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Technical Specification

**Digital cellular telecommunications system (Phase 2+);
Completion of Calls to Busy Subscriber (CCBS);
Stage 3
(GSM 04.93 version 7.0.0 Release 1998)**



GSM®
GLOBAL SYSTEM FOR
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Foreword

This Technical Specification (TS) has been produced by the Special Mobile Group (SMG).

The present document gives the stage 3 description of the Completion of Calls to Busy Subscriber (CCBS) supplementary service within the digital cellular telecommunications system (Phase 2/Phase 2+).

The contents of the present document are subject to continuing work within SMG and may change following formal SMG approval. Should SMG modify the contents of the present document it will then be re-issued with an identifying change of release date and an increase in version number as follows:

Version 7.x.y

where:

- 7 GSM Phase 2+ Release 1998;
- x the second digit is incremented for all other types of changes, i.e. technical enhancements, corrections, updates, etc.;
- y the third digit is incremented when editorial only changes have been incorporated in the specification.

1 Scope

The present document gives the stage 3 description of the Completion of Calls to Busy Subscriber (CCBS) supplementary service. The present document specifies the procedures used at the radio interface (Reference point Um as defined in GSM 04.02) for normal operation, activation, deactivation, invocation and interrogation of the completion of calls to busy subscriber supplementary services. Provision and withdrawal of supplementary services is an administrative matter between the mobile subscriber and the service provider and cause no signalling on the radio interface.

In GSM 04.10 the general aspects of the specification of supplementary services at the layer 3 radio interface are given.

GSM 04.80 specifies the formats and coding for the supplementary services.

Definitions and descriptions of supplementary services are given in GSM 02.04, GSM 02.8x and GSM 02.9x-series. Technical specification GSM 02.93 is related specifically to the Completion of Calls to Busy Subscriber supplementary service.

The technical realization of supplementary services is described in technical specifications GSM 03.11, GSM 03.8x and GSM 03.9x-series. GSM 03.93 is related specifically to Completion of Calls to Busy Subscriber supplementary service.

The procedures for Call Control, Mobility Management and Radio Resource management at the layer 3 radio interface are defined in GSM 04.07 and GSM 04.08.

The following supplementary services belong to the call completion supplementary services and are described in the present document:

- Completion of Calls to Busy Subscriber (CCBS) (see clause 4).

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.
- A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.
- For this Release 1998 document, references to GSM documents are for Release 1998 versions (version 7.x.y).

- [1] GSM 01.04: "Digital cellular telecommunications system (Phase 2+); "Abbreviations and acronyms".
- [2] GSM 02.04: "Digital cellular telecommunications system (Phase 2+); General on supplementary services".
- [3] GSM 02.07: "Digital cellular telecommunications system (Phase 2+); Mobile Stations (MS) features".
- [4] GSM 02.30: "Digital cellular telecommunications system (Phase 2+); Man-Machine Interface (MMI) of the Mobile Station (MS)".
- [5] GSM 02.93: "Digital cellular telecommunications system (Phase 2+); Completion of Calls to Busy Subscriber (CCBS) Service description, Stage 1".

- [6] GSM 03.11: "Digital cellular telecommunications system (Phase 2+); Technical realization of supplementary services".
- [7] GSM 03.93: "Digital cellular telecommunications system (Phase 2+); Technical realization of Completion of Calls to Busy Subscriber (CCBS)".
- [8] GSM 04.02: "Digital cellular telecommunications system (Phase 2+); GSM Public Land Mobile Network (PLMN) access reference configuration".
- [9] GSM 04.07: "Digital cellular telecommunications system (Phase 2+); Mobile radio interface signalling layer 3 General aspects".
- [10] GSM 04.08: "Digital cellular telecommunications system (Phase 2+); Mobile radio interface layer 3 specification".
- [11] GSM 04.10: "Digital cellular telecommunications system (Phase 2+); Mobile radio interface layer 3 Supplementary services specification General aspects".
- [12] GSM 04.80: "Digital cellular telecommunications system (Phase 2+); Mobile radio interface layer 3 supplementary services specification Formats and coding".
- [13] GSM 04.83: "Digital cellular telecommunications system (Phase 2+); Call Waiting (CW) and Call Hold (HOLD) supplementary services - Stage 3".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document the following definitions apply.

Subscriber A: The user of MS A, requesting CCBS.

Destination B: The entity addressed in the original call set up, which is busy when first called by subscriber A.

3.2 Abbreviations

For the purposes of the present document the following abbreviations apply:

CCBS	Completion of Calls to Busy Subscriber
MS A	Mobile Station of subscriber A
NDUB	Network Determined User Busy

Further related abbreviations are given in GSM 01.04

4 General

4.1 Overview

CCBS allows a calling subscriber A, encountering a Network Determined User Busy (NDUB) called destination B, to be notified when destination B is idle and to have the network reinitiate the call to destination B, if subscriber A desires.

All of the radio signalling specific to CCBS is at the subscriber A-side. Each procedure is described in turn. There is no radio signalling specific to CCBS at destination B-side. The radio signalling on the destination B-side uses basic call signalling procedures only.

A mobile station that supports CCBS shall support the requirements of the following options used in GSM 04.08:

- 1) Prolonged Clearing Procedure;
- 2) Network Initiated Mobile Originated Connection Management (MO CM) Connection Request;
- 3) Network initiated MO call.

A network supporting CCBS shall support the requirements of the following options used in GSM 04.08:

- 1) CCBS Request activation; and
- 2) Network initiated MO call.

4.2 Activation

When CCBS is allowed the network shall give subscriber A the option of activating a CCBS Request.

The network shall send a DISCONNECT message to MS A (cause #17 (User Busy) or cause #34 (no circuit / channel available)) with diagnostic field indicating CCBS is Possible and allowed actions indicating CCBS is Possible. The network starts the retention timer T1 when it sends the DISCONNECT message. The MS shall not release the connection with the network if allowed actions is present.

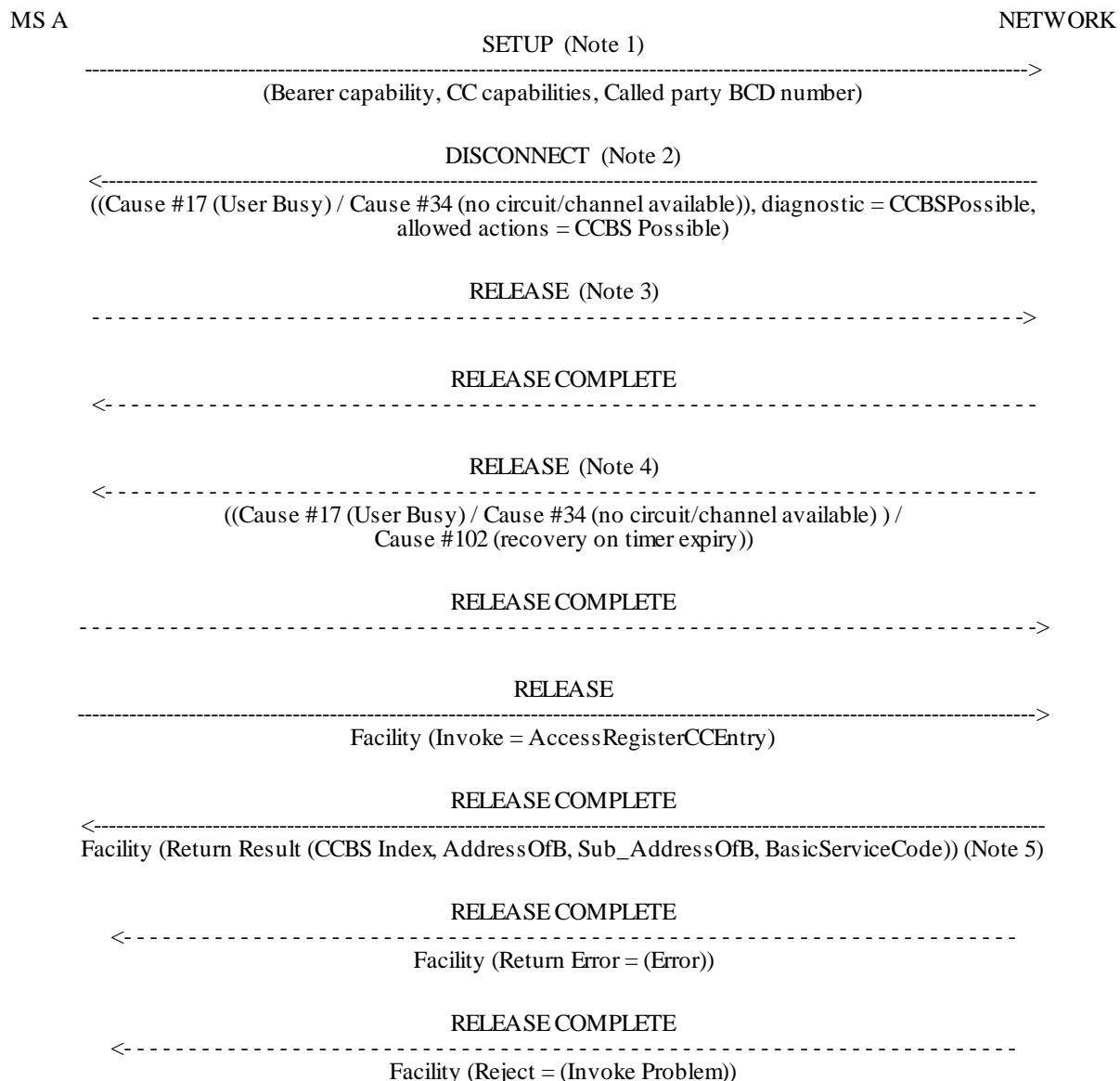
If subscriber A attempts to activate a CCBS Request, MS A shall send a RELEASE message, with the Facility information element indicating CCBSRequest and the network shall stop T1. If the subscriber A does not accept CCBS activation, the MS shall send normal RELEASE message and the network shall stop T1 and continue normal call clearing. If the timer T1 expires before the RELEASE message is received from the MS, the network shall continue normal call clearing.

If the network accepts the activation attempt, it shall acknowledge it by sending a RELEASE COMPLETE message containing the Facility information element with the CCBS index and optionally the AddressOfB, SubAddressOfB and the BasicServiceCode. If the network rejects the activation attempt, it shall send a RELEASE COMPLETE message containing the Facility information element with a return error indication.

If a TCH has been allocated for the initial call and there are no further need for this channel configuration, the network may reconfigure the ongoing connection from TCH(s) mode to SDCCH only mode while waiting for further user input activity.

It is a network option to maintain the ongoing connection in TCH mode while waiting for further user input activity.

SS Version Indicator value 3 or above has to be used.



NOTE 1: The original call set-up is shown for completeness.

NOTE 2: The CCBS activation is possible only when allowed actions field contains CCBS Possible indication

NOTE 3: If Subscriber A rejects the CCBS Possible indication, then the MS shall send RELEASE.

NOTE 4: If T1 (Retention timer) expires then the network shall send a RELEASE message to the MS. The Timer expiry cause may be included.

NOTE 5: AddressOfB, Sub_AddressOfB and BasicServiceCode are optional parameters.

Figure 4.2: Activation of a CCBS Request for supporting MSs

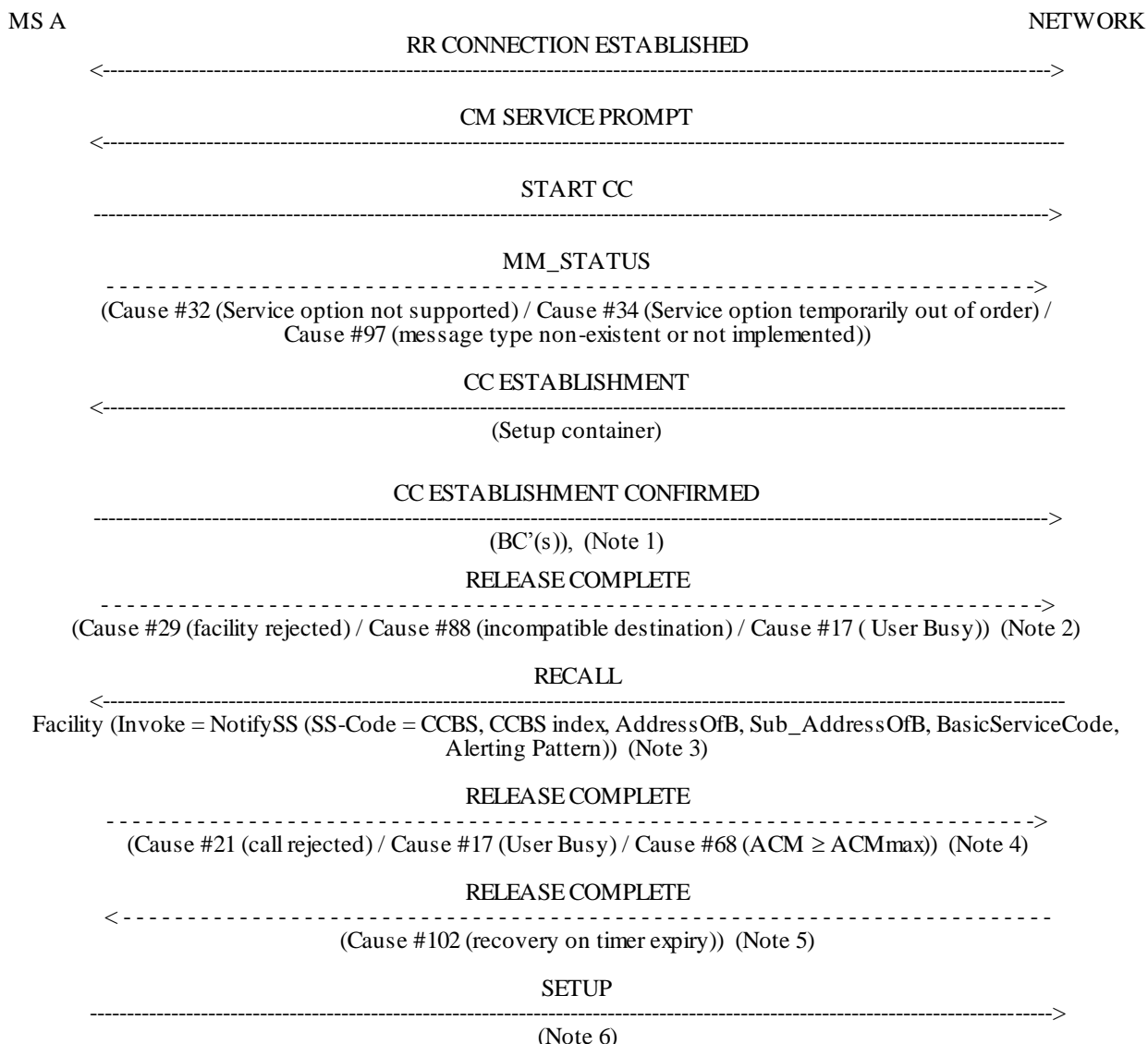
4.3 CCBS Recall and CCBS Call Set-up

When destination B becomes free the network shall offer subscriber A the option of recalling destination B.

The network shall prompt MS A to allocate a Transaction Identifier (TI) and establish the CC connection by sending a CM SERVICE PROMPT message. MS A establishes the CC connection by sending a START CC message to the network. The network shall then send a CC ESTABLISHMENT message to MS A and shall include the Setup container. The Setup container contains information necessary to set-up the CCBS Call. The MS can modify the Bearer Capability (BC), High Level Compatibility (HLC) and Low Level Compatibility (LLC) information within the Setup container provided that the same Basic Service Group is maintained. If MS A is compatible with the basic service group it sends CC ESTABLISHMENT CONFIRMED message to the network. Once the network has received the CC ESTABLISHMENT CONFIRMED message it shall send a RECALL message to MS A, which contains information to be presented to the subscriber. At this stage, if the MS detects that $ACM \geq ACM_{max}$, the MS shall interrupt the recall procedure, shall not alert the user and shall send a RELEASE COMPLETE message with the appropriate cause value to the network. If subscriber A accepts the CCBS recall, MS A shall establish a new call with the SETUP message. MSC A shall maintain the RR connection with MS A throughout the time when acceptance of the CCBS Recall is possible. Once the SETUP message is received, normal call handling continues.

4.3.1 CCBS Call Set-up (MS A idle)

Figure 4.3.1 shows the case where MS A is idle when a CCBS Recall is received by the originating network. The different possibilities for allocating a traffic channel are described in GSM 04.08.



- NOTE 1: The BC may be modified by the MS as long as the same Basic Service Group is maintained.
- NOTE 2: The MS releases the transaction if the BC,HLC,LLC received in the CC ESTABLISHMENT message are incompatible with the MS, the MS cannot decode the contents of the "advanced recall alignment" Facility information element correctly (see GSM 04.10) or the MS responds by indicating UDUB.
- NOTE 3: MS shall start CCBS Recall alerting on receiving the RECALL message. The CCBS timer T4 is started when the RECALL message is sent to the MS. Sub_Address information may be included. The Alerting Pattern parameter may be included by the network to give some indication about alerting (category or level). If supported in the MS, this optional parameter is to be used by the MS as specified in GSM 02.07.
- NOTE 4: Subscriber A explicitly rejects the CCBS Recall or subscriber A responds to the CCBS Recall by indicating UDUB or ACM ≥ ACMmax.
- NOTE 5: The network releases the transaction if CCBS timer T4 expires.
- NOTE 6: The information elements within the SETUP message are derived from the Setup container in the CC ESTABLISHMENT Message. The SETUP message must contain the same BC(s) that was (were) sent to the network in the CC ESTABLISHMENT CONFIRMED message.

Figure 4.3.1: CCBS Call Set-up for supporting MSs - subscriber A idle when RECALL arrives

4.3.2 CCBS Call Set-up (MS A not idle)

If a CCBS Recall is offered to MS A and MS A is not idle, subscriber A may accept the CCBS Recall and either release the existing call or put the existing call on hold.

4.3.2.1 Existing call released

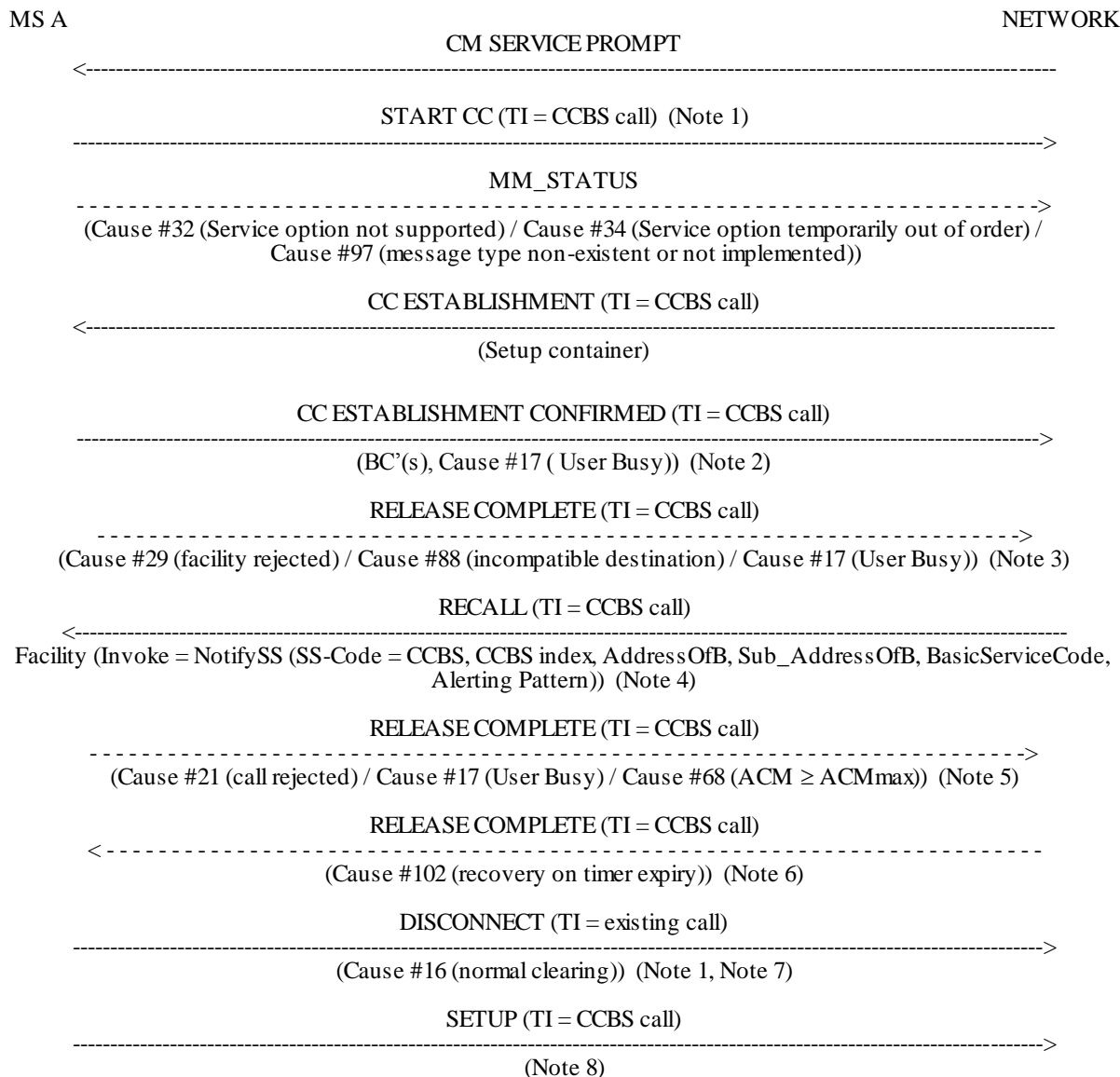


Figure 4.3.2: CCBS Recall arrives while MS involved in a call, the existing call is released on acceptance of the CCBS Recall

Notes to figure 4.3.2:

NOTE 1: A new TI value indicated by "TI = CCBS call" is allocated by the MS for the subsequent CCBS call. The already existing call is referred to by the TI value "TI = existing call".

NOTE 2: The BC may be modified by the MS as long as the same Basic Service Group is maintained. The MS shall indicate "User Busy" if it is not idle.

NOTE 3: The MS releases the transaction if the BC,HLC,LLC received in the CC ESTABLISHMENT message are incompatible with the MS, the MS cannot decode the contents of the "advanced recall alignment" Facility information element correctly (see GSM 04.10) or the MS responds by indicating UDUB.

- NOTE 4: MS shall start CCBS Recall alerting on receiving the RECALL message. The CCBS timer T10 is started when the RECALL message is sent to the MS. Sub_Address information may be included. The Alerting Pattern parameter may be included by the network to give some indication about alerting (category or level). If supported in the MS, this optional parameter is to be used by the MS as specified in GSM 02.07.
- NOTE 5: Subscriber A explicitly rejects the CCBS Recall or subscriber A responds to the CCBS Recall by indicating UDUB or $ACM \geq ACM_{max}$.
- NOTE 6: The network releases the transaction if CCBS timer T10 expires.
- NOTE 7: The existing call is released to make resources available for the CCBS call. The existing call is released according to normal call clearing procedures (see GSM 04.08).
- NOTE 8: The information elements within the SETUP message are derived from the Setup container in the CC ESTABLISHMENT message. The SETUP message must contain the same BC(s) that was (were) sent to the network in the CC ESTABLISHMENT CONFIRMED message.

4.3.2.2 Existing call placed on hold

If the existing call is a telephony call, subscriber A may place this call on hold in order to accept the CCBS Recall.

MS A

NETWORK



Figure 4.3.3: CCBS Recall arrives while MS involved in a call, the existing call is placed on hold on acceptance of the CCBS Recall

Notes to figure 4.3.3:

- NOTE 1: A new TI value indicated by "TI = CCBS call" is allocated by the MS for the subsequent CCBS call. The already existing call is referred to by the TI value "TI = existing call".
- NOTE 2: The BC may be modified by the MS as long as the same Basic Service Group is maintained. The MS shall indicate "User Busy" if it is not idle.
- NOTE 3: The MS releases the transaction if the BC,HLC,LLC received in the CC ESTABLISHMENT message are incompatible with the MS, the MS cannot decode the contents of the "advanced recall alignment" Facility information element correctly, or the MS responds by indicating UDUB.
- NOTE 4: MS shall start CCBS Recall alerting on receiving the RECALL message. The CCBS timer T10 is started when the RECALL message is sent to the MS. Sub_Address information may be included. The Alerting Pattern parameter may be included by the network to give some indication about alerting (category or level). If supported in the MS, this optional parameter is to be used by the MS as specified in GSM 02.07.
- NOTE 5: Subscriber A explicitly rejects the CCBS Recall or subscriber A responds to the CCBS Recall by indicating UDUB or $ACM \geq ACM_{max}$.
- NOTE 6: The network releases the transaction if CCBS timer T10 expires.
- NOTE 7: The existing call is placed on hold to make resources available for the CCBS call. The existing call is placed on hold according to normal call hold procedures (see GSM 04.83).
- NOTE 8: The information elements within the SETUP message derived from the Setup container in the CC ESTABLISHMENT Message. The SETUP message must contain the same BC(s) that was (were) sent to the network in the CC ESTABLISHMENT CONFIRMED message.

4.4 Deactivation

Subscriber A can perform the following operations:

- deactivate all outstanding CCBS requests;
- deactivate a specific CCBS request.

MS A shall send a REGISTER message, with the Facility information element, indicating EraseCCEntry.

SS Version Indicator value 3 or above has to be used.

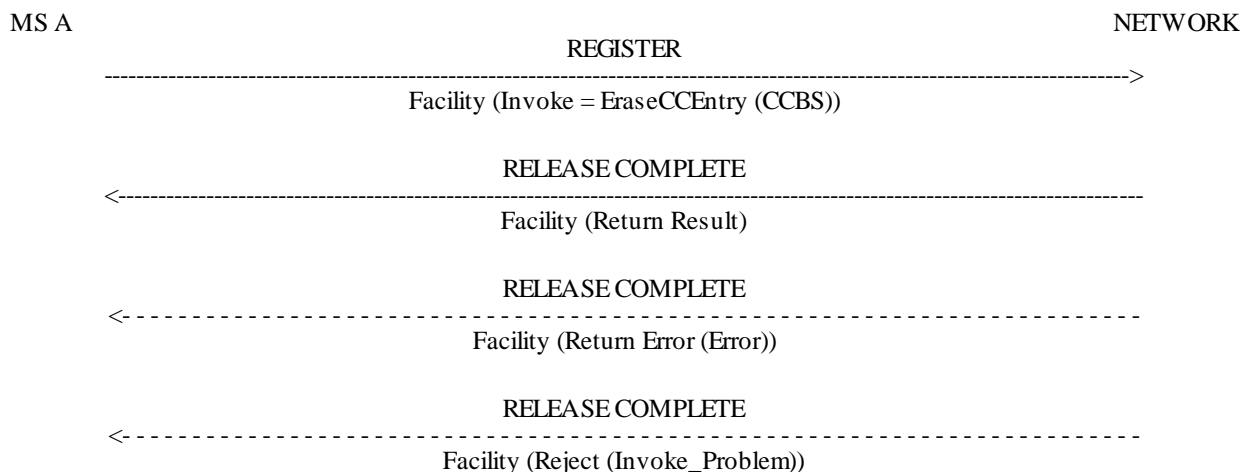


Figure 4.4.1: Deactivation of all CCBS requests

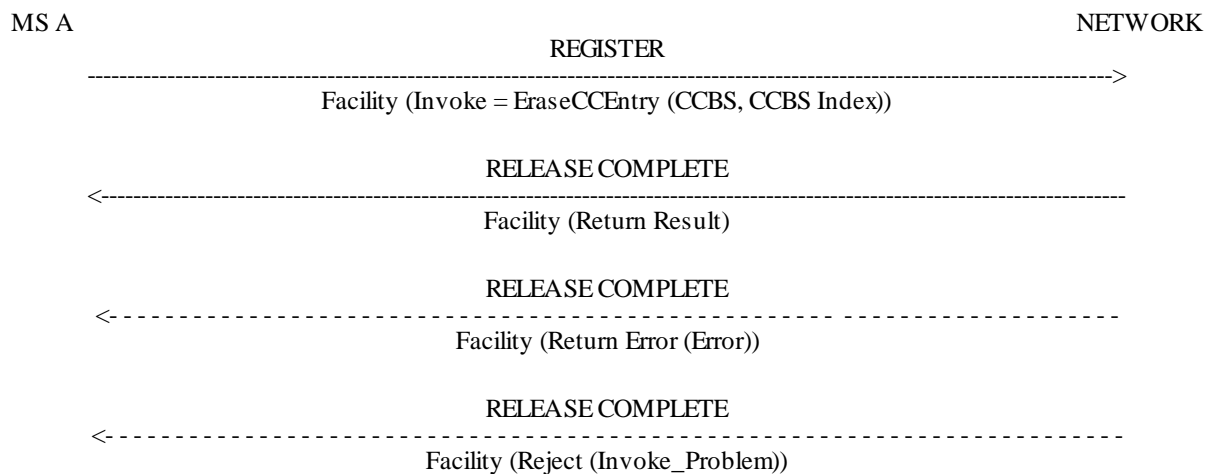


Figure 4.4.2: Deactivation of a specific CCBS request

4.5 Interrogation

Subscriber A can perform an interrogation of the CCBS service, with the three possible outcomes:

- the CCBS service is not provisioned for the subscriber;
- the CCBS service is provisioned for the subscriber, but the queue of requests is empty;
- the CCBS service is provisioned for the subscriber and there are requests in the queue.

MS A shall send a REGISTER message, with the Facility information element, indicating InterrogateSS. SS Version Indicator value 2 or above has to be used. Depending on the outcome of the interrogation, the network shall return:

- a) SS-status set to not provisioned when the CCBS service is not provisioned (figure 4.5.1);
- b) SS status set to provisioned when the CCBS service is provisioned, but there are no outstanding requests (figure 4.5.2);
- c) SS-status set to provisioned and the list of outstanding CCBS requests in the queue (figure 4.5.3).

For each request in the queue, the following data shall be returned:

- CCBS index;
- Address of B;
- Sub-Address of B (optional);
- Basic Service Code.

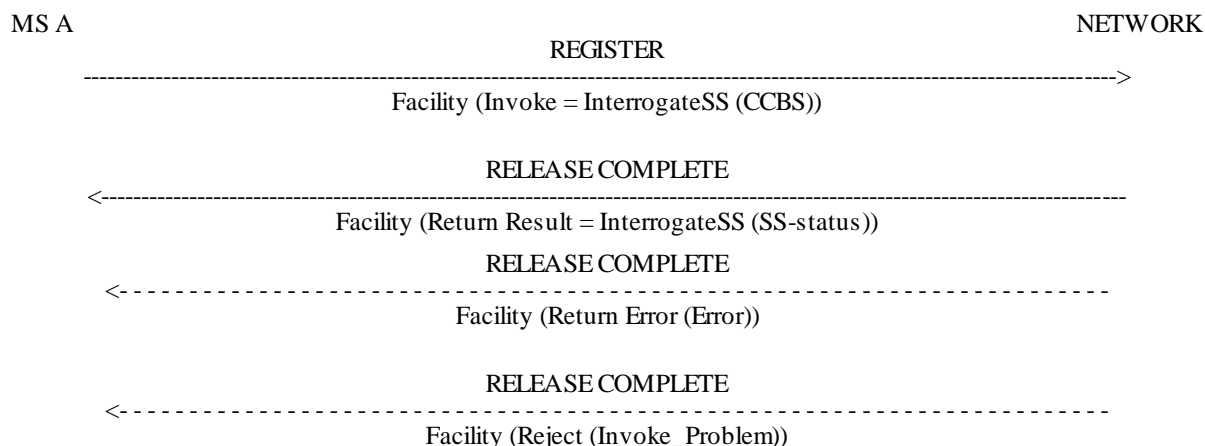


Figure 4.5.1: Interrogation of the CCBS - service not provisioned

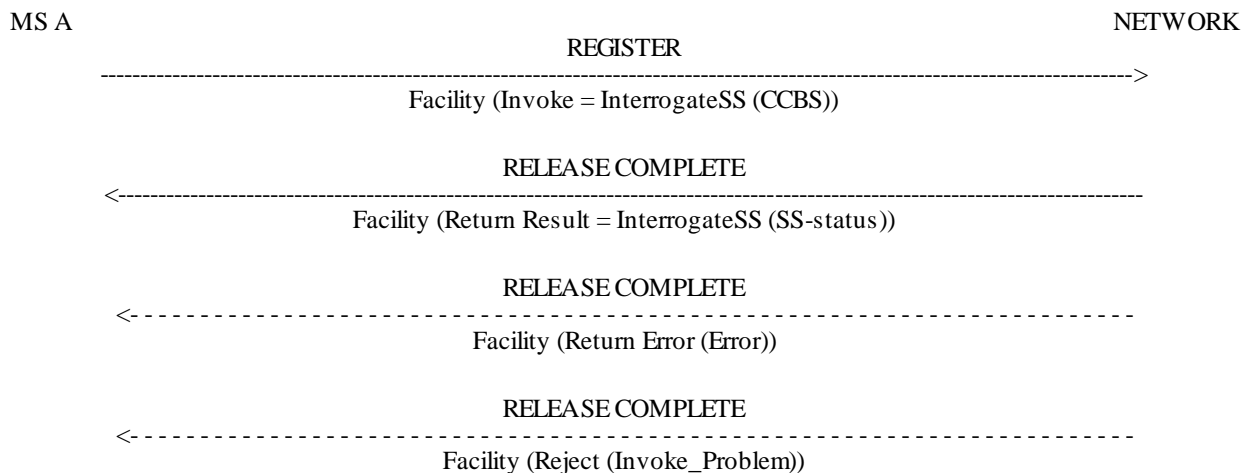
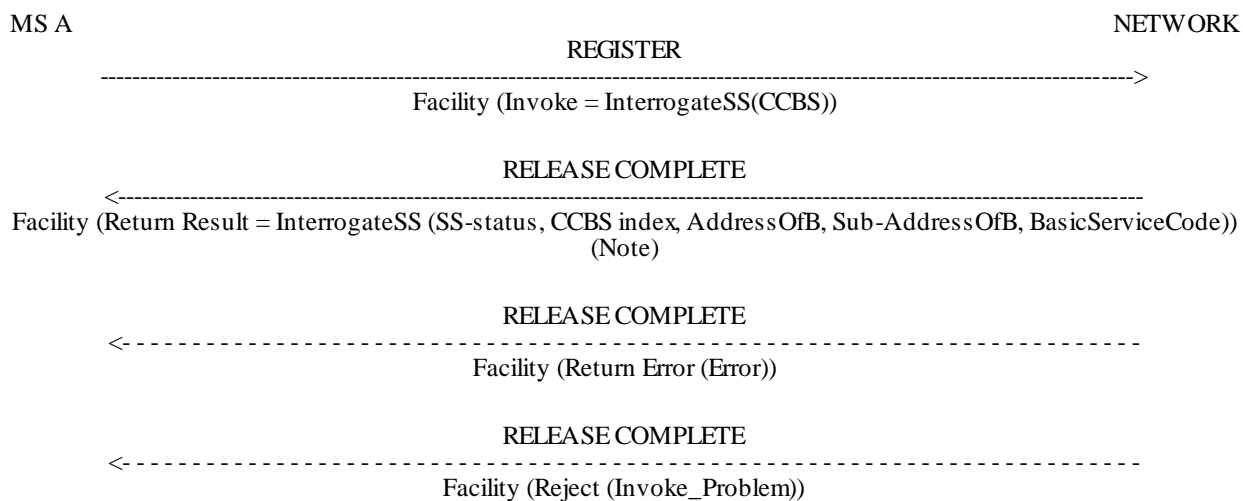


Figure 4.5.2: Interrogation of the CCBS - the request queue is empty



NOTE: The information for up to five CCBS Requests can be included.

Figure 4.5.3: Interrogation of the CCBS - all existing requests

Annex A (informative): Operation for Non-Supporting MS's

A.0 Scope

This annex is included for information only and is for further study.

A.1 MSs which do not support CCBS

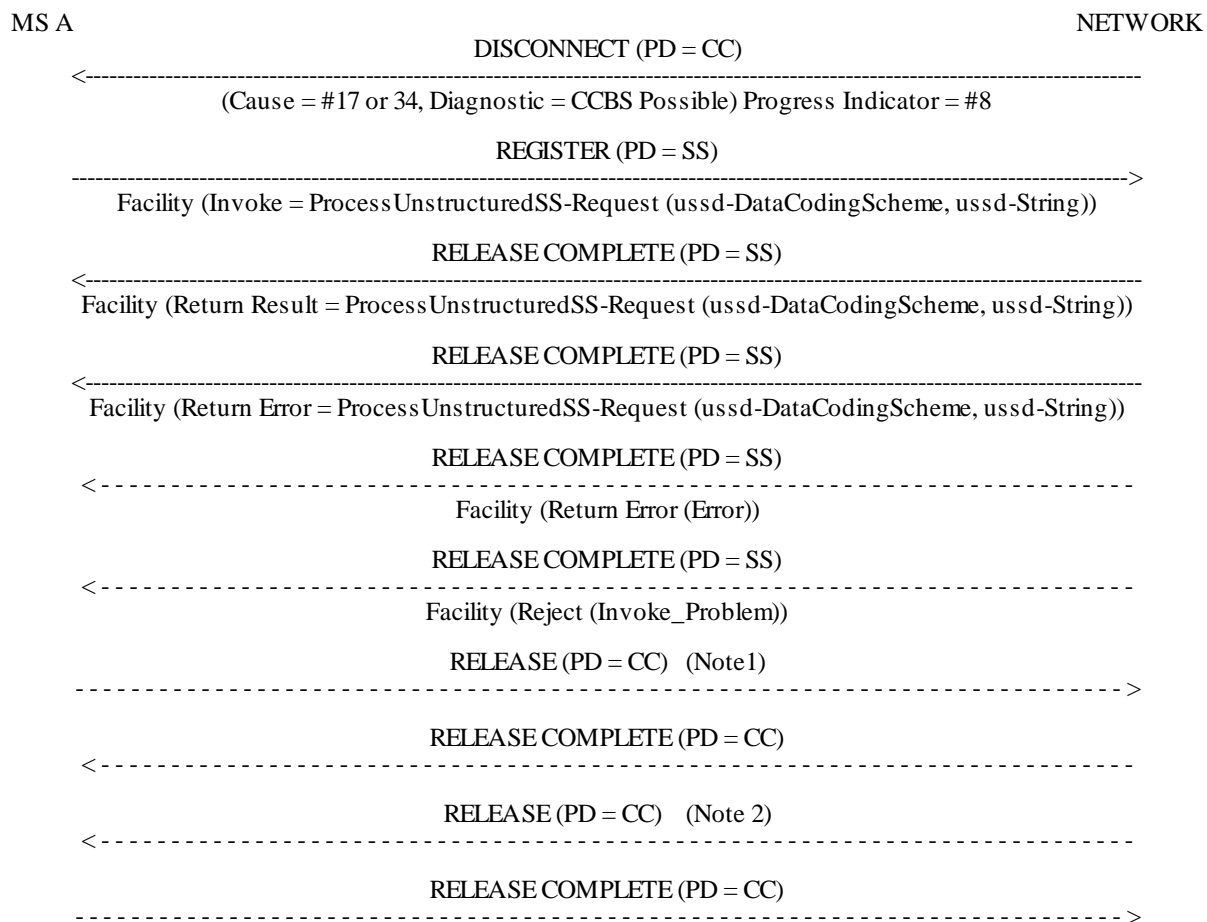
MSs which do not explicitly support CCBS are not precluded from attempting to activate CCBS or from accepting a CCBS Recall. The mechanisms employed to offer the CCBS service to these MSs shall be a matter for individual networks.

A.1.1 Activation for non supporting MSs

The network shall send DISCONNECT to MS A (cause #17 or #34) with diagnostic field indicating CCBS is Possible, and a progress indicator indicating inband information is available. This inband information shall be used to indicate CCBS possible. The absence of a progress indicator in the DISCONNECT, prevents subscriber A from successfully activating CCBS. If subscriber A requests CCBS, MS A will send a REGISTER message, containing a ProcessUnstructuredSS-Request invoke component. The receiving network entity shall pass the data received in the request to the application handling USSD operations and shall wait for the response of the application. When the application accepts the request and terminates the dialogue, the network shall clear the transaction by sending a RELEASE COMPLETE message containing a return result component.

If the network is unable to process the request received from the MS, it shall clear the call independent transaction by sending a RELEASE COMPLETE message containing a return error component.

When the call independent transaction has been cleared, either the MS or the network shall release the call related transaction by sending a RELEASE COMPLETE message.



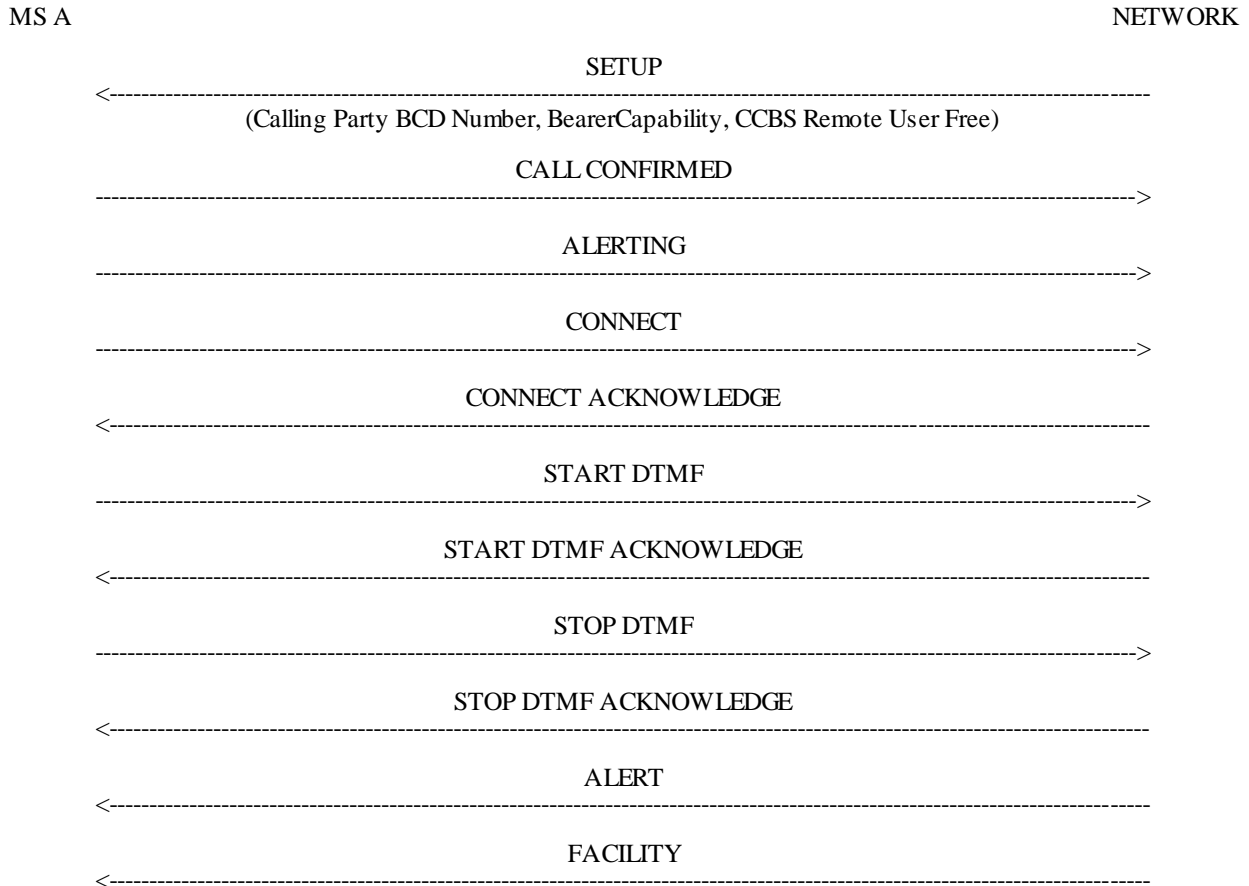
NOTE 1: If Subscriber A rejects the CCBS Possible indication or ends the call having received either a successful or unsuccessful indication following an activation attempt, then the MS shall send a RELEASE message.

NOTE 2: If the call control timer expires (T306) or if T1 expires, then network shall send a RELEASE message to MS.

Figure A.1: Activation of CCBS for non supporting MSs

A.2 CCBS Call Set-up for non supporting MSs

The CCBS recall shall be treated as a mobile terminated call set-up. The network shall send a SETUP message to MS A, which causes the MS to ring indicating that destination B is now idle. If subscriber A accepts the CCBS recall, MS A shall establish a new call with the CONNECT message.



NOTE*: It is an operator option to request the user if he/she wishes to continue

Figure A.2: CCBS Call Set-up for non supporting MSs

Editors Note: The network needs to know that this is a CCBS Call so that the destination network can be informed.
How does the originating network know that this is a CCBS Call? Can the network determine this based on the transaction identifier?

Editors Note: This area is currently under discussion within SMG1 & SMG3

A.3 Deactivation for non supporting MSs

MS A shall send a REGISTER message to the network, with the Facility information element, indicating ProcessUnstructuredSS-Request. Different MMI is required (as specified in GSM 02.30) for the three different deactivation operations, although each deactivation operation uses the USSD mechanism to transport the information to the network.

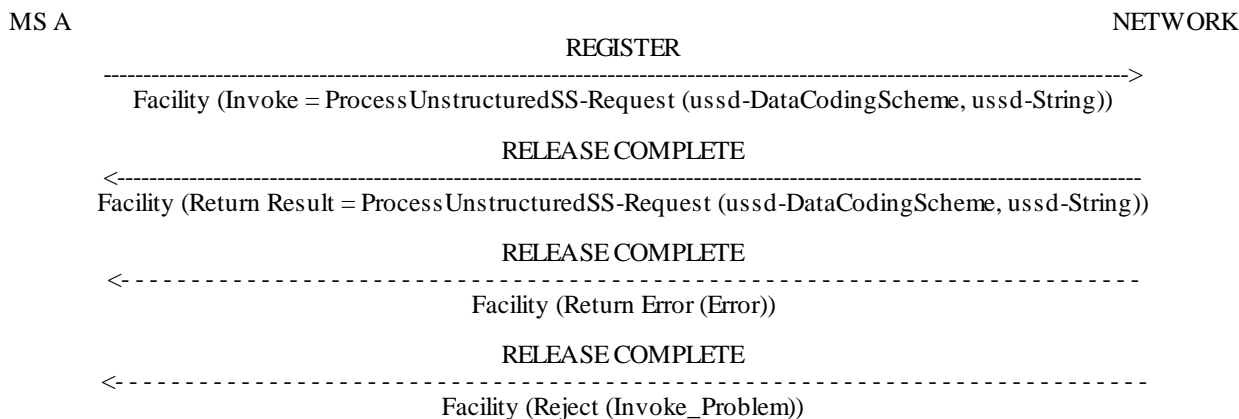


Figure A.3: Deactivation of all CCBS requests, the last or a single CCBS Request for non supporting MSs

A.4 Interrogation for non supporting MSs

MS A shall send a REGISTER message to the network, with the Facility information element, indicating ProcessUnstructuredSS-Request. Different MMI is required (as specified in GSM 02.30) for the two different interrogation operations, although each interrogation operation uses the USSD mechanism to transport the information to the network.

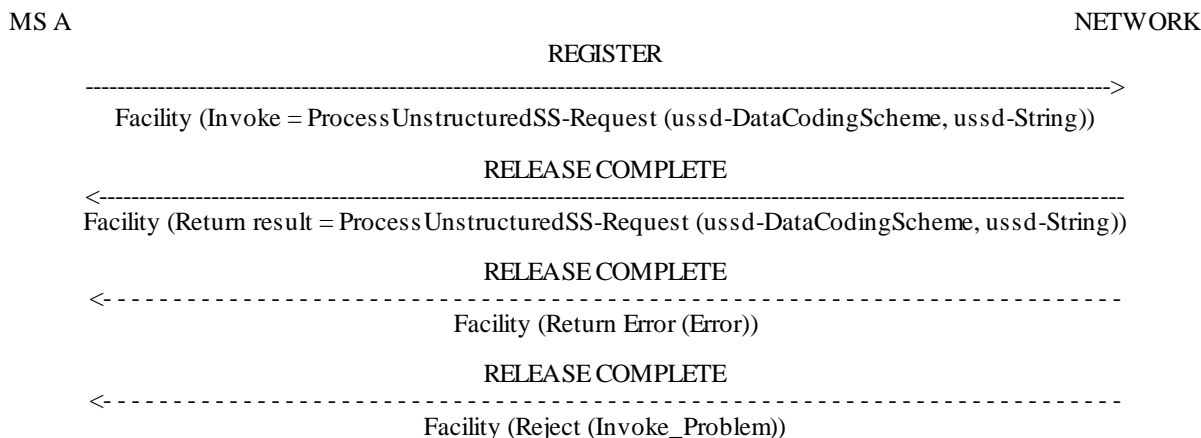


Figure A.4: Interrogation of all CCBS requests or a single CCBS request for Non supporting MSs

Annex B (informative): Status of Technical Specification GSM 04.93

Status of Technical Specification GSM 04.93: stage 3 of CCBS		
Date	Version	Comments
		No Phase 1 version
September 1997	version 1.0.0	to SMG#23 for information
March 1998	version 2.0.0	to SMG#25 for approval
March 1998	version 6.0.0	TS approved by SMG#25 for Release 97
June 1998	version 6.1.0	CR 04.93-A001 (cat F -CCBS) approved SMG#26 specification published as TS 101 284
February 1999	version 6.1.1	CR 04.93-A002r2 (R97) (cat D -CCBS) approved SMG#28
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