPRS RPs (fallback from GTPv.1 to GTPv.0).
-

For more detailed information about the subset of tests, please see Annex 3.

The tester will need a UE that accepts USIM and SIM cards and the coverage of a UMSC and a USGSN. If the VPLMN doesn't have this type of handset available, it should be provided by the HPLMN.

TADIG:
It is necessary to perform the corresponding unilateral TADIG tests also.

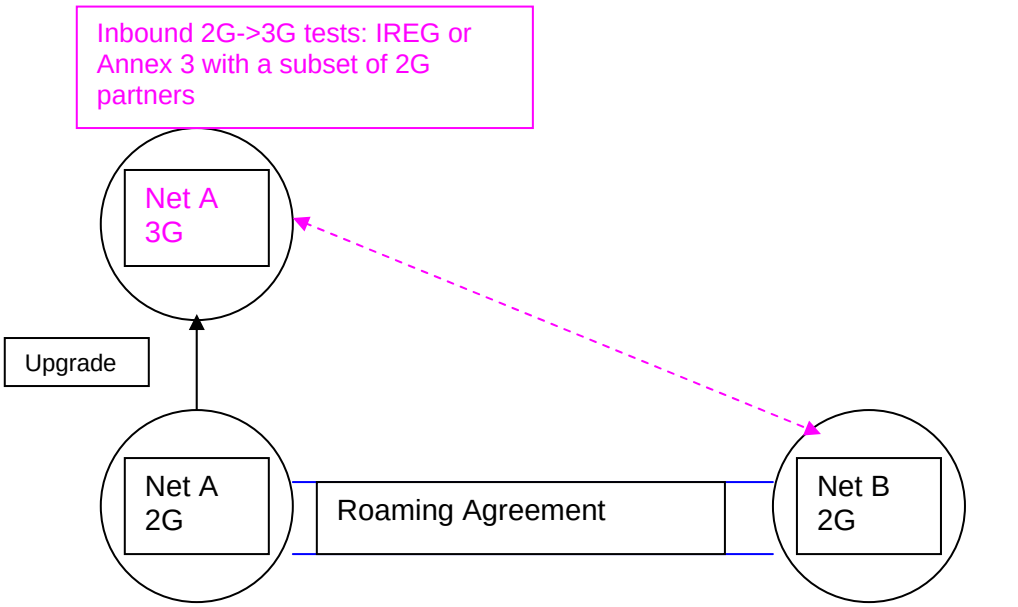


Figure 1. Inbound 2G-3G tests that need to be done by Net A in the 3G network when it upgrades to 3G

4.2.2. 3G→3G inbound roaming tests

This case is the same as the 3G→3G outbound roaming tests – please refer to §7.2.2.

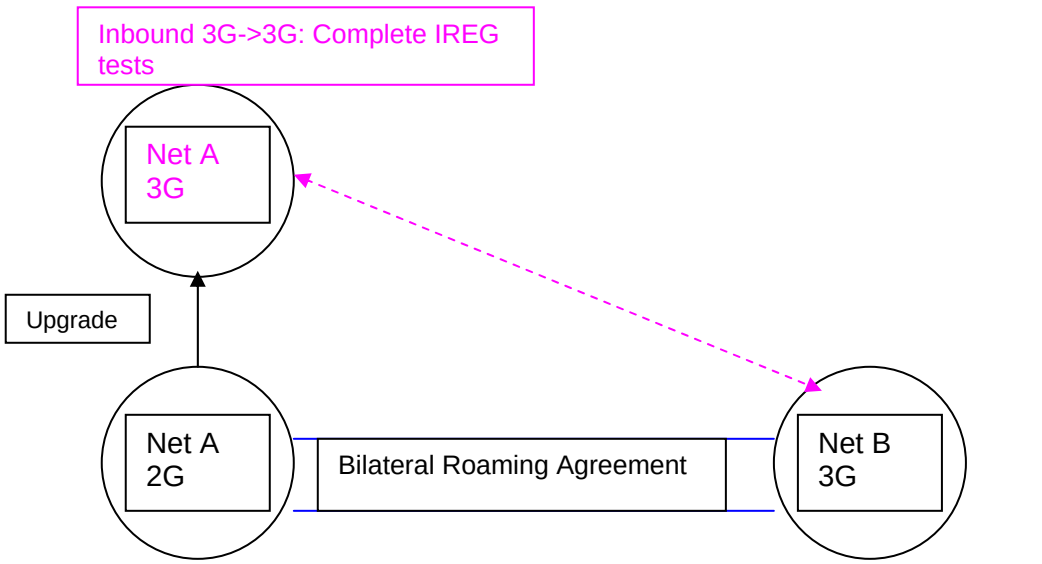


Figure 2. Inbound 3G-3G tests that need to be done by Net A in the 3G network when it upgrades to 3G

4.3. Outbound tests performed by 3G HPLMN with live 2G/3G Roaming Partners

If you already have a 2G network available, your company probably would like to offer Roaming to your 3G customers from day 1 in your live RP´s network. In this case it is recommended that you perform roaming tests with your live RP´s in order to ensure that:

a) subscribers of your 3G HLR don´t have problems while roaming in your live 2G and 3G RPs network.
b) If you have some live 3G RP´s, prove "3G-3G compatibility" (GTP v.1/QoS, Video Telephony, 3G Authentication) and the corresponding "TAP files" .

Therefore, when a 2G operator upgrades his network to 3G, he will have to perform both 3G→2G and 3G→3G outgoing roaming tests. Two different strategies may apply for those two cases.

4.3.1. 3G→2G outbound roaming tests

Given that in this case roaming tests have already been performed for 2G-2G roaming, it may be sufficient to perform a subset of the usual test suit in order to ensure non regression of the service provided to 3G subscribers when they access a visited 2G network.
Therefore, for 3G→2G roaming, it is recommended to proceed in the following way:

- Inform your roaming partners about the fact that you are going to launch 3G at least some time (X months) before your commercial 3G launch. This time is to be specified by BARG /un the Agreement.
- Send USIM (if applicable, otherwise SIM) cards to a large group of your live 2G RPs. The USIM should be configured as described in Annex1.
- Send them also the Test Sheet contained in Annex 2. This Annex includes tests that try to cover the most critical signalling interworking factors that can appear between 2G and 3G.

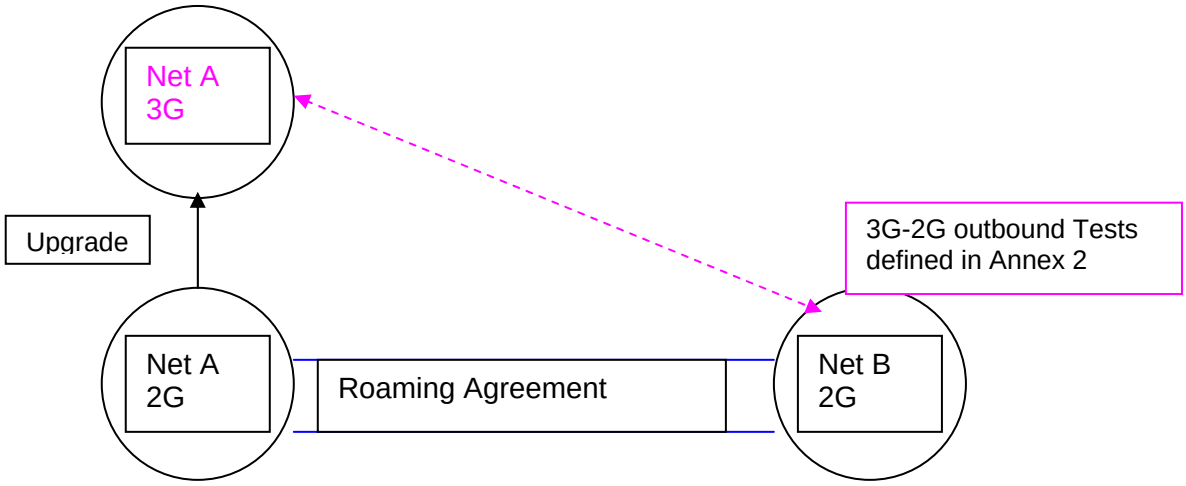


Figure 3. 3G-3G outbound roaming Tests that Net A asks Net B to perform when Net A upgrades to 3G.

In the case that your 3G Vendor is a new one, the same procedure as above described can be followed. It is not necessary that your live RPs do complete IREG tests because the CDR generation happens in the same 2G NE´s as the one they used for 2G-2G IREG roaming tests he first time. So basically they just need to do the interworking tests proposed in Annex 2.

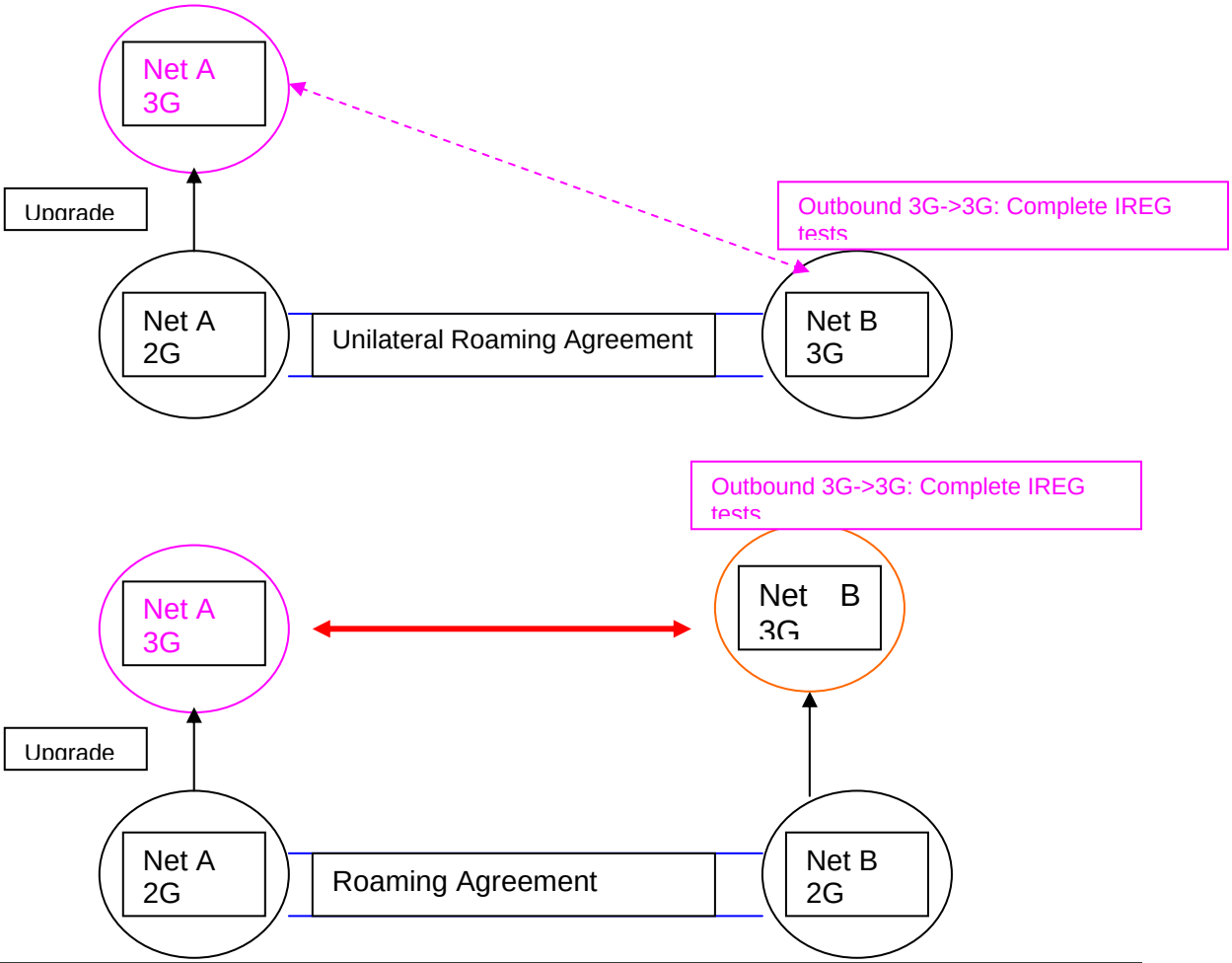
4.3.2. 3G→3G outbound roaming tests

For the 3G→3G roaming, the case is the same as for a new roaming agreement: the usual IREG tests (IR24, IR.27, CAMEL, GPRS) requested by the Home PLMN should be performed. The operator may choose to perform the tests with a subset or with all the live RP´s to the testing moment.

It is recommended to proceed in the following way:

- Inform your roaming partners about the fact that you are going to launch 3G at least some time (X months) before your commercial 3G launch. This time is to be specified by BARG /un the Agreement.
- Send USIM (if applicable, otherwise SIM) cards to all your live 2G roaming partners who have also a 3G network. However, subject to bilateral agreement, two roaming partners may decide to differ or to not perform 3G-3G roaming tests.
- The USIM should be configured as described in Annex1.
- Perform the usual set of IREG test plus the new applicable 3G-3G roaming tests.

TADIG:
It is necessary to perform the corresponding unilateral TADIG tests also.



Figures 4 and 5. 3G-3G Roaming tests in case of an existing 2G-3G unilateral agreement and in the case of a parallel 3G upgrade

However, if there was already a bilateral 2G ↔ 3G Roaming agreement available, for example because the 3G network was a 3G network from the beginning, this 3G network will not need to do all IREG tests again in their network, because the elements of this 3G network are the same where the tests were performed in order to open the 2G-3G agreement.

In this case the 3G network just needs to perform the tests in Annex 2 and the specific 3G-3G roaming tests (for the circuit and packet switched domains) when his 2G partner upgrades to 3G. The 2G will be in charge of informing the 3G network of the upgrade.

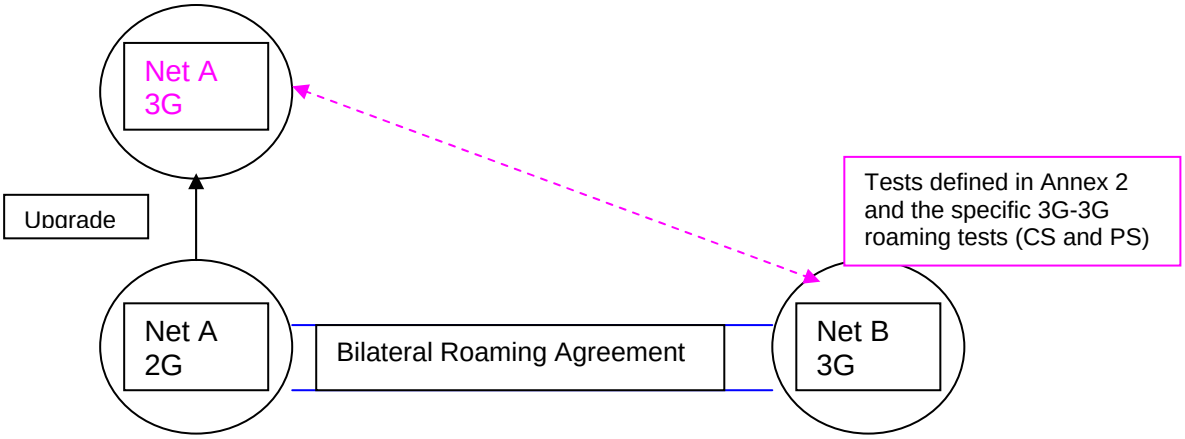


Figure 6. 3G-3G tests in a case of an existing 2G-3G bilateral agreement

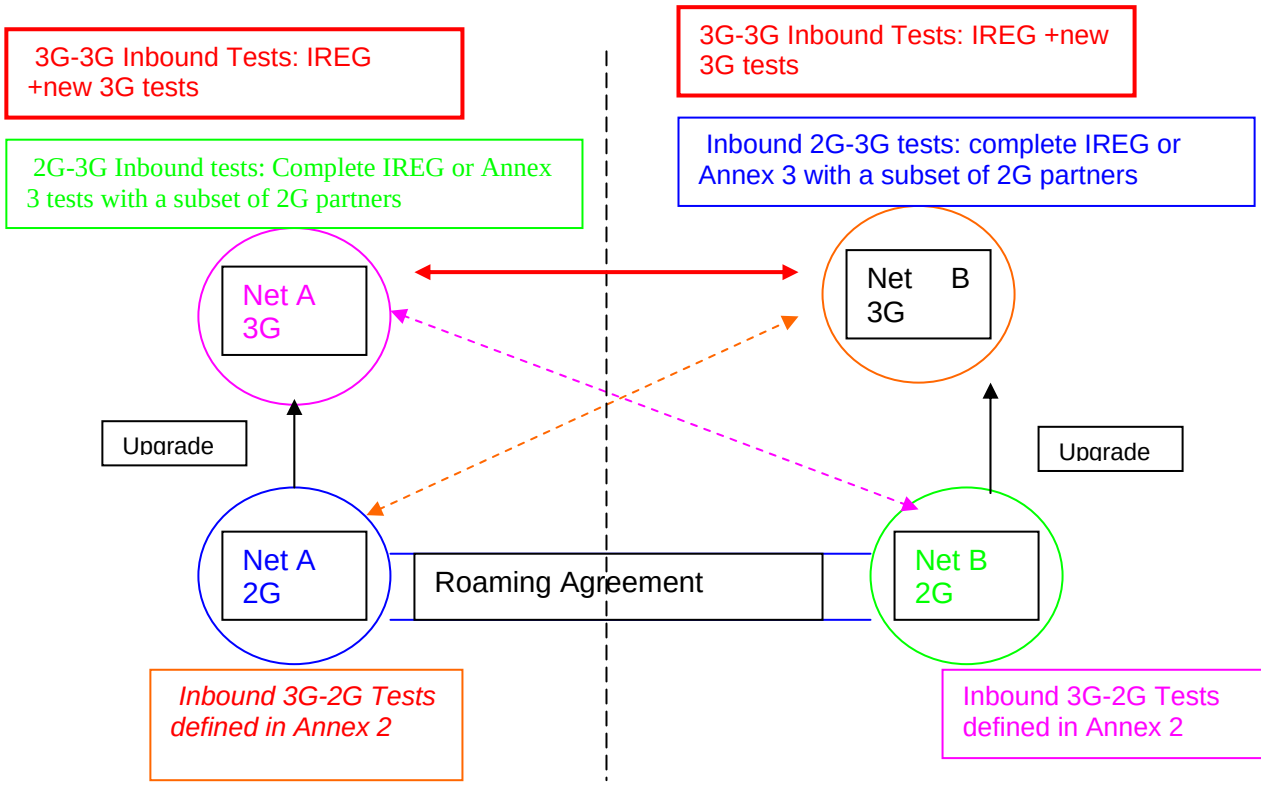


Figure 7. Overview of all the tests that need to be done at both sides when 2 networks upgrade to 3G.

4.4. Outbound tests performed by 3G HPLMN with a new 2G and 3G roaming partners

Basically you will need to make the corresponding standard bilateral (inbound+outbound) IREG tests with your new roaming Partners (RP).

Operators that have separated nodes for 2G and 3G (i.e. 2G MSC <>3G MSC,...) and want to open both for roaming, need to do the IREG tests once in the 2G NE and once in the 3G NE. It should be revised if it would be possible to suppress some tests in the repetition.

Operators that have combined NEs in the backbone (i.e. MSC=UMSC, SGSN=USGSN, etc.) need to do the IREG tests just via either the Iu or the A interface, depending on the type of service. However, it is recommended to test at least a circuit switched call and a PDP context establishment under both 2G and 3G access.

4.5. IREG tests

IR24 tests include MAP interworking and basic CS services like MOC, MTC, Call Forwarding, SS Barring, ODB Barring and SMS while roaming. These tests prove the roaming functionality **for MSC and UMSC, VLR and UVLR and HLR and UHLR**. These tests apply for any pair of networks that would like to offer CS services to their customers abroad.

IR35 tests include PS/GPRS roaming service functionality of **SGSN, USGSN, GGSN and UGGSN**. The GPRS HLR/UHLR functionality is also tested. These tests apply for any pair of networks that would like to offer PS services to their customers abroad.

IR32 tests apply for testing the CAMEL protocol functionality in the roaming case between networks that would like to offer IN services to their customers abroad. Specially IR60 applies for testing Prepaid Roaming based on the CAMEL protocol. These tests prove the roaming functionality of the **gsmSSP in the MSC and/or UMSC and the gsmSCP**.

Videotelephony tests are recommended to be performed between networks that would like to offer this service to his customers abroad and when UDI is supported end-to-end. The tests are included in **IR27**.

Annex 1. 3G Subscription of the Test USIM (SIM in the case USIM does not apply)

3G Subscription of the Test USIM	
Telephony	
SMS MO and MT	
General Data Asynchronous	
General Data Synchronous	For Videotelephony
GPRS	at least 1 APN with the Qos profile that will be commercial. Ideal would be to have 4 APN´s, each one with a different QoS traffic classes: Streaming, Backgroung, Conversational, Interactive).
CFNRy	
CFNRc	
CFBusy	
CFU	
BAOC	
BOIC	
BOICexHPLMN	
BAIC	
BAICroam	

Annex 2. Outbound Tests towards live 2G Roaming Partners.

To be sent to and **performed by my existing live 2G Roaming Partners** when HPMN's network is upgraded to 3G

Operator:
Technology (2G/3G/both):
Name of the Tester:
e-mail:
Telephone:

MSISDN of test SIM/USIM:
IMSI of test SIM/USIM

Test	Description	TADIG	Pass/fail
Location Update in 2GVLR	See that all UMTS subscribed services are accepted by the 2G MSC	-	
Authentication tests (Quintuplet/triplet conversion)	Do 10 MOC	-	
MTC	Do 1 mobile terminating call	-	
Location Update in 2G SGSN	Should be possible regardless of the extended QoS parameters	-	
PDP context activation	To do if GPRS roaming applicable. Do it for all APNs defined in the USIM that have different QoS, Do web browsing	Time of activation: Time of deactivation: Volume Tx: Volume Rx: Date:	

Annex 3. Inbound Tests (with existing live RP´s.)

Proposed version of reduced IREG tests to be performed **in 3G HPMN's Network Elements** with a subset (if desired) of 2G Roaming Partners when HPMN upgrades to 3G, and if 2G→3G roaming is allowed. Time-and-resources-Saving-method.

Testscenario	**IR.24**	**IR.32 and/or IR.60**	**IR.35**	**IR.27**
Location Update	✓	✓	✓	
Cancel Location				
ODB				
MS to MS call	✓	✓		
PSTN to MS	✓	✓		
PSTN to MS- IMSI detached	✓			
PSTN to MS- no response to paging	✓			
SS BAOC				
SS BOIC				
SS BOICexH	✓			
BAIC/BAICroam				
CFNRc- no response to paging	✓			
CFNRc –IMSI detached	✓			
CFB	✓			
CFNRy	✓			
SMS	✓			
PDP Ctxt activation-web browsing	✓		✓	

Annex 4: Services available when roaming

Method of describing the services overview

In the AA14-document a complete overview of possible bearer services is described. Based on this inventory, an overview can be generated for each bearer service whether it is available in 2G (GSM), 2.5G (GPRS) and/or 3G (UMTS).

The following constraints/assumptions are applicable to this overview:

- The roaming subscriber is in possession of a mobile equipment (UE) which is capable of all bearer-services (circuit- and packet switched) in all network generations (2G, 2.5G and 3G)

- The roaming subscriber is in possession of a subscription to all possible bearer-services (circuit- and packet switched) in all network generations (2G, 2.5G and 3G)

Services Overview

	2G	**2.5G**	**3G**
SERVICES			
GSM CS/3GSM CS Common Part			
Speech telephony	Yes	No	Yes
Speech, emergency calls	Yes	No	Yes
Short Message Service MT/PP	Yes	Yes	Yes
Short Message Service MO/PP	Yes	Yes	Yes
Short Message Service Cell Broadcast	Yes	Yes	Yes
GSM CS Specific Part			
Alternate speech and facsimile gr.3,T	Yes	No	No
Alternate speech and facsimile gr.3,NT	Yes	No	No
Automatic facsimile gr.3, T	Yes	No	No
Automatic facsimile gr.3 , NT	Yes	No	No
SUPPLEMENTARY SERVICES			
GSM CS/3GSM CS Common Part			
Calling line	Yes	No	Yes

identification presentation (CLIP)			
Calling line identification restriction (CLIR)	Yes	No	Yes
Connected line identification presentation (CoLP)	Yes	No	Yes
Connected line identification restriction (CoLR)	Yes	No	Yes
Call forwarding unconditional (CFU)	Yes	No	Yes
Call forwarding on mobile subscriber busy (CFB)	Yes	No	Yes
Call forwarding on no reply (CFNRy)	Yes	No	Yes
Call forwarding on mobile subscr. Not reachable (CFNRc)	Yes	No	Yes
Call waiting (CW)	Yes	No	Yes
Call hold (HOLD)	Yes	No	Yes
Multy party (MPTY)	Yes	No	Yes
Closed user group (CUG)	Yes	No	Yes
Multiple Subscriber Profile	Yes	No	Yes
Completion of Calls to Busy Subscribers	Yes	No	Yes
Call Deflection	Yes	No	Yes
Explicit Call Transfer	Yes	No	Yes
Advice of charge, information (AoCI)	Yes	No	Yes
Advice of charge, charging (AoCC)	Yes	No	Yes
Supplementary Services			
Barring of all outgoing calls (BAOC)	Yes	No	yes
Barring of all outgoing international calls (BOIC)	Yes	No	yes
Barring of all outgoing international calls except (BOIC-ex HC)	Yes	No	yes
Barring of all incoming calls (BAIC)	Yes	No	yes
Barring of all incoming calls when roaming outs. HPMN (BAIC-Roam)	Yes	No	yes
User to User Signalling (UUS)	Yes	No	yes

USSD /MO	Yes	No	yes
USSD /MT	Yes	No	yes
Support of Private Numbering Plan (SPNP)	Yes	No	yes
Calling Name Presentation (CNAP)	Yes	No	yes
EMLPP (Enhanced Multi-Level Procedure and Pre-emption)	Yes	No	yes
3GSM CS Specific Part			
Multi Call (MC)	No	No	Yes
BEARER SERVICES			
GSM CS Specific Part			
Asyncronous 300 - 9600 bps, T	Yes	No	No
Asynchronous 300 - 9600 bps, NT	Yes	No	No
Asynchronous 14.4 kbps	Yes	No	No
Synchronous 1.2 - 9.6 kbps, T	Yes	No	No
Synchronous 2.4 - 9.6 kbps,NT	Yes	No	No
PAD access 300 - 9600 bps, T	Yes	No	No
PAD access 300 - 9600 bps, NT	Yes	No	No
HSCSD Asymmetric	Yes	No	No
HSCSD Symmetric	Yes	No	No
ECSD (EDGE Circuit Switched Connexion)	No	No	No
3GSM CS Specific Part			
Asyncronous, T	No	No	Yes
Asyncronous, NT	No	No	Yes
Synacronous, T	No	No	Yes
ADDITIONAL GSM FEATURES			
GSM CS/3GSM CS Common Part			
Call forwarding to abroad, unrestricted	Yes	No	Yes
Call forwarding to abroad, restricted (which countries)	Yes	No	Yes
Call forwarding to	Yes	No	Yes

abroad , not allowed			
Support of Optimal Routing (SOR) Phase 1	Yes	No	Yes
CAMEL Phase 1	Yes	No	Yes
CAMEL Phase 2	Yes	No	Yes
CAMEL Phase 3	Yes	No	Yes
CAMEL Phase 4	Yes	No	Yes
UDI	Yes	No	Yes
MexE	Yes	No	Yes
Operator determined barring for CS	Yes	No	Yes
EMS MO	Yes	No	Yes
EMS MT	Yes	No	Yes
Support of DTMF signalling	Yes	No	Yes
IMSI attach/detach	Yes	yes	Yes
Implicit deregistration	Yes	yes	Yes
IMEI handling in MSCs and SGSNs	Yes	yes	Yes
Equipment identity register	Yes	No	Yes
Immediate Call Itemisation (hot billing)	Yes	No	Yes
NITZ (Network Identity and Time Zone)	Yes	No	Yes
LCS (Location Services)	Yes	No	Yes
GSM CS Specific Part			
SAT (SIM Application Toolkit)	Yes	No	No
SoLSA (Support of Localised Service Area)	Yes	No	No
3GSM CS Specific Part			
Multimedia Call	No	No	Yes
USAT (USIM Application Toolkit)	No	No	Yes
MMS (Multimedia Messaging Service)	No	No	Yes
BANDS and MODES			
GSM CS Specific Part			
Single Band GSM 900	Yes	Yes	No
Single Band GSM 1800	Yes	Yes	No
Dual Band GSM 900/1800	Yes	Yes	No
Single Band GSM 1900	Yes	Yes	No

E-GSM	Yes	Yes	No
E-GSM Single Band GSM900	Yes	Yes	No
E-GSM Dual Band GSM900/1800	Yes	Yes	No
E-GSM Single Band GSM1800	Yes	Yes	No
Satellite	Yes	Yes	No
3GSM CS Specific Part			
3GSM Band 1920-1980, 2110-2170 MHz (a.k.a. IMT-2000 Core Bands)	No	No	Yes
3GSM Band 1800 MHz (a.k.a. UMTS 1800)	No	No	Yes
3GSM Band 1900 MHz (a.k.a. PCS Band)	No	No	yes
Additional GSM SERVICES			
GSM CS/3GSM CS Common Part			
Access to the Home WAP gateway	Yes	Yes	Yes
Access locally to the Internet through the local GSM and/or 3GSM operator	Yes	Yes	Yes
GPRS and/or 3GSM PS CAPABILITIES **GPRS/3GSM PS Common Part**			
point-to-point service	Not Applicable	Yes	Yes
point-to-multipoint service	Not Applicable	Yes	Yes
Home Access (Inter-PMN backbone roaming)	Not Applicable	Yes	Yes
Local access (ISP roaming)	Not Applicable	Yes	Yes
-Terminal originated PDP context activation	Not Applicable	Yes	Yes
- Network originated PDP context activation	Not Applicable	Yes	Yes
- IP PDP type	Not Applicable	Yes	Yes
- X.25 PDP type	Not Applicable	Yes	Yes
- PPP PDP type	Not Applicable	Yes	Yes
Service QoS (Release 99)	Not Applicable	Yes	Yes
- Traffic Class	Not Applicable	Yes	Yes

- Maximum bitrate for incoming and outgoing traffic	Not Applicable	Yes	Yes
- Delivery order	Not Applicable	Yes	Yes
- Maximum SDU size	Not Applicable	Yes	Yes
- SDU error ratio	Not Applicable	Yes	Yes
- Delivery of erroneous SDUs	Not Applicable	Yes	Yes
- Transfer delay	Not Applicable	Yes	Yes
- Guaranteed bit rate (in 3GSM phase 1 this coincides with the maximum SDU size)	Not Applicable	Yes	Yes
- Traffic handling priority	Not Applicable	Yes	Yes
- Allocation/Retention priority	Not Applicable	Yes	Yes
Service access point (Internet access)	Not Applicable	Yes	Yes
GPRS and/or 3GSM PS CAPABILITIES **GPRS/3GSM PS Common Part**			
Hot Billing for PS	Not Applicable	Yes	Yes
GPRS AoC for PS	Not Applicable	Yes	Yes
Short message Service MT/ PTP	Not Applicable	Yes	Yes
Short message Service MO/ PTP	Not Applicable	Yes	Yes
Short message Service MT/ PTM – G	Not Applicable	Yes	Yes
Short message Service MO/ PTM - G	Not Applicable	Yes	Yes
CAMEL phase3	Not Applicable	Yes	Yes
CAMEL phase4	Not Applicable	Yes	Yes
MexE	Not Applicable	Yes	Yes
Operator determined barring for PS	Not Applicable	Yes	Yes
LCS(Location Services)	Not Applicable	Yes	Yes
GPRS specific part			
GSM Service QoS (Release 97 & 98)	Not Applicable	Yes	Not Applicable
- precedence	Not Applicable	…	Not Applicable
- delay	Not Applicable	…	Not Applicable
- reliability	Not Applicable	…	Not Applicable
- peak throughput	Not Applicable	…	Not Applicable
- mean throughput	Not Applicable	…	Not Applicable
SAT(SIM Application Toolkit)	Not Applicable	Yes	Not Applicable

3GSM PS specific part			
USAT(USIM Application Toolkit)	No	No	Yes
MMS(Multimedia Messaging Service)	No	No	Yes
GSM PS specific part		Yes	
Single Band GSM 900	No	Yes	No
Single Band GSM 1800	No	Yes	No
Dual Band GSM 900/1800	No	Yes	No
Single Band GSM 1900	No	Yes	No
E-GSM	No	Yes	No
E-GSM Single Band GSM900	No	Yes	No
E-GSM Dual Band GSM900/1800	No	Yes	No
E-GSM Single Band GSM1800	No	Yes	No
Satellite	No	Yes	No
3GSM PS specific part			
3GSM Band 1920 – 1980, 2110-2170 MHz (a.k.a. IMT-2000 core bands)	No	No	Yes
3GSM Band 1800 MHz (a.k.a. UMTS 1800)	No	No	Yes
3GSM Band1900 MHz (a.k.a. PCS band)	No	No	Yes