



End-to-End Functional Capability Specification for Associate-PLMN SMS-Roaming

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1 Introduction

1.1 Scope of document

This document contains the specification of IREG End-to-end Functional Capability tests relating to the international roaming of a Mobile Station subscribed to SMS services, belonging to a home PLMN(a), to and within a visited PLMN(b), and using an Associate PLMN (c).

1.2 Abbreviations

Term	Description
PLMN	Public Land Mobile Network
SMS	Short message Service
MAP	Mobile Application Part
MO	Mobile Originated
MT	Mobile Terminated
E214	ITU.T recommendation
IMSI	International Mobile Subscriber Identity (E.212)
TAP	Transferred Account Process
MSISDN	Mobile Subscriber ISDN Number
SMS-C	Short

1.3 General description

The following diagrams give an overview of the various technical entities involved in each of the SMS transactions. They also present the procedure and MAP messages exchanged between the equipments.

1.4 SMS MT transaction

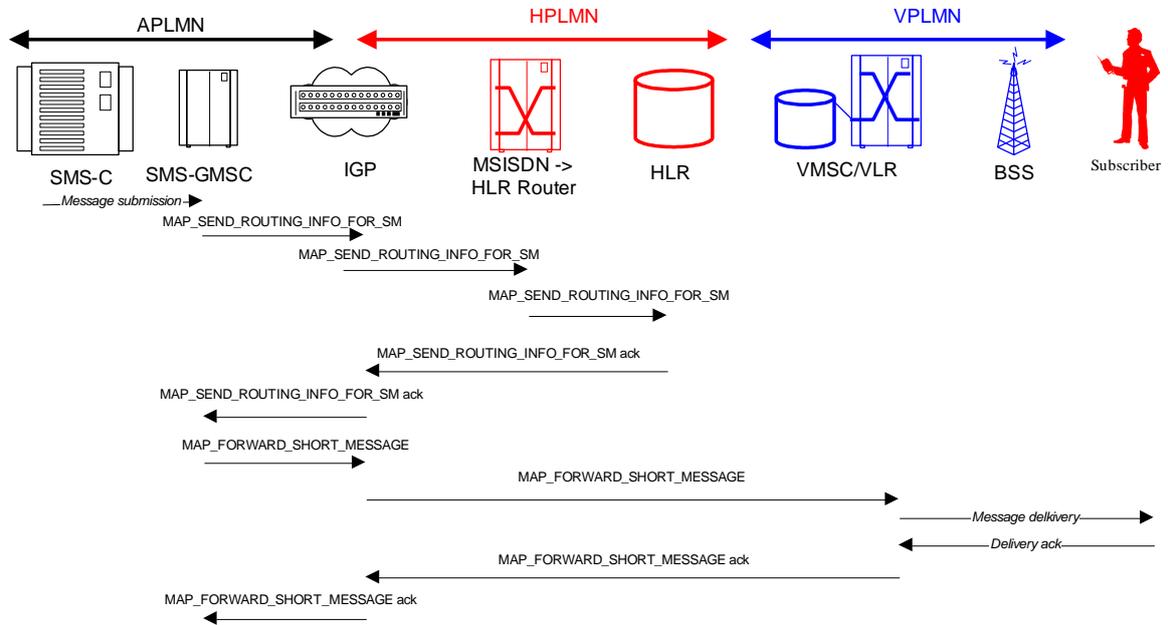


Figure 1: SMS MT message flow.

1.5 SMS MO transaction

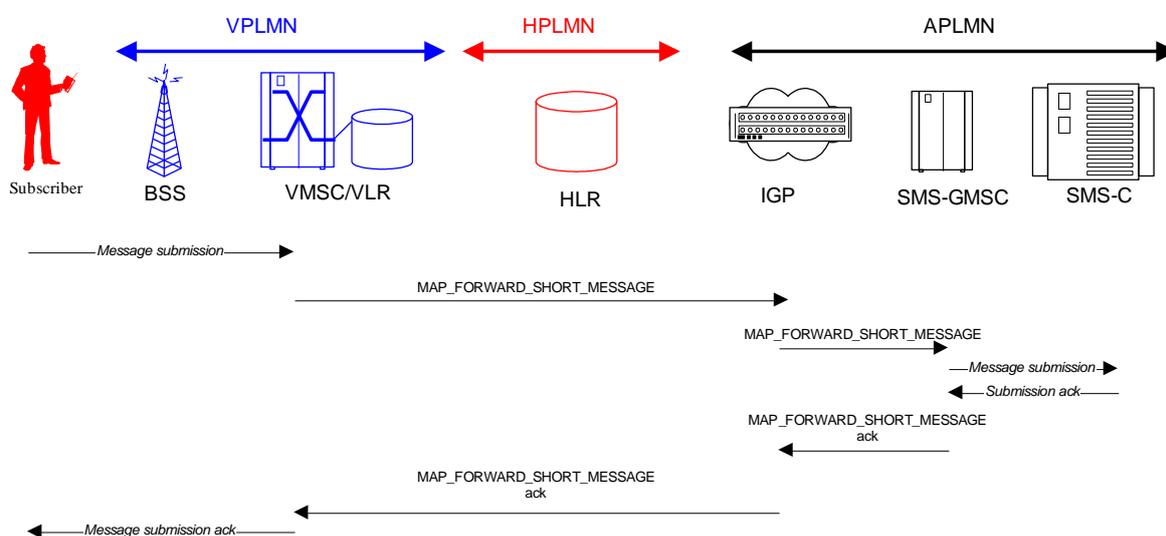


Figure 2: SMS MO message flow

1.6 Impacts on C7 gateway and on the networks

1.6.1 Introduction

Operators implementing SMS inter-working may have to face two major problems:

1. Making it possible for the various technical equipments involved in the transmission of the short messages to interconnection order for the SM to be correctly delivered to the proper recipient.
2. Making it impossible for any SMS inter-working transactions to take place, when no specific agreement has been implemented.

The first problem can easily be solved by implementing new routing capabilities thanks to a proper configuration of the network.

The second point requires making use of screening capabilities. These capabilities may not exist in the network. In this case some specific development may be required.

The following sections will review each of the above two points, and propose for each of the SMS inter-working transactions (SMS-MO, SMS-MT) some possible solutions. Please note that implementing the SMS-MT reverse charging transaction will not require any additional action, from a C7 point of view, than implementing the basic SMS-MT transaction.

1.6.2 Routing capabilities

The following paragraphs review for each of the PLMN involved and for each SMS inter-working transaction, the network configuration that should be done.

1.6.2.1 SMS-MO transaction

The goal is here to make it possible for the HPLMN's subscriber to submit an SMS-MO to the APLMN SMS-C.

HPLMN: the HPLMN is not specifically involved in the technical transaction, so it has no change to introduce in its network

VPLMN: since it is assumed that a roaming agreement exists between the APLMN and the VPLMN (see section 2), no specific network change is needed on the VPLMN side. The technical transaction is precisely the same as if an APLMN's subscriber would try to submit an SMS-MO to the APLMN SMS-C, while roaming on the VPLMN network.

APLMN: as above, since a roaming agreement exists between the APLMN and the VPLMN, no specific network change is needed on the APLMN side. The APLMN may need to configure its screening capability, though, in order to allow the HPLMN's subscriber to access to its SMS-C.

1.6.2.2 SMS-MT transaction

The aim is to allow the APLMN SMS-C to send an SMS MT to the HPLMN's subscriber.

HPLMN: the SMS-C has to interrogate the HLR of the HPLMN in order to retrieve the VLR address where to send the SMS MT. Since it has no knowledge of the correct HLR address, the SMS-C will send its "MAP Send Routing Info for MT SM" message with the recipient's MSISDN as Called Party Address. The HPLMN has to implement in some of its equipments a routing capability so that these messages arrive to the correct HLR.

There are mainly three different possibilities to implement this capability:

1. SMS-C of the APLMN can manage the MSISDN / HLR address table
2. Routing capability can be implemented in the international signalling gateway
3. Some internal HPLMN equipment can be in charge of this function

For Operation and maintenance considerations at least, the SMS Steering Committee would recommend the third solution.

The answer from the HLR will be routed to the SMS-C without any additional changes to be done, since all the necessary configurations must have been done when implementing roaming between the APLMN and the HPLMN. This configuration should also be sufficient to route correctly the "Alert SC" messages.

The HPLMN may also have to configure its screening capability to allow the SMS-C of the APLMN to send messages to its subscribers.

VPLMN: since it is assumed that a roaming agreement exists between the APLMN and the VPLMN, no specific network change is needed on the VPLMN side. The technical transaction is precisely the same as if the SMS-C of the APLMN tried to submit an SMS-MT to an APLMN's subscriber roaming on the VPLMN network.

APLMN: two actions may have to be taken by the APLMN. The first would be to configure its screening capability within the SMS-C in order to make it possible for its SMS-C to send messages to HPLMN's subscribers. The second one would be to configure its SMS-C routing table so in such a way that the messages to HPLMN's subscribers can be transmitted to the international signalling gateway.

1.6.3 Screening solutions

As far as SMS Inter-working is concerned, an operator may want to bar access to its network to some PLMNs (e.g. because no SMS Inter-working Agreement has been signed with the operators of these PLMNs).

1.6.3.1 SMS MO transaction

In this case, the only concern is for the APLMN to ensure that only authorized subscriber's access to its SMS-C.

This can be performed by using an "SMS-C access table" in which the subscribers that are allowed to submit messages are defined. Most of the main SMS-C manufacturers provide such functionality.

1.6.3.2 SMS-MT transaction

In the case of the SMS-MT transaction, the HPLMN may want to keep a control on the SMS its subscribers will receive from foreign SMS-C. This functionality may cover a number of needs, including but not limited to:

- Barring SMS coming from an APLMN with which no SMS inter-working agreement has been signed
- Protecting the network against jeopardizing streams of SMS coming from foreign SMS-C
- Protecting HPLMN's subscribers against unsolicited messages coming from foreign SMS-C

This screening functionality can be implemented in different equipments in the HPLMN network:

International signalling gateway: in case where a SMS-MT from the SMS-C of the APLMN is sent to an HPLMN's subscriber, the international signalling gateway of the HPLMN will receive "Map Send Routing Info for MT SM" message coming from the SMS-C of the APLMN. The international signalling gateway can identify this message at the SCCP level by the fact that the called party address is not an usual E214 signalling point global title, but an E164 MSISDN. The international signalling gateway is then able to route or not the message, according to the calling party address.

The major advantage of this implementation is that the message is barred as soon as possible, saving resources in the HPLMN. On the other hand, implementing this solution will require specific developments at the international signalling gateway, and will only work if the E214 and E164 addresses can be distinguished easily within the HPLMN.

HLR: the HLR can answer, or not, the “Map Send Routing Info for MT SM” message, according to the SMS-C address. Implementing the functionality in the HLR does not fully prevent the HPLMN’s signalling network from being overloaded by unsolicited incoming messages.

Intermediate Signalling Transfer Point: both previous solutions could be implemented in an intermediate STP that would ensure the screening using either solution.

1.7 New IREG tests to implement

With a normal IR agreement, all the tests between the HPLMN and the VPLMN have been performed through the IR.24 tests. So the only test useful with the APLMN is when the VPLMN is the HPLMN. The test case will be described at the end of this document.

1.8 How to fulfil Annexes C5 and I5

No specific modification to these annexes is necessary.

1.9 Declaration in IR.21 or other IREG documents

1.9.1 IR.21 Roaming Database, Structure and Updating Procedures

In the IR.21 document it is mandatory to declare the APLMN Service Centre address and network name, to ensure the E164 address is accepted by the VPLMN.

1.9.2 IR.23 Organisation of GSM International Roaming Tests

This document describes the existence of this PRD

1.9.3 IR.20 Technical Implications of the Use of Optimal Routing

This document describes the connection between the HPLMN and the APLMN.

1.10 Impact of Number Portability

1.10.1 Introduction

The studies made to introduce number portability in mobile networks have been able to propose technical solutions, so that all of the basic mobile telephony services are properly delivered to the customers.

There are a few interactions with SMS inter-working that still have to be studied further.

1.10.2 Impact on the technical implementation of SMS inter-working

The technical implementation of SMS inter-working does not raise any specific problem: the basic implementation of mobile number portability is sufficient for all the SMS inter-working transactions to work properly.

1.10.3 Impact on the billing procedures

The basic billing principles of the SMS MO inter-working transaction specify that the APLMN can invoice the HPLMN, based on TAP records. In most cases, the TAP records produced by the APLMN will not contain the IMSI of the sender, but only ITS MSISDN.

If the HPLMN has implemented mobile number portability, the APLMN will probably not be able to determine to which HPLMN the sender belongs, based on its MSISDN.

If no specific procedure is specified, the APLMN may have to face situations in which he will not be able to invoice for some MS MO that it will have handled.

The other SMS inter-working transactions should not raise any specific problem, since their billing procedures are based on information that are not affected by mobile number portability (IMSI or E212 address).

1.10.4 Impact on the screening functionalities

As seen above in section 1.6.3., screening functionalities may be implemented by PLMNs in order to bar SMS inter-working transactions with other networks with which no agreement has been signed.

In the case of the SMS MO transaction, this barring feature can only be based on the sender's MSISDN.

If the HPLMN has implemented mobile number portability, the screening function of the APLMN may turn out to be inefficient. In particular, the APLMN will not be able to bar messages coming from subscribers having moved from an HPLMN with which SMS inter-working has been implemented to another HPLMN with which no SMS inter-working agreement has been signed.

This is probably no longer an issue if the APLMN has implemented SMS inter-working with all the networks in a country.

1.10.5 Possible solutions

Both the problems mentioned above come from the fact the SMS-C, in most cases, does not have any other information about the sender of an SMS MO than its MSISDN.

The SMS Steering Committee has considered various solutions to these problems. It is recommended that IREG and SERG go on working on these issues together with SMG1 and SMG3.

1.10.5.1 Evolution of "MAP Forward MO SM" message

The principle of this solution would be to introduce a new parameter in the "MAP Forward SM" in the MO case that would contain the IMSI of the sender. The SMS-C would then be able to screen properly the incoming messages, based on the IMSI, and to generate TAP records with the IMSI.

As far as the SMS-STC is informed, a change request had already been submitted to SMG3 (Nov. 1998), to change the GSM 09.02 according to the above.

1.10.5.2 Evolution of the SMS MO procedure in the SMS-C

This second solution would be based on an evolution of the SMS-C behaviour when receiving a SMS MO submission. The SMS-C could then retrieve the sender's IMSI, by interrogating his HLR via a "MAP Send Routing Info for SM" message.

This solution would have various drawbacks:

- It would generate an additional load on the signalling network
- It would require the APLMN to implement SMS MT inter-working agreements with all the HPLMN with which the problem may appear
- It would damage the quality of service, increasing the duration for handling each SMS MO

1.11 Other technical improvements

The possibility to implement SMS Inter-working even though there is no preliminary IR agreement.

SMS Inter-working needs at least a Signalling Agreement to ensure the necessary connections, and to define the E164 addresses into the different PLMNs.

Possibility to meter in network equipment the number of SMS-MT received by a HPLMN from an APLMN

The analysis from the SMS-STC is the following:

- It seems that such a counter might only be implemented in the VMSC. As a matter of fact, it is necessary to meter successful messages only, so that metering at HLR would not be relevant. Furthermore, the N7 gateway, which handles low layers, cannot handle the applicative level, and therefore cannot differentiate SMS-MO from SMS-MT or location update, call related signalling, etc.
- In a non-roaming situation (HPLMN=VPLMN), the HPLMN will issue VMSC SMS-MT records however. It is probably not more difficult to meter those tickets than to implement a new counter in the VMSC.
- In a roaming situation, the VMSC is in the VPLMN, so that the counter information can only be provided by the VPLMN. It would then be necessary to send the counter information from the VPLMN to the HPLMN via TAP or other means. But this would raise a new difficulty; in this case the VPLMN would have at least to:
 - Create the bulk charge data for each HPLMN (number of SMS send to the different HPLMNs subscribers, registered on the VPLMN, for each day that the bulk data refers to),
 - Send it to the different HPLMNS (via TAP)

But it is not suitable to put constraints on VPLMNs for the SMS Inter-working agreements (to which they are third parties) to work correctly. So that our conclusion is that this scenario seems to be not very appropriate in practise.

1.12 SMS-MT with No SMS Interworking Agreement procedure

Where operators do not have a commercial agreement in place for SMS interworking they may want to block SMS traffic. In such circumstances IREG recommends the following technical basis.

When the HLR receives 'Send Routing Info for SM' from the GMSC, HLR checks whether a SMS inter-working agreement is valid or not based on SMS-C address.

1. If the SMS inter-working agreement does not exist, HLR responds with an Error cause to the GMSC. As a result, it is possible to prevent operator B from receiving SMS-MT, and does not allow Operator B to bulk charge operator A as defined in BARG [See SMS interworking Handbook, and BA.08]
2. If the GMSC receives an Error cause from Operator B, Operator A does not send SMS-MT to Operator B.

Note: Operator B is not allowed to request bulk charging to operator A if Operator B does not have this solution implemented.

Bulk charging is counted by using bulk SMS data.

Bulk SMS data: Data transferred by a PLMN Operator to an APLMN Operator which relates to SMS received by that HPLMN Operator's subscribers, whether these subscribers have been roaming or not. This is bulk information and not subscriber related.

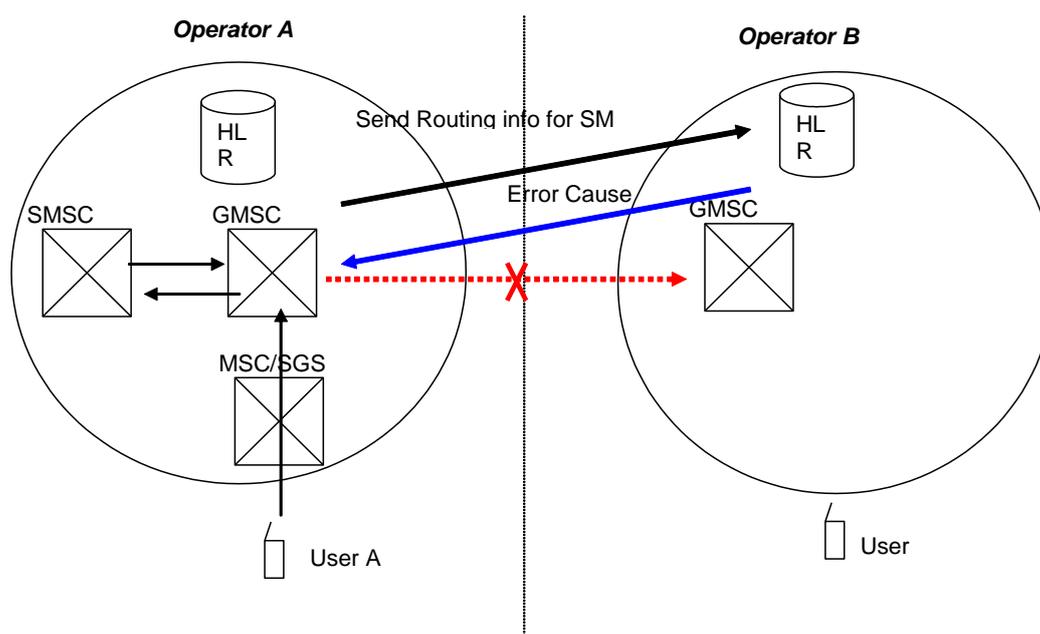


Figure 3: SMS Inter-working agreement NOT signed.

- User A subscribed with Operator A
- User B subscribed with Operator B.
- Operator A and Operator B have a Roaming agreement; however, do not have an SMS Inter-working agreement
- Operator B implements Bulk charging

2 SMS Test Cases

This is the global diagram used for the SMS.

One test is described, from/to HPLMN using an APLMN service Centre:

- MS₁(a) sends a message to MS₂(a) using the SMS-C(c)

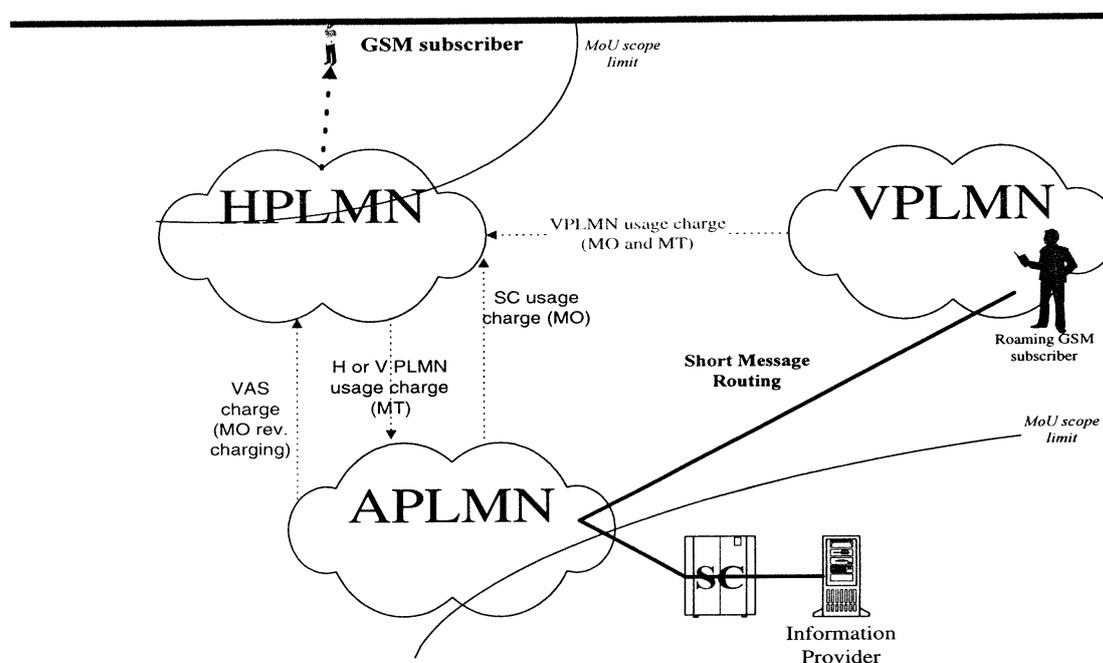


Figure 4: Main Scenario for SMS

2.1 Mobile Originated and Terminated SMS

- MS₁(a) to MS₂(a) using SMS-C(c)
- Preconditions: SMS-MO/MT is provisioned in HLR subscription. MS₁(a) and MS₂(a) are registered in HPLMN(a).
- Action: Switch on MS₁(a). Switch off MS₂(a).

- Use MS₁(a) to transmit a Short Message to MS₂(a) via the APLMN SMS - Service Centre (C) with Message Waiting priority selected.
- Wait for at least 2 minutes, to be sure there's a retry
- Switch on MS₂(a)
- Await delivery of Short Message to MS₂(a)
- Check contents of Short Message with those transmitted.
- Result: Successful result if Short Message is correctly delivered within [2] minutes of switching MS₂(a) on.

Comments: This test case confirms correct operation of SMS - Mobile Originated / Terminated Services including "Message Waiting" and "Note MS Present" procedures.

2.2 Mobile Originated and Terminated Short Message Service

MS₁(a) to MS₂(a) using SMS-C(c)

(a) MSISDN of MS₁(a)

(b) E164 address of APLMN SMS - Service Centre

Time of transmitting to SMS - Service Centrehr.....min.....sec

(d) MSISDN of MS₂(a)

(e) Time of switching on MS₂(a)hrminsec

(f) Time of receipt of SMS at MS₂(a)hrminsec

(g) Was message correctly received? [Yes/No]

If the message was not received, repeat test with MS₂(a) switched on.

Was message correctly received this time? [Yes/No]

(i) Comments

(j) Testcase Result [Pass/Fail/Not performed]

Signature of Tester Date.....

Annex A Document Management

A.1 Document History

Version	Date	Brief Description of Change	Approval Authority	Editor / Company
3.1.0	10 October 2005	Specification of IREG End-to-end Functional Capability tests relating to the international roaming of a Mobile Station subscribed to SMS services.	Networks Group	Javier Sendin GSMA

A.2 Other Information

Type	Description
Document Owner	Networks Group - SIGNAL
Editor / Company	Mark McGinley (AT&T Mobility)

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