

OC Roaming Hub Simplified IR Testing
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1 Introduction

1.1 Scope of document

This document is the specification of IREG End-to-end Functional Capability tests relating to 2G and 3G services in the case of international roaming of a Mobile Station, belonging to a home PMN(a), to a visited PMN(b), both connected to the same Roaming Hub Service Provider.

The tests included in PRD IR.48 will be performed once if the VPMN is a combined 2G/3G network or twice if the VPMN is not a combined 2G/3G network.

This document does not cover:

- The peerings scenarios (two Roaming Hub Services Providers between a home PMN(a) and a visited PMN(b)
- Testing of CAMEL Services
- Testing of services over LTE

1.2 Testing principles

In order to maximize the efficiency of testing, the test cases have been drawn up so as to minimize the requirement for simultaneous joint activity by both PMN (a) and PMN (b).

There are two potential testing strategies, depending on the business strategy of the Roaming Hubs:

1. PMN(a), PMN(b), PMN(c) and PMN(d) are all Operators connected to the same Roaming Hub. Both GSM and GPRS services are fully tested with PMN(c), acting as HPMN, based on IR24 and IR35 testing PRDs when PMN(b) is acting first time as VPMN. The test configuration is shown in Figure 1.

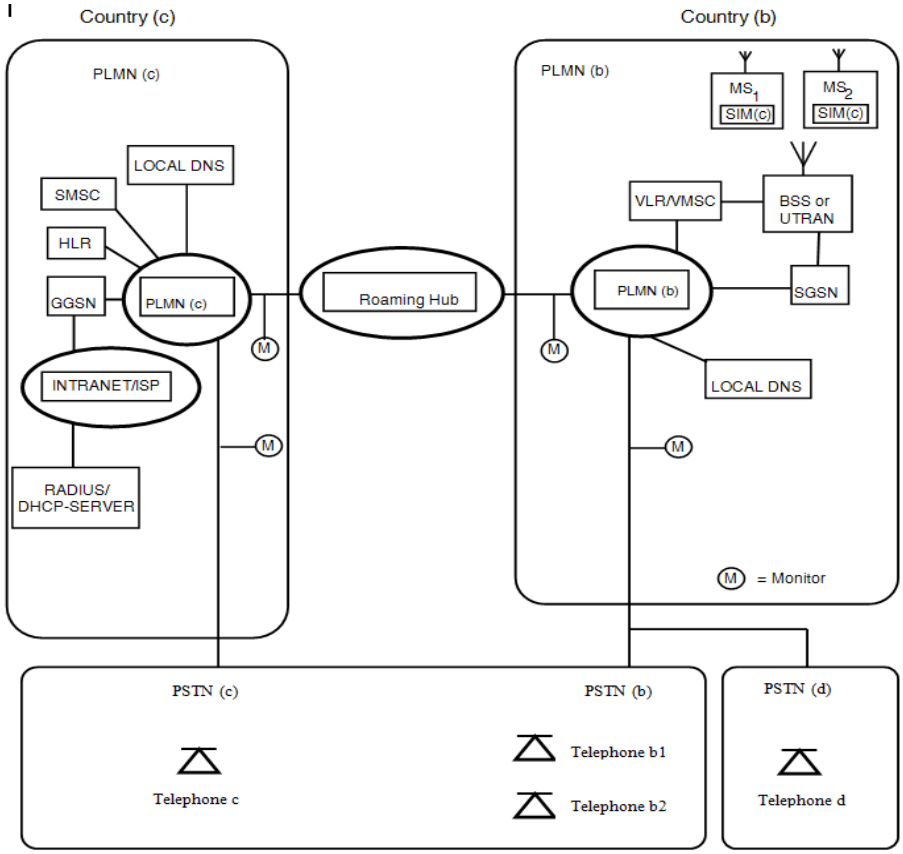

Figure 1: Testing Configuration – Full IREG testing

Upon successful completion the services tested with PMN(c), acting as HPMN, can be tested and opened in parallel with PMN(a) and PMN(d), acting as HPMNs, using a reduced testing scope that will ensure the basic functionality of the services. Therefore when PMN (a) , another Operator connected to the Roaming Hub, acting as HPMN, will request GSM and GPRS services to be opened into PMN (b) via the same Roaming Hub, the tests can be performed based on a reduced testing scope described in PRD IR48. The test configuration is shown in Figure 2.

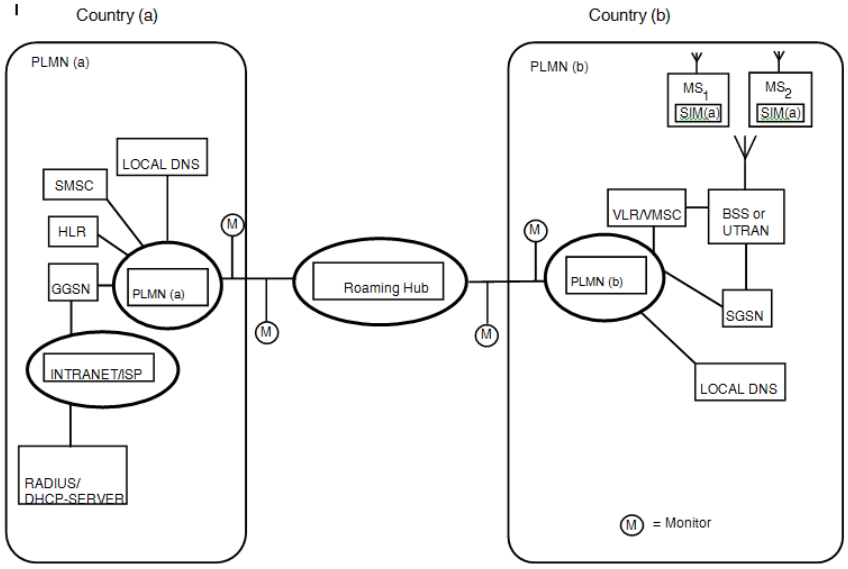

Figure 2: Testing Configuration – Reduced Testing

2. PMN(a) and PMN(b) are both connected to the same Roaming Hub. The Roaming Hub proves via active and passive Quality of Service monitoring that the connected Operators acting as VPMN are compliant with the prerequisites of the connected Operators acting as HPMN. Therefore no full IREG testing is required and the GSM and GPRS services can be opened upon completion of the reduced set of tests listed in PRD IR48. The test configuration is shown in Figure 3 .

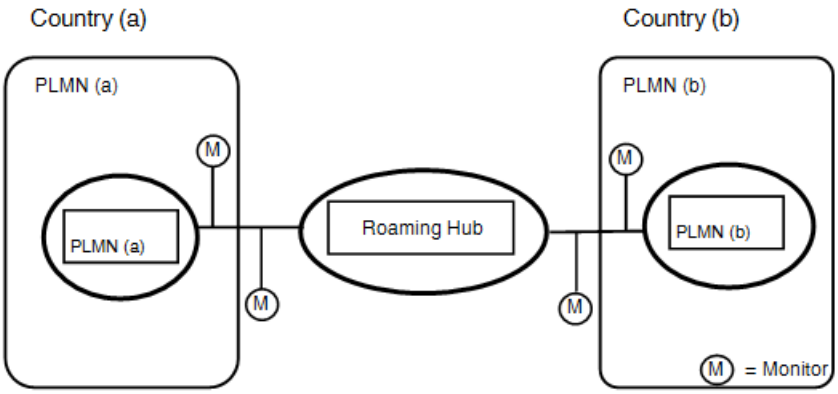

Figure 3: Testing Configuration with Monitoring

The reduced set of tests required in PRD IR48 is the minimum set of tests required for GSM and GPRS service openings.

Accordingly, the program of testing forms three distinct components.

i. PMN(a) issues pre-programmed (U)SIMs and programmed HLR
ii. PMN(b) or RHSP on behalf of PMN(b) performs tests
iii. PMN(b) and PMN(a) discuss results via the RHSP

1.3 Objective of tests

The fundamental objective of this testing is to confirm the capability, and sample the quality of service which users will receive when roaming from their Home PMN (a) to PMN (b) which are connected to the same Roaming Hub Provider. Consequently the tests are restricted to top-level capability testing.

The overall objective of the tests is to confirm that the functions and features, which are already known to operate correctly within each separate PMN, will also operate correctly for Inter-PMN roaming.

When there is no difference in a PMN's operation between Home and Visiting MSs, then there is no requirement to confirm successful operation during Stage 3 testing. An example of this is "handover".

In a Roaming Hub environment, when there is no difference in a PMN's operation during first Stage 3 testing when acting as VPMN and PMN's operation for the subsequent service openings as VPMN via the same RHSP, then there is no requirement to confirm successful operation during Stage 3 testing. In addition where a feature involves only the Gateway MSC and HLR, (both located in the HPMN), then there is no requirement to test during Stage 3.

The specific objectives are to prove that:

- "Location updating" and the associated "Inserting of Subscriber data" can be successfully completed for MS (a) roaming to VPMN (b).
- Incoming speech calls to MS (a) can be handled by:
    - HPMN(a) asking for Roaming Number from VPMN (b)
    - HPMN(a) successfully routing the call
    - VPMN(b) connecting the call
- Outgoing speech calls by MS(a) to the VPMN(b) are handled for: -
    - Emergency calls
    - International calls
    - Calls blocked from prepaid (U)SIMs where there is no live CAMEL agreement and the registration is allowed
- Supplementary Services can be registered and activated, and their status interrogated by the MS (a).
- Specific Supplementary Services can be invoked successfully:
    - Call Barring: All Outgoing Calls
    - Call Forwarding on No Reply
- Specific Supplementary Services can be activated by a MS which is roamed.
- Short Message Service is available between Home Country Service Centre and roamed mobile station.

- For CAMEL phase 1 and phase 2 prepaid subscribers, when HPMN allows registration, SMS is available and subscriber rightly charged.
- For CAMEL phase 3 or later, when HPMN allows registration, SMS are not allowed.

- Confirm the capability of packet switched data services which users will receive when roaming from their Home PMN(a) to PMN(b) via Roaming Hub Provider.

1.4 Definition of Terms

Term	Description
APN	Access Point Name
DN	Directory Number
DNS	Domain Name System
GGSN	Gateway GPRS Support Node
GMSC	Gateway Mobile Services Switching Centre
GTP	GPRS Tunnelling Protocol
HLR	Home Location Register
HPMN	Home PMN
HTTP	Hypertext Transport Protocol
MMSC	Multimedia Messaging Service Centre
MS	Mobile Station. MS (b) indicates that the MS subscription is managed by PMN(b)
PDP	Packet Data Protocol
PMN	("Public Mobile Network") including RSS ("Radio Sub-System") and NSS ("Network Sub-System").
RHSP	Roaming Hub Service Provider
SGSN	Serving GPRS Support Node
SMS	Short Message Service
SMSC	Short Message Service Centre
UDP	User Datagram Protocol
VMSC	Visited Mobile Services Switching Centre, including the always co-located entities MSC ("Mobile Services Switching Centre") and VLR ("Visitor Location Register")
VPMN	Visited PMN

1.5 Document Cross-References

Ref	Document Number	Title
1	IR.23	Organisation of GSM International Roaming Tests
2	IR.24	End-to-End Functional Capability Specification for Inter-PLMN Roaming
3	IR.35	End–to–End Functional Capability Test Specification for Inter-PLMN GPRS Roaming

4	IR.80	Technical Architecture Alternatives for Open Connectivity Roaming Hubbing Model

2 Test Cases

The test cases are divided in 4 groups:

- Basic Service (Telephony)
- Supplementary Services
- Short Message Service (Point to point)
- 2G/3G data services

The test configuration is shown in Figure 2 above. It is anticipated that it may be necessary to monitor signaling messages, voice calls and IP packet data on any of the Network Entity interfaces shown in the diagram. However this is not a firm requirement for this test specification.

The results of the test cases shall be recorded in Annex A: Appendix

2.1 Basic service test cases

2.1.1 MS1(a) Calls MS2(a), Both Roamed In VPMN(b)

2.1.1.1 Preconditions

MS1(a) and MS2(a) have location updated successfully in VPMN(b).

2.1.1.2 Action

- MS1(a) establishes call to MS2(a).
- Call answered and held for one minute.
- Quality assessed.

2.1.1.3 Expected Result

Successful result if call is established in 30 seconds, and call is stable in unanswered and answered phases, and there is no perceptible echo to either user, and call remains in intelligible/high quality conversation phase for 61 seconds. See CCITT Rec P.84 Annex D for instructions on use of Quality Scales. This test will also confirm the correct delivery of CLI information (or lack thereof) in a roaming scenario. The absence of the right CLI does not mean that the test has failed.

2.1.1.4 Comments

This test case confirms Mobile Originated and Mobile Terminated call sequences for roamers. It checks the support of the Provide Roaming Number MAP operation between PMN(a) and PMN(b). It checks the ability to establish international call between the two PMNs using roaming numbers. It implies the ability of the PMNs to disable excessive instances of echo control devices.

2.1.2 CAMEL negative test (MOC to local number with prepaid (U)SIM where there is no live CAMEL agreement) - Optional

2.1.2.1 Precondition

CAMEL is not enabled for the tested IMSI range on the VPMN

2.1.2.2 Actions

Perform a MOC to a local number from the VPMN

2.1.2.3 Expected Result

Test is PASSED, if the MOC will fail and the balance will not be deducted or if the registration of the prepaid (U)SIM is not allowed.

2.1.2.4 Comments

Depending on the set-up of the HPMN, the registration of the prepaid (U)SIM is allowed and the outgoing calls are barred in a non-Camel network or the registration is restricted.

2.2 Supplementary services test cases

2.2.1 Barring Of All Outgoing Calls [BAOC]

2.2.1.1 Precondition

HLR entry contains "SS:BAOC:Active" [Set by MS]

2.2.1.2 Actions

- MS(a) attempts Emergency Call [112 keyed on MS]
- MS(a) attempts call to PSTN.

2.2.1.3 Expected Result

- Successful result if the Emergency Call succeeds and the call to PSTN fails

2.2.1.4 Comments

This test case confirms the support of this Supplementary Service by the VPMN (b). It also indicates that Emergency Services are available to visitors from HPLM(a).

2.2.2 Call Forwarding on No Reply (CFNRY)

2.2.2.1 Precondition

- HLR entry for MS1(a) contains "SS: CFNRy: Active: Forwarded-to-address is MS2(a) or PSTN (a). [Set by MS]
- MS1(a) is attached and idle.
- If used, MS2(a) is attached.

2.2.2.2 Actions

MS1(a) initiates an “Interrogate Call Forward Information”. MS1(a) displays information. Attempt a call from PSTN(b) or MS(b) to MS1(a). After a period of time during which MS1(a) "rings", call is diverted to PSTN(a), MS2(a) or Voice Mail where it is answered.

2.2.2.3 Expected Result

Successful result if MS1(a) displays equivalent information to that stored in HLR and if MS1(a) "rings" for length of time equal to "No Reply Timeout" value stored in HLR, and call is completed to PSTN(a), MS2(a) or Voice Mail, and the call quality is acceptable. See CCITT Rec P.84 Annex D for instructions on use of Quality Scales. Optionally, PSTN telephone(b) or MS(b) may receive an announcement that the call is being forwarded.

2.2.2.4 Comments

This test case confirms that CFNRy operates correctly. It also confirms that the procedure “Interrogate Call Forward Information” operates correctly.

2.3 Short Message Service test cases

2.3.1 Mobile ORIGINATED and Terminated Short Message Service (SMS-MO)

2.3.1.1 Preconditions

SMS-MO/MT is provisioned in HLR subscription. MS1(a) and MS2(a) are registered in VPMN(b).

2.3.1.2 Action

- Switch on MS1(a). Switch off MS2(a).
- Use MS1(a) to transmit a 160 character Short Message to MS2(a) via the Home Country SMS - Service Centre with Message Waiting priority selected.
- Switch on MS2(a)
- Await delivery of Short Message to MS2(a)
- Check contents of Short Message with those transmitted.

2.3.1.3 Expected Result

Successful result if Short Message is correctly delivered within [2] minutes of switching MS2(a) on.

2.3.1.4 Comments

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

2.3.2 CAMEL negative test (SMS-MO from a prepaid (U)SIM to a postpaid (U)SIM from the HPMN where there is no live CAMEL agreement) - Optional

2.3.2.1 Precondition

CAMEL is not enabled for the tested IMSI range on the VPMN

2.3.2.2 Action

Sent a SMS-MO from a prepaid of the HPMN, via their SMSC, to a postpaid from the same network. Please check before and after the balance of the prepaid (U)SIM

2.3.2.3 Expected Result

Test is PASSED, if the SMS-MO will be delivered to the postpaid (U)SIM and the balance will be deducted or if the registration of the prepaid (U)SIM is not allowed or if the SMS-MO is not allowed.

2.3.2.4 Comments

Depending on the set-up of the HPMN, the registration of the prepaid (U)SIM and the SMS-MO are allowed in a non-Camel network or the registration is restricted.

2.4 2G/3G Data service test cases

2.4.1 HTTP-WEB-Browsing of MS1(a) in VPMN(b) using home GGSN

2.4.1.1 Precondition

- MS1(a) is GPRS-Attached in VPMN(b). (MS in STANDBY or READY state for 2.5G)
- No valid PDP contexts are established in the MS1(a).
- PDP context subscription record(s) exists in HLR(a) where PDP type (S) = PDP type (R).
- One PDP context subscription record exists in HLR(a) where APN(S) = APN(R).
- VPMN not allowed for selected PDP context subscription records.

2.4.1.2 Actions

- MS1(a) performs “Activate PDP Context Request”. PDP type (R) is sent by MS1(a).
- A PDP Address is not sent by MS1(a) and is not present in a PDP context subscription record. (Dynamic address allocation)
- APN (R) (Network-ID, no Operator-ID) is sent by MS1(a).
- Pre-defined file is requested/transferred from External Network (Network-ID) to MS1(a) by accessing HTTP-server over WEB-browsing.

2.4.1.3 Expected Result

- SGSN(b) receives APN(R) sent by MS1(a).
- SGSN(b) selects PDP context subscription record (APN(S), APN(S)=(APN(R)) and sets selection mode parameter to “subscribed”.
- SGSN interrogates DNS-Functionality with selected APN with appended HPMN APN-Operator-ID
- Selected APN is translated to a GGSN(a)-Address in the HPMN(a) or to the associated alias on the Roaming Hub, depending on the setup
- SGSN(b) returns an “Activate PDP Context Accept” message to the MS1(a) including PDP type and PDP address.
- Valid PDP contexts are established in the MS1(a).
- Connection to Network specified by APN(Network-ID) is established.
- Pre-defined file is successfully transferred at an agreed quality (data rate) with no errors after using HTTP-Service.

- PDP-Context is deactivated

2.4.1.4 Comments

This test case confirms PDP context activation/deactivation towards a home GGSN(a) with:

- APN(R) is not empty; (Network-ID, no Operator-ID)
- Setting of APN (Operator-ID) by subscription for HPMN(a) (APN(S)).
- Setting up IP-tunnel connections (GTP, IP, UDP/TCP)
- Root address lookup and dynamic address allocation.

If the PDP context activation procedure fails or if the SGSN returns an “Activate PDP Context Reject” (Cause, PDP Configuration Options) message, then the user may attempt another activation to the same APN up to a maximum number of attempts.

2.4.2 MMS with MS1(a), MS2(a) in VPMN(b) using home GGSN and MMSC

2.4.2.1 Precondition:

- MMS-MO/MT is provisioned
- MS1(a) and MS2(a) are registered in VPMN(b).

2.4.2.2 Actions

- Use MS1(a) to transmit a Multimedia Message to MS2(a) via the Home MMSC
- Await delivery of Multimedia Message to MS2(a)
- Check contents of Multimedia Message with those transmitted

2.4.2.3 Expected Result

Successful result if Multimedia Message is correctly delivered. If delivery report is requested, check that it is correctly delivered.

2.4.2.4 Comments

This test case confirms correct operation of mobile-originated/terminated MMS routing and transfer over GPRS radio channels

3 Equipment requirements

The testing responsibility on PMN(b) is sitting with PMN(b) or the RHSP, dependent on their agreement as per PRD IR.80.

3.1 User equipment

The Equipment described in this Section is necessary for undertaking the test cases described in Section 2.

a) Two Mobile Equipments supplied by PMN(b) or equivalent testing probes supplied by the RHSP where PMN(b) is connected to.
b) Two postpaid (U)SIMs supplied by PMN(a)
c) Two prepaid (U)SIMs supplied by PMN(a)
d) Two postpaid (U)SIMs supplied by PMN(b)

3.2 Test Equipment

The availability of a CCITT # 7 tester able to decode SCCP, TCAP, MAP is highly advisable, but not strictly necessary for these tests. However it is essential for any analysis of test case failures.

Clock capable of being used to allow testing personnel to record call start and chargeable start (that is, answer) time of calls to an accuracy of better than five seconds. If possible, the clock shall be adjusted to be in alignment with the internal MSC clock which is used for the Toll Ticketing function.

Stopwatch capable of measuring perceived chargeable duration of calls to an accuracy of one second.

4 Pre-Testing Data Exchange

It is necessary for the Roaming Hub Provider to manage the exchange of the pre-testing data defined in this Section prior to the commencement of testing.

4.1 Testing Contact Information

The following test Co-ordination contact information should be exchanged by both PMNs and Roaming Hub Provider:

- names,
- telephone numbers,
- fax numbers, and
- email address.

4.2 (U)SIM associated data supplied by PMN(a)

The following information is required individually for each of the (U)SIMs supplied

- PIN, PUK/ (SUPER PIN).
- IMSI
- MSISDN
- APNs

PLMN addressing numbering and routing data as referenced in PRD IR.23 [1] is regarded as advisable. Such information includes:

1. E212-E214 translation
2. MSC/VLR and HLR E.164 addresses
3. MSRN number ranges
4. SMS Service Centre E.164 address

Annex A Test book



IR48_3.xls

Annex B Document Management

B.1 Document History

Version	Date	Brief Description of Change	Approval Authority	Editor / Company
1.0	April 2014	First version for GSM and GPRS services	IREG	Mihaela Ambrozie / Vodafone Roaming Services

Other Information

Type	Description
Document Owner	IREG SIGNAL
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