3GPP TR 31.828 V10.0.0 (2011-04)

Technical Report

3rd Generation Partnership Project;
Technical Specification Group Core Network and Terminals;
UICC access to IMS
(Release 10)

Keywords
IMS, UICC, card

3GPP

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Contents

Foreword

This Technical Report has been produced by the 3rd Generation Partnership Project (3GPP).

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where:

- x the first digit:
  - 1 presented to TSG for information;
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- y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
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Introduction

IMS is foreseen to provide all the services, current and future, that existing mobile networks provide. IMS may allow operators to develop new value added applications as well as to enhance their existing solutions. These IMS-based applications may be located in the UE. Furthermore, additional IMS-based applications could reside and be executed in the UICC. This will lead to new opportunities and allows for example the development of operator-specific IMS-based applications that require a high level of security and portability.

1 Scope

This Technical Report will identify technical solutions in order to provide the necessary mechanism in the UICC and the UE to make use of IMS functionalities implemented in the UE.

The selected solution should allow

- discovery of the support of the feature by each other (UE-UICC)
- discovery of the supported capability by the UE
- UICC registration to IMS network through the UE.
- the UICC to participate to an IMS session (i.e. receive messages pushed by an IMS application server)
- the UICC to set up an IMS session (i.e. send messages to an IMS application server)
- the UICC to be notified when IMS de-registration occurs
- the identification of a message for which the destination is a UICC application
- routing messages from and to UICC applications
- UICC applications to be identified by other applications in the IMS network

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] 3GPP TS 24.229: "IP multimedia call control protocol based on Session Initiation Protocol (SIP) and Session Description Protocol (SDP); Stage 3"

[3] 3GPP TS 23.228:"IP Multimedia Subsystem (IMS); stage 2"

[4] 3GPP TS 31.111:"USIM Application Toolkit (USAT)"

[5] 3GPP TS 23.003:"Numbering, addressing and identification"

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in TR 21.905 [1] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in TR 21.905 [1].

UICC application Id: a unique identifier allowing UICC application to be identified in IMS network.

3.2 Symbols

For the purposes of the present document, the following symbols apply:

|| Concatenation

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [1].

BIP: Bearer Independent Protocol

IARI: IMS Application Reference ID

IMPI: IMS Private user Identity.

IMPU: IMS Public User Identity.

IP: Internet Protocol

OTA: Over The Air

SCWS: Smart Card Web Server

4 Use cases and problem description

Currently the UICC cannot send and receive SIP traffic to an IMS network. This feature is required in order to enable OTA updates to the UICC. This can be done through both a push data mechanism and a pull data mechanism.

This section contains a list of use cases for the UICC access to IMS.

NOTE: Use cases are listed for the sole purpose of illustrating scenarios in which the UICC will make use of IMS functionalities implemented on the ME. The use cases below are informative, and are not functional description of requirements.

Use Case 1: Over-The-Air Remote management of single-user-multiple-UICC

Today when an operator needs to update the subscriber's UICC contents, it uses the OTA remote management platform. The OTA platform would send SMS messages containing the commands that the UICC would execute at the reception of the messages. It is based on a point-to-point concept, in particular with the OTA server sending messages to a single UICC. When the user has multiple devices, the OTA platform would need in this case to send several sets of messages to the deferent user's UICC. The OTA management of these UICCs could be optimized if a single OTA management message could reach all the UICCs of a specific user.

Use Case 2: Over-The-Internet UICC remote management

Some operators are offering "unified" communication package to corporate users or small business users. Such offers bundle a mobile phone subscription and VoIP & Messaging PC/Laptop applications, and are typically deployed inside a USB dongle. These USB dongles are secured by a USIM (user authentication at access and service level). These USIM cannot be addressed by SMS (no 3GPP modem), but still need to be managed as a conventional USIM. The management of such devices could benefit from the use of the SIP/IMS capabilities by allowing the management platform to send/receive SIP/IMS messages to/from the USIM.

Use Case 3: UICC based Rich Communication Suite (RCS) Client

RCS is a communication package that allows user to communicate via instant-messaging, chat, whiteboard, to share documents, videos, pictures and be always in contact with its social network. More and more GSMA RCS pilots are launched worldwide. GSMA RCS is based on IMS. Today, more and more handsets are sold with SCWS technology support. Some operators may want to deploy RCS Client on UICCs supporting both SCWS and "UICC Access to IMS" features. These UICC-based RCS Clients would provide a default RCS client to a mobile user without the need to install a full-fledged RCS client on the handset. This would allow the user to access directly the RCS service and have a fast and first flavour of the service prior to downloading the full-fledged RCS client.

Use Case 4: User Authentication to Internet Services

Some operators are looking at providing Identity Management service to their users. As an example, a mobile user benefiting from such service would receive an authentication message from his mobile operator, asking him to enter a PIN, every time he is logging into his Internet banking service on his PC for instance. This system is making use of the GBA Push mechanism. For a single device user situation, the message asking for the PIN, is sent inside an SMS to the user's UICC. The UICC then sends a STK command to the Handset asking the handset to display a text and requesting the user to enter his PIN. The PIN is checked by the UICC locally and the UICC then sends an answer back to the operator with the results of the user verification process. In a multiple device environment, the message should be sent to all the user's devices, and the user would pick up the message on the most convenient device at the moment he receives that message. This is possible if the UICCs have access to the device IMS capabilities.

5 Solutions overview

Solution 1 : explicit IMPU registration based solution

In this solution, the UICC application identifier is an IMPU. The UICC registers to the IMS network by sending explicitly a registration command to the ME. The ME, upon reception of the command, will initiate a registration procedure, and register IMPU provided by UICC. This implies that the ME supports registration of several IMPU at different points in time, since the registration request form UICC can come anytime.

Solution 2 : implicit IMPU registration based solution

In this solution, the UICC application identifier is an IMPU. The IMPU stored in ME and the IMPU for UICC will belong to the same implicitly registered ID set, as defined in TS 23.228 [3]. With implicit registration based solution, the ME does not need to trigger an IMS registration when requested by UICC, if ME has already registered.

Solution 3 : IARI routing based solution

One possible solution to enable IMS access to the UICC is to use the IMS Application Reference ID (IARI). This solution would enable active applications hosted on the UICC to register their IARIs to the IMS network. Like applications installed in the ME, these applications would receive all relevant SIP traffic associated with their IARIs directed to them using the IARI in the Accept-Contact header in the SIP request. This solution would also allow the ME to register all known active IARI regardless of their location (ME or UICC) in a single SIP REGISTER message sent to the IMS network.

Usage of BIP mechanism

The Above solutions will reuse BIP mechanism defined in 3GPP TS 31.111 [4] in terminal-UICC interface

- discovery of supported features using USAT mechanism
- establishment of a channel dedicated to IMS
- allocation of buffers, channel id, using BIP mechanism
- usage of SEND DATA RECEIVE DATA to convey SIP messages

Extension or modification to existing BIP mechanism may be needed, depending on the solution selected.

5.1 Discovery of the supported features

5.1.1 IMPU explicit registration based solution

A ME supporting UICC access to IMS based on IMPU explicit registration will support the BIP OPEN CHANNEL for IMS proactive command. The support of this command will be indicated in TERMINAL PROFILE, using mechanism defined in 3GPP TS 31.111 [4].

5.1.2 IMPU implicit registration based solution

A ME supporting UICC access to IMS based on IMPU implicit registration will support the BIP OPEN CHANNEL for IMS proactive command. The support of this command will be indicated in TERMINAL PROFILE, using mechanism defined in 3GPP TS 31.111 [4].

5.1.3 IARI SIP Routing to the UICC

5.1.3.1 Discovery of the UICC's IARIs

In order to reduce the amount of SIP REGISTER [2] messages to indicate the IARIs associated with active applications on the UE, the UICC advertises at boot-up (or initialisation) the IARIs associated with active UICC hosted applications to the ME.

5.2 Registration and authentication

5.2.1 IMPU explicit registration based solution

5.2.1.1 UICC Identifiers

The UICC is allocated with an IMS public identity (UICC IMPU).

This UICC IMPU is provided to the ME during registration, as part of BIP Open Channel for IMS proactive command.

5.2.1.2 Explicit registration

The UICC will provide to the ME in OPEN CHANNEL for IMS command all necessary parameters to register to IMS.

Upon receiving this command, the ME will attempt a registration of the IMS Public user identity contained in the OPEN CHANNEL for IMS parameter field to IMS network, as specified in 3GPP TS 24.229 [2].

If the IMPU is already registered by ME, the ME is expected to return an error.

Upon successful registration, the ME returns to the UICC the ME IP address bound with the IMPU.

5.2.1.5 De-Registration

- IMS network initiated de-registration:

The ME sends an ENVELOPE (Event download - channel status) to indicate the UICC that IMPU is de-registered.

- User initiated de-registration

The UICC sends a CLOSE CHANNEL command to indicate that the User de-registered the IMPU. Upon reception of a CLOSE CHANNEL command, the ME executes an IMS de-registration process, as specified in TS 24.229 [2].

5.2.2 IMPU implicit registration based solution

5.2.2.1 UICC Identifiers

The UICC is allocated with an IMS public identity (UICC IMPU).

This UICC IMPU is deduced using a function **F** (IMPI), private identity associated with the subscription

(ISIM IMPI if ISIM is present, temporary IMPI deduced from IMSI either).

*Note: this function **F** is not to be standardized.*

5.2.2.2 Implicit registration

The implicit registration feature described in TS 23.228 [3] is used to associate the UICC IMPU to other public identities of the subscription.

When an ISIM is present, the IMPU for the UICC is associated with the first Public User Identity of the ISIM in an implicitly registered ID set.

When an ISIM is not present, the IMPU for the UICC is associated with the IMPU derived from the IMSI.

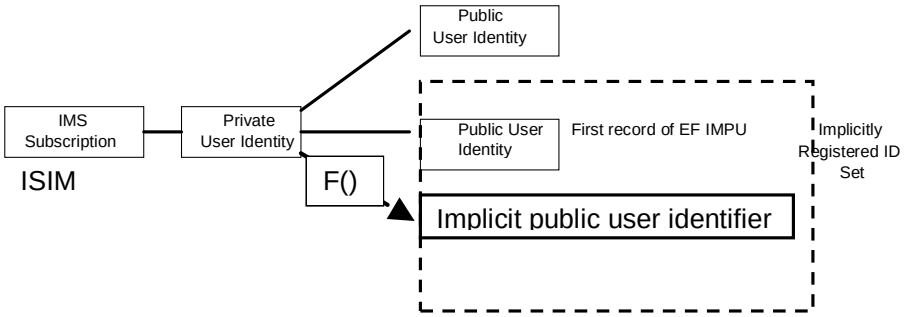

Figure 5.1: Relationship of Public User Identities when implicitly registered

5.2.2.3 Registration

See TS 24.229 [2]

When the UICC requests a USAT "BIP Open channel for IMS" command

- If the ME already registered to IMS the user public identity (ies) then the IMPU for UICC is implicitly registered, the ME can directly return successful command status

- If the ME has not already registered to IMS, it is up to the ME to trigger the standard IMS registration as stated in TS 24.229 [2], using this first IMPU of EF_{IMPU}. In case the ME implements this registration, the ME will manage re-registration

It is expected that no extra code is needed for the ME and that there is a minimum impact onto its registration state machine in this solution.

5.2.2.4 Authentication

See TS 24.229 [2].

5.2.2.5 De-Registration

Two possible de-registration causes are handled in the following way:

- IMS network initiated de-registration:

In this case the ME sends an ENVELOPE (Event download - channel status) to indicate to the UICC that its implicit public ID is de-registered.

NOTE: It is not possible for the network to directly ask for UICC de-registration, as the side effect would be user de-registration.

- First IMPU de-registration by the ME:

In this case the ME sends an ENVELOPE (Event download - channel status) to indicate to the UICC that its implicit public ID is de-registered.

5.2.3 IARI SIP Routing to the UICC

The initial SIP REGISTER [2] request sent by the ME contains the IARIs associated with active applications hosted on the UICC along with the active applications hosted on the ME. If the list of IARIs associated with active applications on the UICC changes, the UICC indicates this change to the ME. The ME then sends the necessary SIP REGISTER [2] request containing the UICC hosted IARIs and ME hosted IARIs to reflect this change.

The ME sends the list of registered IMPUs as received from the IM CN Subsystem in response to the IMS registration as an indication to the UICC that the IMS registration has been completed successfully and that the UICC IARIs have been registered associated with these IMPUs.

After the successful registration the ME forwards to the UICC all SIP requests containing an Accept-Contact header field containing the IARIs associated with the active applications hosted on the UICC. The ME also forwards to the UICC any SIP responses or subsequent SIP requests received that are part of the same dialog or standalone transaction as an initial SIP request forwarded to the UICC or received from the UICC.

5.3 Message flow

5.3.1 Message flow for IMPU explicit registration based solution

5.3.1.1 Registration

Upon reception of OPEN CHANNEL for IMS command, the ME will initiate a registration process with the parameters provided by the UICC.

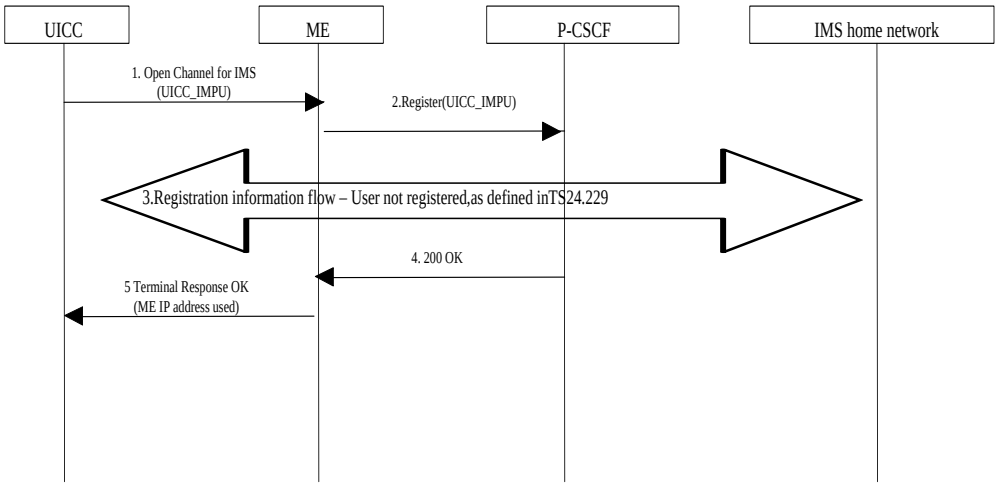

Figure 5.2: explicit registration

5.3.1.2 De-Registration

Initiated by the user:

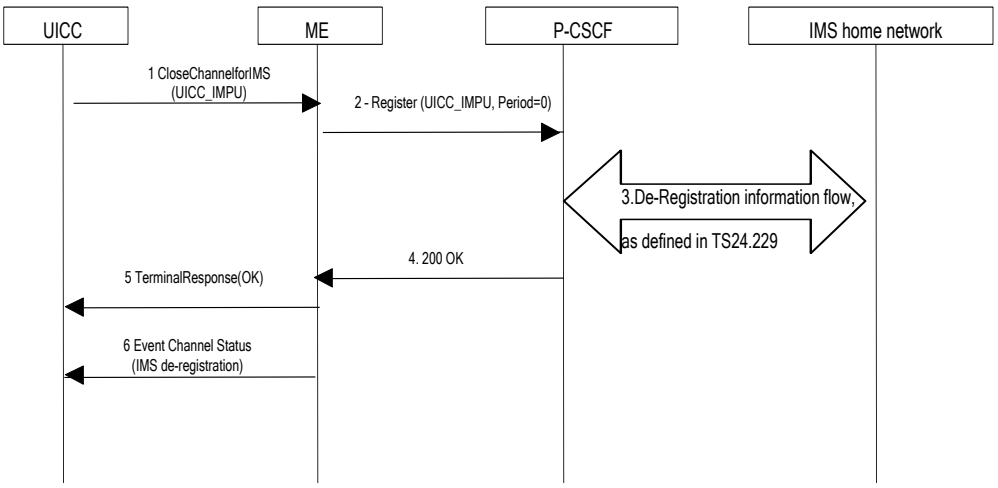

Figure 5.3: user initiated de-registration

Initiated by the Network (i.e. administrative de-registration). In this case

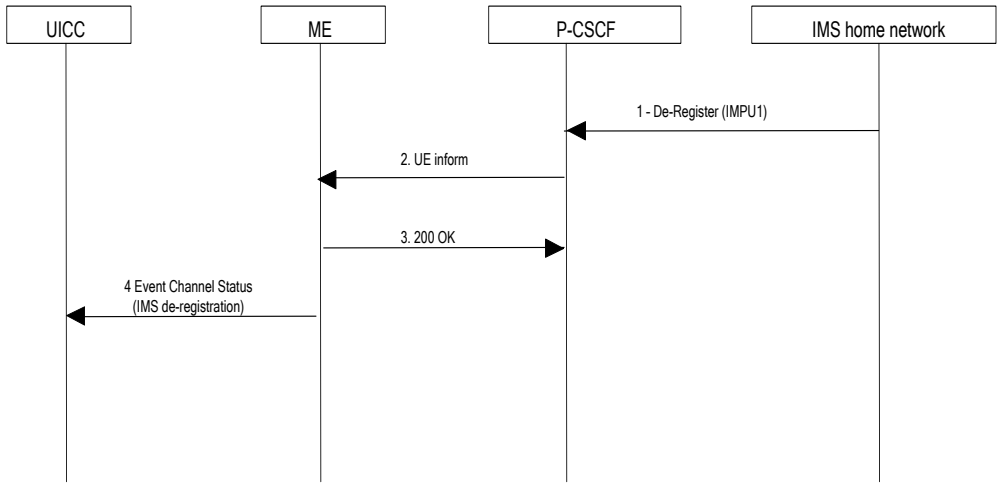

Figure 5.4: Network initiated de-registration

5.3.1.3 SIP Message from UICC

Same as for "IMPU implicit registration based solution"

5.3.1.4 SIP Message to UICC

Same as for "IMPU implicit registration based solution"

5.3.2 Message flow for IMPU implicit registration based solution

5.3.2.1 Registration

If the ME has not already registered to IMS, it is up to the ME to trigger the standard IMS registration as stated in TS 24.229, using this first IMPU of EF_{IMPU}:

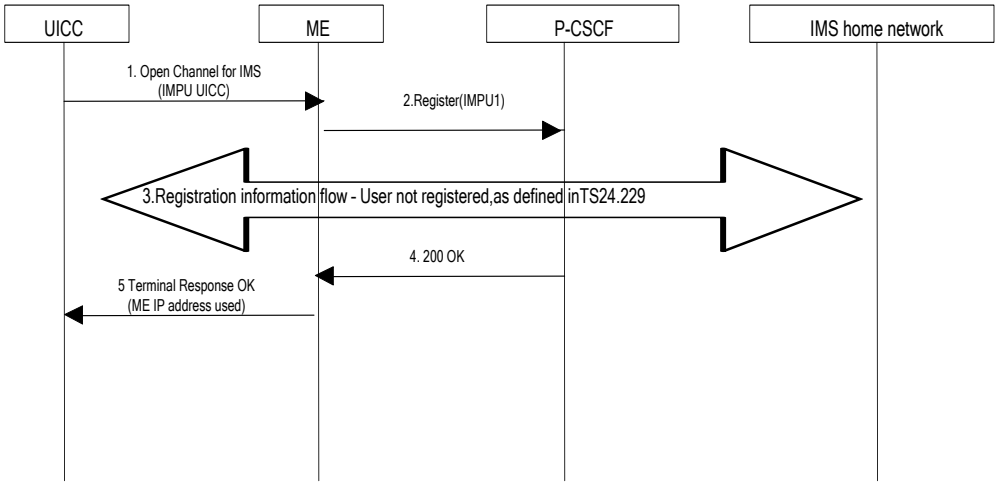

Figure 5.5: User IMPU not already registered

If the ME already registered to IMS the user public identity (ies) then the IMPU for UICC is implicitly registered, the ME can directly return successful command status:

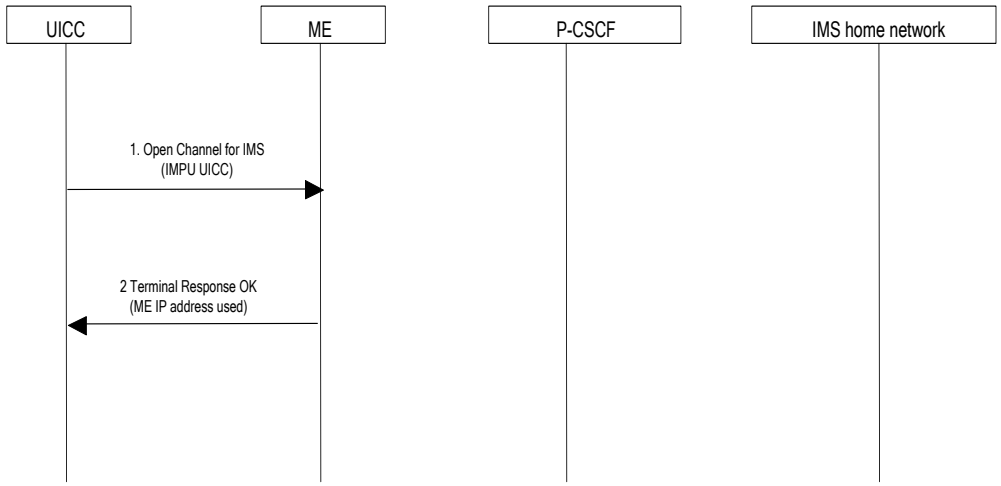

Figure 5.6: User IMPU already registered

5.3.2.2 De-Registration

Initiated by the ME:

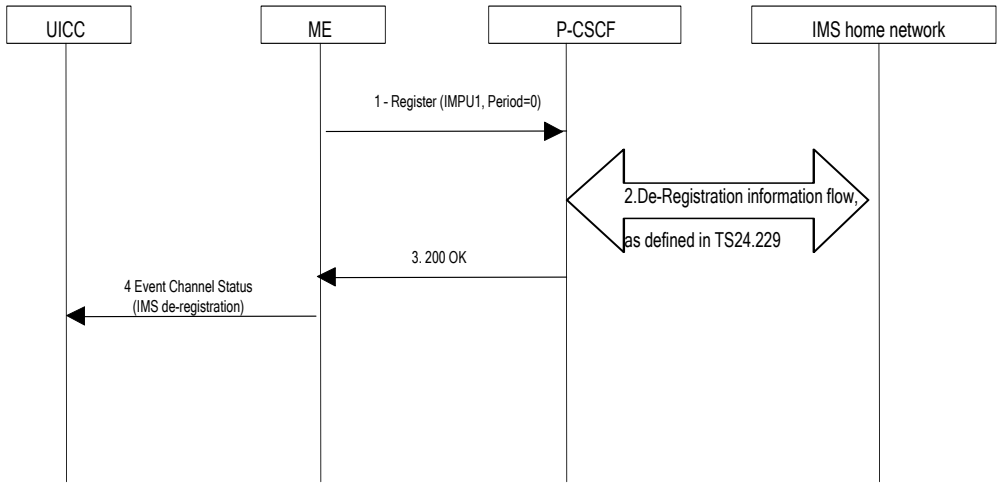

Figure 5.7: Mobile initiated de-registration

Initiated by the Network (i.e. administrative de-registration). In this case

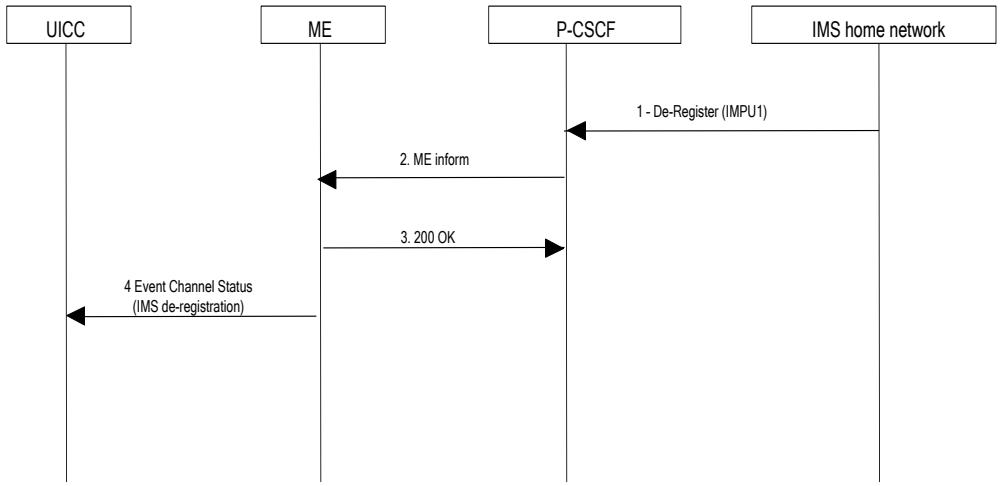

Figure 5.8: Network initiated de-registration

5.3.2.3 SIP Message from UICC

After a successful "BIP OPEN CHANNEL for IMS" command

- the UICC IMPU is IMS registered

- the UICC knows the IP address used by the ME for IMS signalling.

UICC can then build SIP messages and send them encapsulated in a SEND DATA command, the ME is in charge to de-capsulate the SEND DATA and to send the SIP message to the P-CSCF

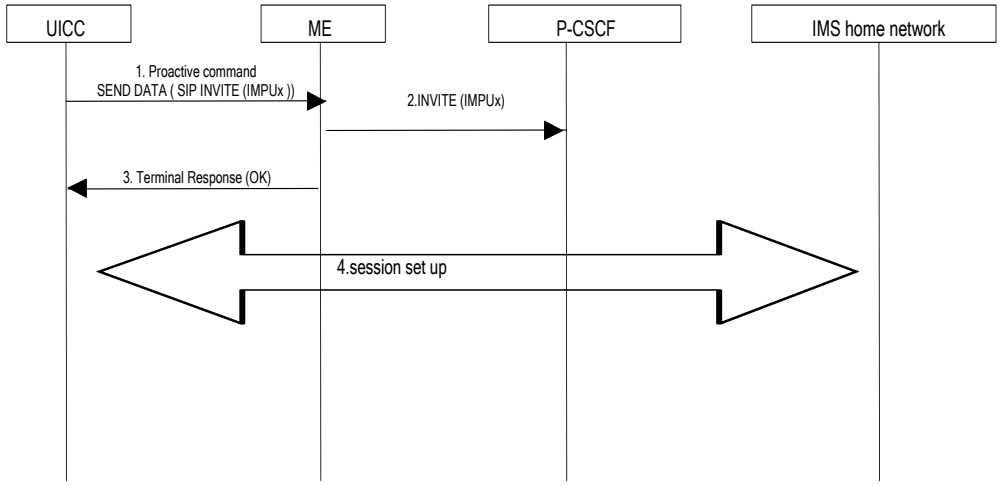

Figure 5.9: SIP message from UICC, i.e. : session INVITE

5.3.2.4 SIP Message to UICC

After a successful "BIP OPEN CHANNEL for IMS" command, the ME is aware of the UICC IMPU. The ME is then able to trigger an Event Data available for the UICC to retrieve the SIP message encapsulated in a RECEIVE DATA command

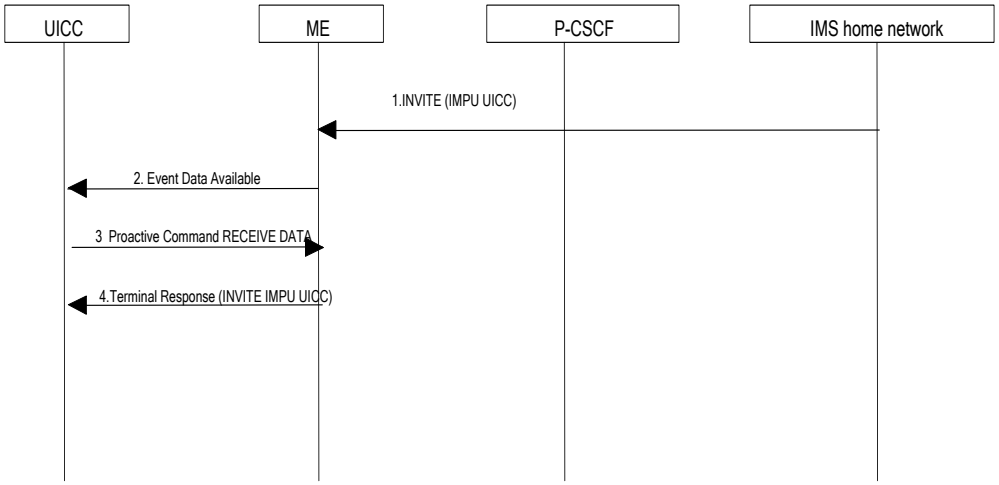

Figure 5.10: SIP message to UICC

5.3.3 IARI SIP Routing to the UICC

5.3.3.1 Discovery of the UICC's IARIs and Registration

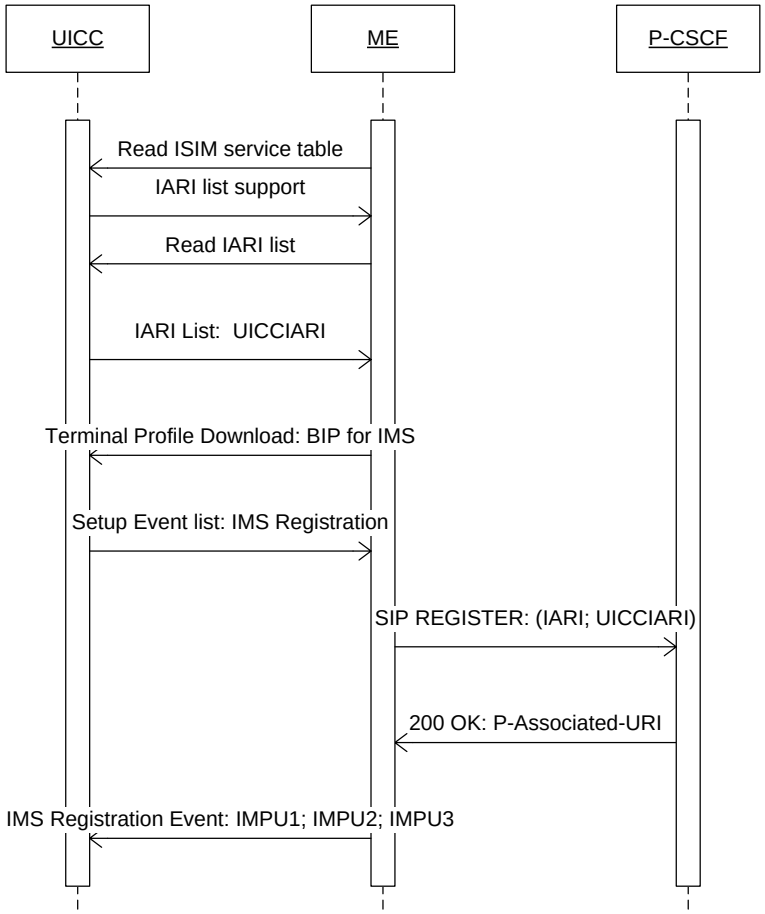

Figure 5.11: Discovery of the UICC's IARIs and Registration

The UICC can provide a list of active IARIs to the ME using an EF. This EF can be part of the ISIM or USIM or DF TELECOM.

The UICC registers for the IMS Registration event with the ME. The ME registers the IARIs associated with all of the UICCs active applications.

Once the registration is complete and successful, the ME sends the IMPU list included in the P-Associated-URI of the SIP 200 (OK) response [2] to the UICC as part of the IMS Registration Event. The UICC now knows the state of the IMS Registration and can send an Open Channel command to the ME when it needs to transmit or receive its SIP data.

For the UICC to change its active applications and trigger a subsequent registration it triggers a Refresh command on its list of Active IARIs. The ME will identify the change and transmit the necessary SIP REGISTER request [2] to reflect that change to the network.

5.3.3.2 Notification of Incoming IMS data

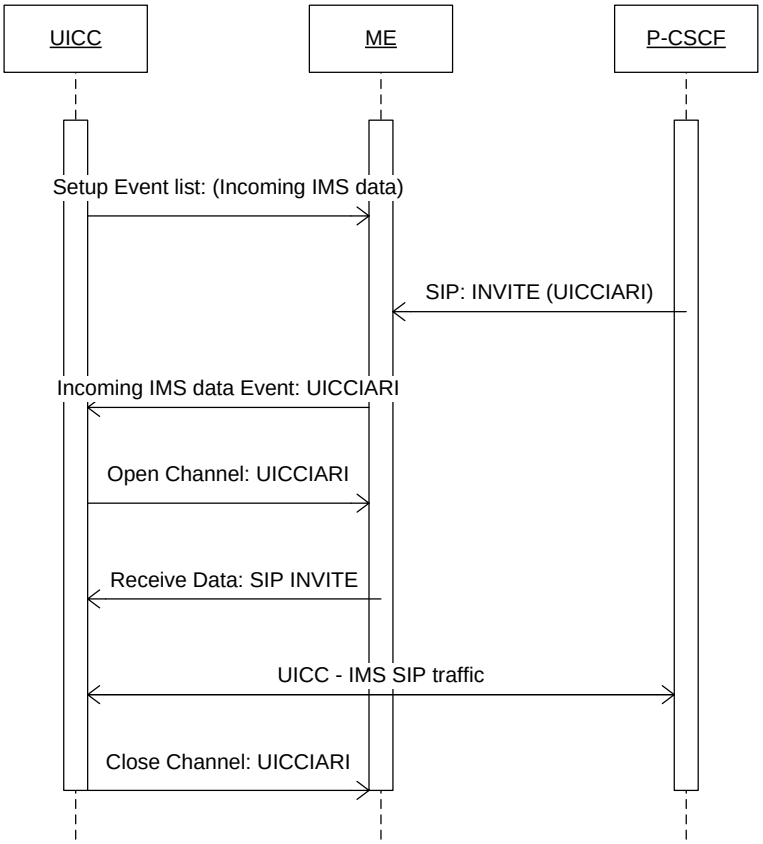

Figure 5.12: Notification of incoming IMS data

The UICC Registers for the incoming IMS data event. When the ME receives a SIP INVITE request [2]) containing an Accept-Contact header field containing an IARI associated with an active application hosted on the UICC, the ME sends the incoming IMS data event to inform the UICC of the pending data.

The UICC then opens a channel for the application associated with the IARI and receive the incoming SIP request. The UICC will complete its SIP data transfer session and then close the channel for the application associated with the IARI.

5.3.3.3 UICC originating a SIP INVITE

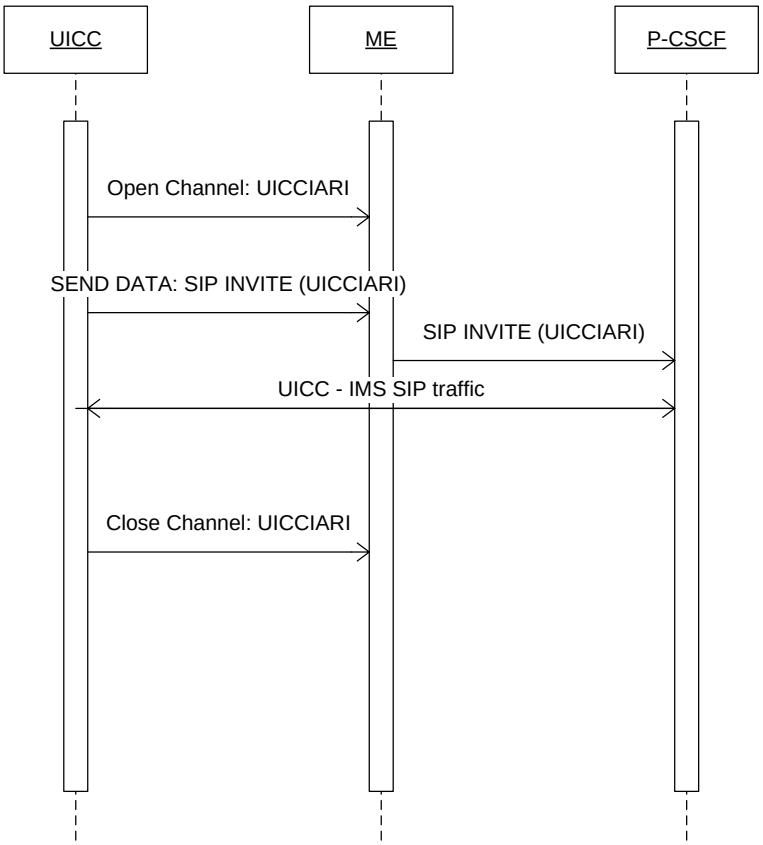

Figure 5.13: UICC originating a SIP INVITE

To initiate a SIP session, the UICC can open a channel for the application associated with the IARI and transmit the SIP request. After the termination of a SIP dialog or completion of a SIP standalone transaction the UICC closes the channel for the application associated with the IARI.

5.3.3.4 Discovery of an IMS Registration error

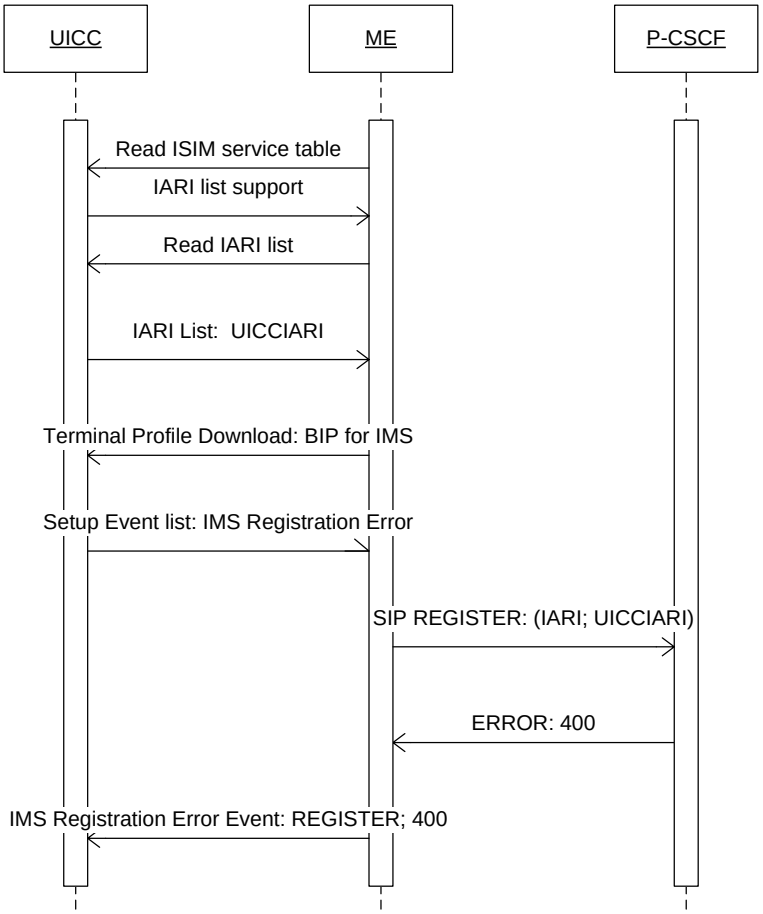

Figure 5.14: IMS Registration Error Event

The UICC can provide a list of active IARIs to the ME using an EF. This EF can be part of the ISIM or USIM or DF TELECOM.

The UICC registers for the IMS Registration Error event with the ME. The ME registers the IARIs associated with all of the UICCs active applications.

If there is an error during the IMS Registration procedure, the ME notifies the UICC of the error by providing the status code received from the network in response to the SIP REGISTER message. The ME may want to choose to inform the UICC of the status codes that represent more "permanent" failures.

It is feasible for this event registration to be combined with the IMS Registration Event described in 5.3.3.1.

5.4 Impact on IMS Core network

5.4.1 Explicit IMPU registration based solution

No impact on the HSS.

Optionally, an IMPU address range can be allocated on the HSS side to mark the IMPU associated with UICC.

No impact identified on P-CSCF, I-CSCF, S-CSCF.

5.4.2 Implicit IMPU registration based solution

The derivation function **F** () is used in the HSS to compute IMPU_UICC from the IMPI stored in the ISIM.

- The derivation function is not described in TS 31.111
- Can be pre-computed, and HSS pre-provisioned
- Can be computed on the fly

It is assumed that the implicit registration set is maintained properly in HSS, to avoid potential synchronization problem.

If no ISIM is present in the UICC, temporary IMPI / IMPU are derived from IMSI following the rules defined in TS 23.003 [5]. The derivation function F( ) will be applied to temporary IMPI to compute IMPU_UICC.

Since the UICC will own its own IMPI / IMPU, these values will be stored in the HSS and bound to the UICC.

No impact identified on P-CSCF, I-CSCF, S-CSCF.

5.4.3 IARI SIP Routing to the UICC

There are no impacts to the IMS Core network as the UE's IMPU is still in use for addressing the user and the UE and all the network-based application server needs to do is include the appropriate IARI in the Accept-Contact header field of the SIP request. This is in-line with the current IMS architecture for routing to installed applications on the UE.

5.5 Impact on the Mobile Equipment

5.5.1 IMPU explicit registration based solution

- The support of BIP OPEN CHANNEL for IMS proactive command will be indicated in TERMINAL PROFILE, using mechanism defined in 3GPP TS 31.111 [4].

- A ME triggers a Registration procedure as described in TS 24.229 when receiving BIP OPEN CHANNEL for IMS from the UICC

- A ME acts as a gateway between SEND DATA / RECEIVE DATA BIP protocol with the UICC and SIP messages with P-CSCF for signalling based on UICC IMPU

- The ME needs to maintain the SIP registration state (timers etc) for the SIP registration transmissions coming from the UICC and its own SIP stack in order to avoid potential conflicts when accessing the IMS network.

5.5.2 IMPU implicit registration based solution

- The support of BIP OPEN CHANNEL for IMS proactive command will be indicated in TERMINAL PROFILE, using mechanism defined in 3GPP TS 31.111 [4].

- A ME may trigger a Registration procedure as described in TS 24.229 when receiving BIP OPEN CHANNEL for IMS from UICC

- A ME acts as a gateway between SEND DATA / RECEIVE DATA BIP protocol with UICC and SIP messages with P-CSCF for signalling based on UICC IMPU

- The ME needs to maintain the SIP registration state (timers etc) for the SIP registration transmissions coming from the UICC and its own SIP stack in order to avoid potential conflicts when accessing the IMS network.

5.5.3 IARI based solution

The ME needs to support the necessary additional USAT commands along with the necessary ISIM or USIM files to support this feature:

- Open Channel for IMS/IARI
- Setup Event List and Event download for IMS Registrations
- Setup Event List and Event download for incoming IMS requests
- An ISIM or USIM EF that contains all IARIs associated with active applications hosted on the UICC

6 Conclusion

Three solutions have been identified; their respective mechanisms are described in section 5.

In this section, the pros and cons of the three solutions are discussed.

6.1 Solution 1 explicit IMPU based solution, pros and cons

Cons:

- This solution has the greatest impact on the handset amongst the 3 solutions. This solution also has some impact on the network (carrier IMPU management).

Pros:

- The UICC IMS application can trigger explicit IMS registration using an Open Channel proactive command..

6.2 Solution 2 implicit IMPU based solution, pros and cons

Cons:

- There is an impact on the HSS related to provisioning of the implicitly registered IMPU.

Pros:

- This solution has the lowest impact on the handset implementation amongst the three solutions.

6.3 Solution 3 IARI based routing solution, pros and cons

Cons:

- The UICC applications can not trigger an IMS registration using an USAT proactive command.

Pros:

- This solution will impact the handset implementation; the amount of work required is considered to be inferior to solution 6.1. This solution also has no impact on the network (IMS) implementation.

- This solution enables significant optimisations around IMS registration by allowing for IMS SIP signalling consolidation. This solution also maintains the ME's responsibility of identifying all active applications that require IMS access.

6.4 Selected solution

6.3 was selected as the preferred solution. This solution provides a means for IMS to address the UICC uniquely using what was agreed as a more appropriate identifier for this purpose. Additionally the resulting UE to IMS interaction remains unchanged while the ME to UICC interaction remains closely aligned to previously specified mechanisms.

Annex A (Informative): Explicit IMPU registration SIP REGISTER content example

For explicit IMPU registration, the ME constructs the initial unprotected SIP REGISTER message as defined in 3GPP TS 24.229 [2]. The parameters list looks as follows:

Field name	**Content**	**Comment**
Request-URI	SIP URI of the domain name of the home network	Home network domain name retrieved by ME from ISIM or derived by ME from USIM as described in 3GPP TS 24.229 [2], subclause 5.1.1.1A
From	SIP URI that contains IMS public user identity to be registered.	IMS Public user identity contained in OPEN CHANNEL for IMS parameter field
To	SIP URI that contains IMS public user identity to be registered.	IMS Public user identity contained in OPEN CHANNEL for IMS parameter field
Contact	SIP URI containing the IP address or FQDN of the ME Used for address binding.	ME parameter
Via	IP address or FQDN of the ME	ME parameter
Route (optional)	Set to P-CSCF address	ME parameter

Annex B: Change history

Change history							
Date	TSG #	TSG Doc.	CR	Rev	Subject/Comment	Old	New
2011-03	CT #51	CP-110226			Technical approved by TSG CT	2.0.0	10.0.0