THIS DOCUMENT IS A SAMPLE CALL FLOW DOCUMENT WITH ALL PROPRIETARY INFORMATION REMOVED.

GSM Voice Call Flow Specification

Table of Contents

1. Introduction

1.1 Document Purpose and Scope

This document presents the GSM Voice Call Flow Specification supported by the generic voice application.

This interface is compliant with CAMEL Application Part (CAP) Phase 2 Release 1998 and Mobile Application Part (MAP) version 2 and version 3 specifications.

1.2 Acronyms, Abbreviations and Special Terms

APN –	Access Point Name
BCSM –	Basic Call State Model
CAMEL –	Customised Applications for Mobile networks Enhanced Logic
CAP –	CAMEL Application Part
CCBS –	Completion of Calls to Busy Subscriber
CDR –	Call Detail Record –information generated at the end of each call.
CSR –	Customer Service Representative
DP –	Detection Point
DWS	Data Warehouse System
EDP-N –	Event Detection Point - Notification
EDP-R –	Event Detection Point - Request
ERB –	Event Report BCSM (message)
ERS –	Event Report SMS (message)
ETC –	Establish Temporary Connection (message)
GGSN –	Gateway GPRS Support Node
GMSC –	Gateway Mobile Switching Center
GPRS Session –	The period during the subscriber is registered to the GPRS data network
gprsSSF –	GPRS Service Switching Function
HLR –	Home Location Register
IMSI –	International Mobile Station Identity
IN –	Intelligent Network
MAP	Mobile Application Part
MF –	Mobile Forwarded
MO–	Mobile Originated
MS –	Mobile Station
MSC –	Mobile Switching Center
MSISDN –	Mobile Station International Subscriber Directory Number

MT –	Mobile Terminated
PSTN –	Public Switched Telephone Network
PLMN –	Public Land Mobile Network
QoS –	Quality of Service
RRBE –	Request Report BCSM Event (message)
RRSE –	Request Report SMS Event (message)
SMSC –	Short Message Service Center
TCAP –	Transaction Capability Application Protocol
TDP –	Trigger Detection Point
USSD –	Unstructured Supplementary Service Data
VMSC –	Visited Mobile Switching Center

1.3 Disclaimer

The call flows in this document are based on the MAP version 2, MAP version 3 CAMEL phase 2 and 3 specification. CAMEL Phase 3 is used for Text Self-Care via SMS only. CAP and MAP operations are carried in the component sub-layer of Transaction Capabilities Application Part (TCAP). The details of the TCAP messaging are not included in the flows unless it is required to make the use case clear.

2. Mobile Originated Voice

In call origination, the voice application determines the number of seconds (quanta) to allow the call. When the balance is depleted, the application will direct the MSC to disconnect the call. The CAMEL control relationship between the MSC and the voice application is established when the MSC invokes the TDP Collected_Info. The voice application, in turn, monitors the CAMEL BCSM events of the call setup. The table below lists the CAMEL DPs supported for Mobile Originated voice calls.

CAMEL DP	DP Type
DP2 Collected_Info	TDP-R
DP4 Route_Select_Failure	EDP-N, EDP-R
DP5 O_Busy	EDP-N, EDP-R
DP6 O_No_Answer	EDP-N, EDP-R
DP7 O_Answer	EDP-N, EDP-R
DP9 O_Disconnect (Leg1 and Leg2)	EDP-N, EDP-R
DP10 O_Abandon	EDP-N

Upon receipt of CAMEL BCSM events, the application instructs the MSC and other network elements of the actions to handle a call origination. The voice application will record a Call Detail Record (CDR) at the end of a charged transaction. While generation of the CDR is shown in the call flows, the contents of the CDR are not given.

GSM CAMEL Phase 2 wireless network protocol is supported as shown in this specification. Any additional CAMEL messages are not used.

NOTE: APPLICATION INFORMATION IS REMOVED IN THE FOLLOWING DIAGRAMS.

2.1 Allowed – First Quantum Disconnect

This section illustrates a successful call origination with normal disconnect within the first quantum. Note that the time zone and current time at the MSC is included in the InitialDP message. If the subscriber's balance is less than a configured threshold, the call is rated before answer to determine whether there is sufficient balance for the first quanta or for reduced first quanta. If there is not sufficient balance for the first quantum, the call is released for insufficient funds (shown in Section 2.6). If the subscriber's balance is above the threshold, the call is not rated until answer.

Note: Both Basic End (shown in Figure 2-1) and Pre-arranged End (shown in Figure 2-2) are supported. Subsequent diagrams in this document illustrated Basic End only.

Figure 2-1 CAMEL MO Allowed Call –Disconnect in the First Quantum – Basic End

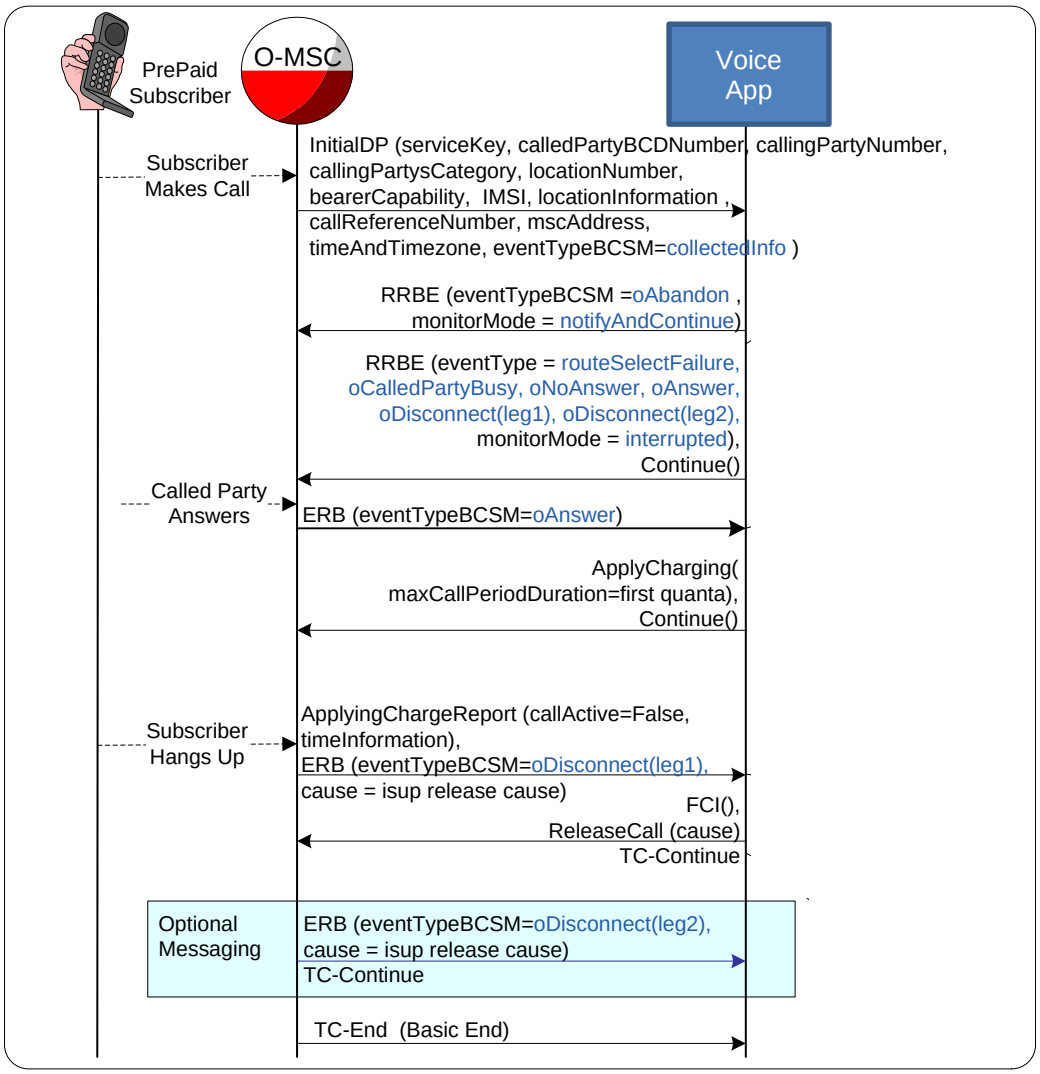
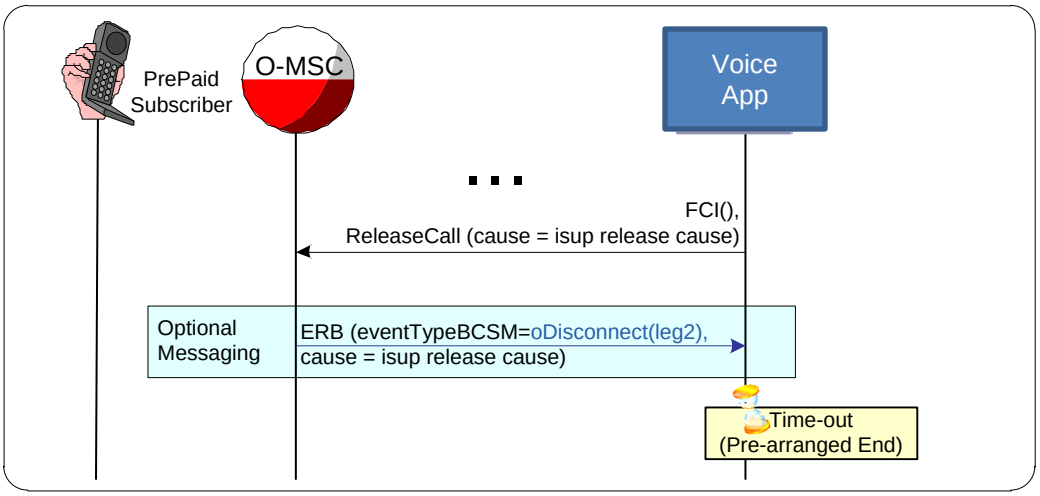


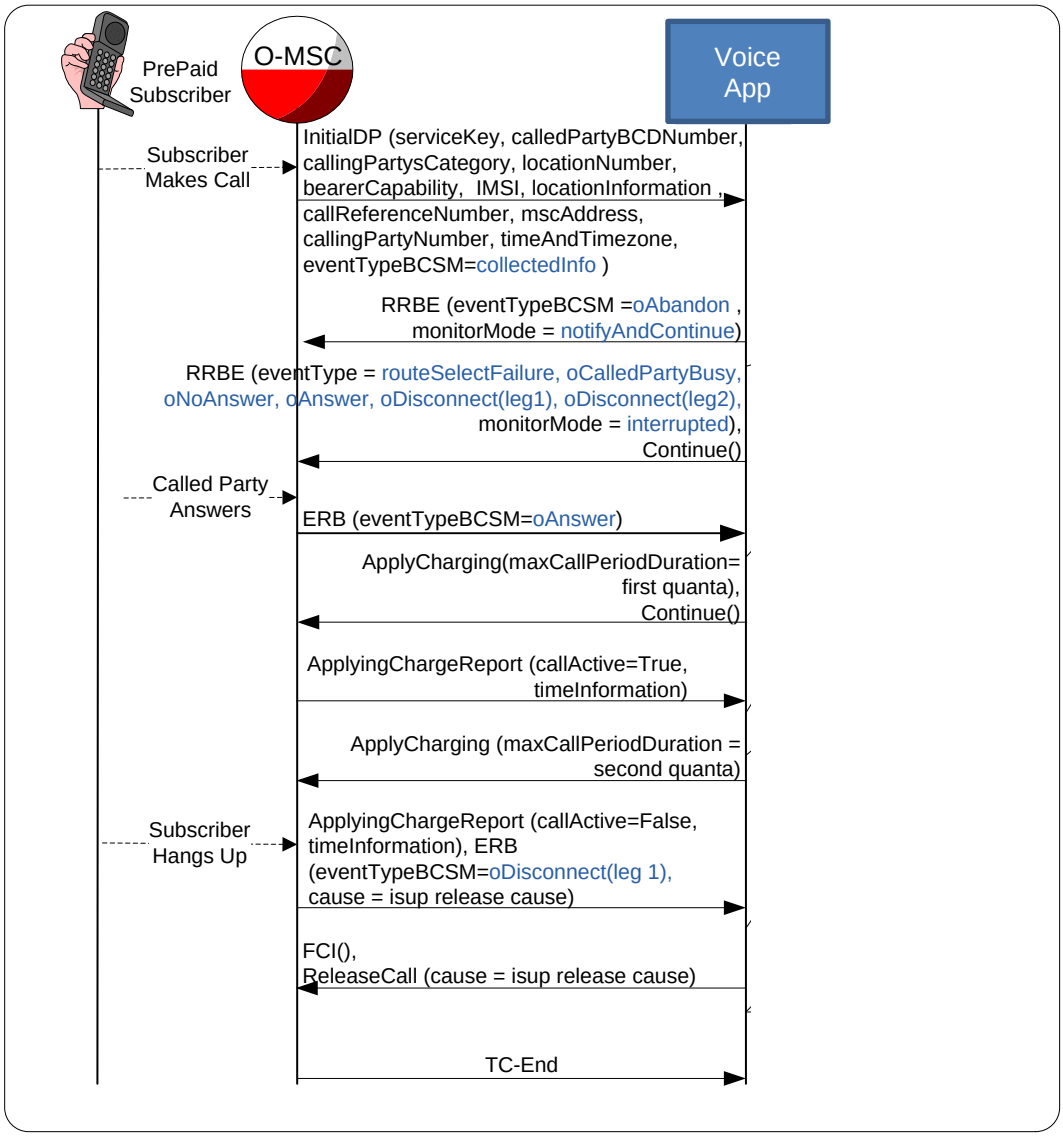
Figure 2-2 CAMEL MO Allowed Call – Disconnect in the First Quantum – Prearranged End



2.2 Allowed – Second Quantum Disconnect

This section illustrates a successful call origination with normal disconnect within the second quantum. The MSC sends an ApplyChargingReport message to report that the first quantum has expired, the application will check the configured threshold to determine whether to allow the call to continue. When the call is allowed, an ApplyCharging message is sent to the MSC specifying the new quanta.

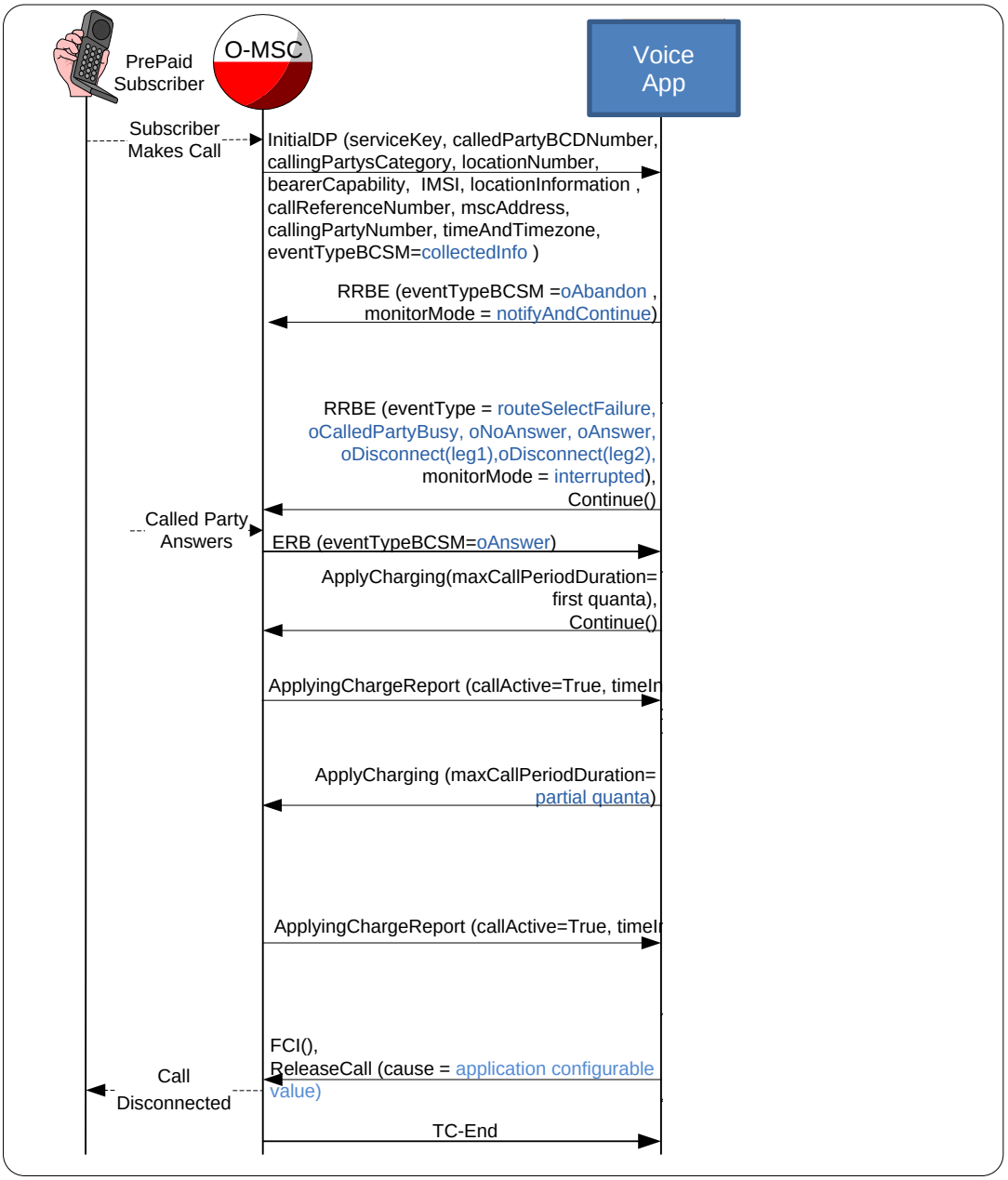
Figure 2-3 CAMEL MO Allowed Call – Subscriber Disconnect in the Second Quantum



2.3 Allowed – Balance Depletion Mid-Call

This section illustrates call origination with mid-call tear-down due to account balance depletion. As balance is running low, a partial quantum is allowed in the ApplyCharging message and a Text Alert may be sent via MSC to notify the subscriber of the low balance. Once the last quantum expires, the ReleaseCall message directs the MSC to disconnect the call and send a final advice of charge Text Alert.

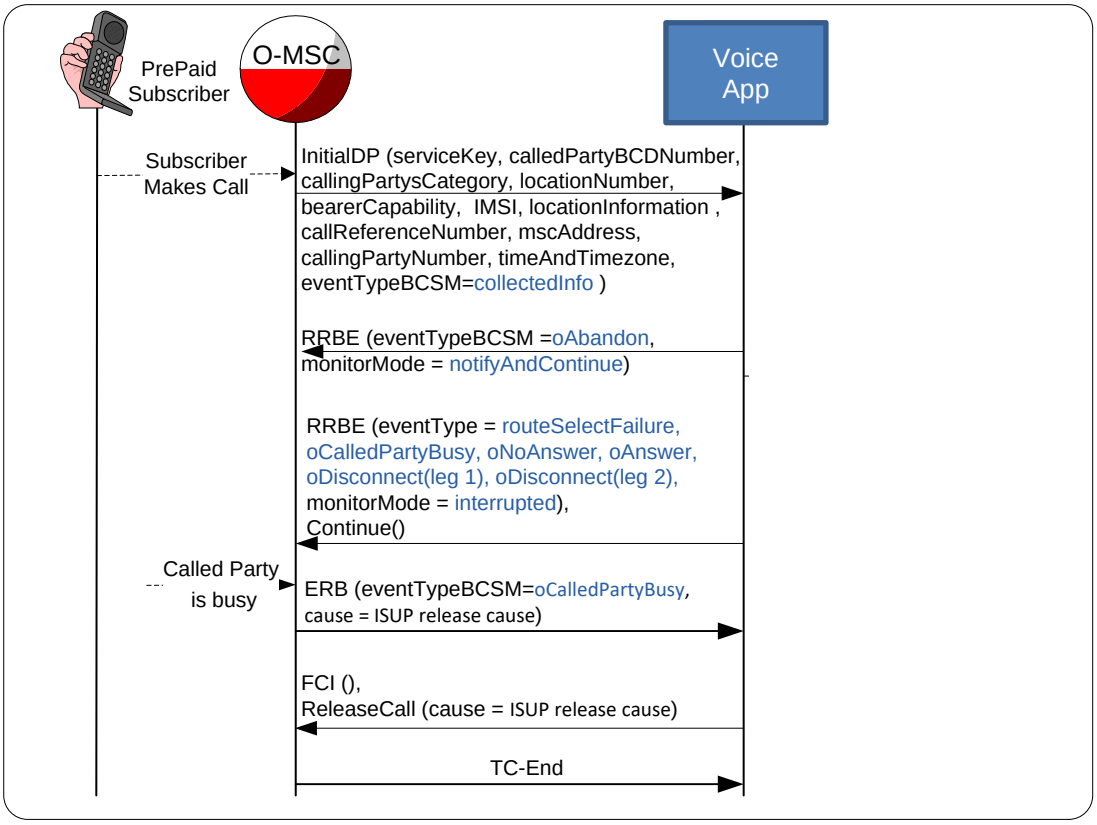
Figure 2-4 CAMEL MO Allowed Call – Mid-Call Balance Depletion



2.4 Setup Failed - Busy

This section illustrates a successful call origination with called party being busy.

Figure 2-5 CAMEL MO Allowed Call – Called Party Busy



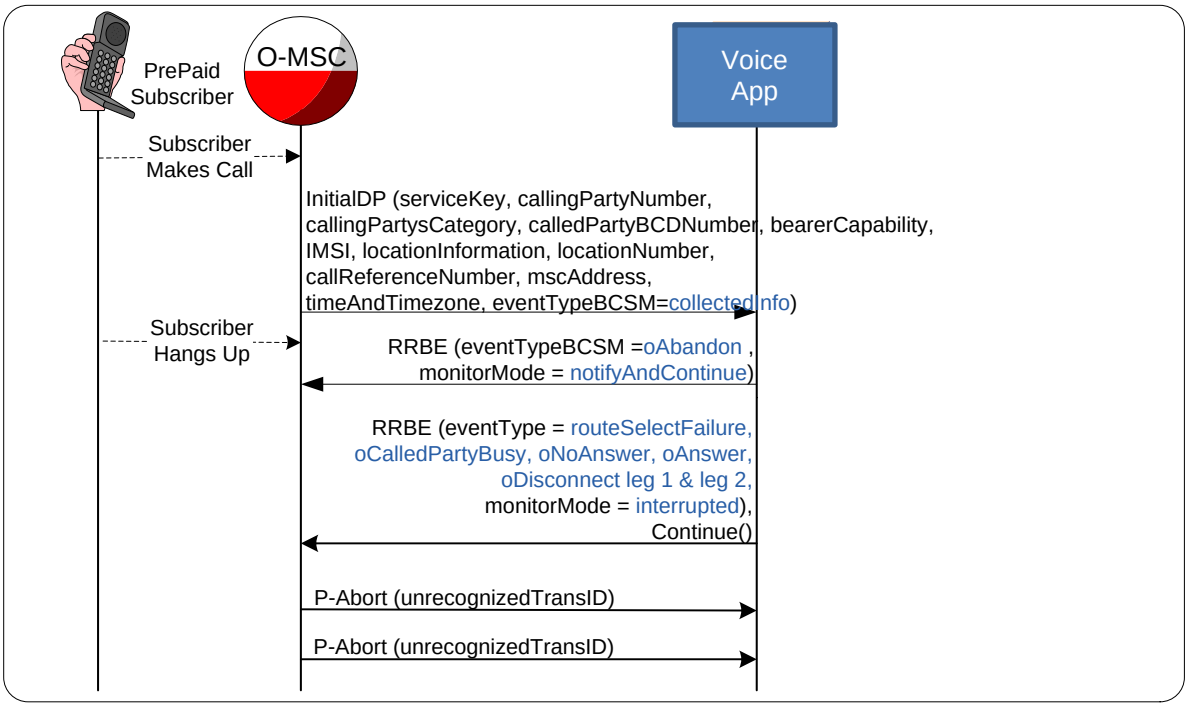
2.5 Setup Failed - Caller Abandon

Caller abandon occurs when the subscriber hangs up before the call is answered. Caller abandon can occur any time during call set-up. This section illustrates several caller-abandon scenarios including, abandon before events are requested and abandon after events are requested.

2.5.1 Abandon before Requested Events

The following figure illustrates a caller abandon event that occurs when the subscriber hangs up before the voice application returns RRBE, that is, the transaction at the MSC has ended before the application has responded.

Figure 2-6 – Caller Abandon before RRBE



2.5.2 Abandon After Requested Events

The figures in this section illustrate caller abandon after the MSC has received one or both of the RRBE requests. Three variations of closing the dialogue after abandon are supported as shown in the first three figures.

- ERB(eventTypeBCSM=oAbandon) in Continue with a Timeout at application
- ERB(eventTypeBCSM=oAbandon) in Continue, followed by TC-End
- ERB(eventTypeBCSM=oAbandon) in TC-End

Figure 2-7 CAMEL MO – Caller Abandon – Prearranged End

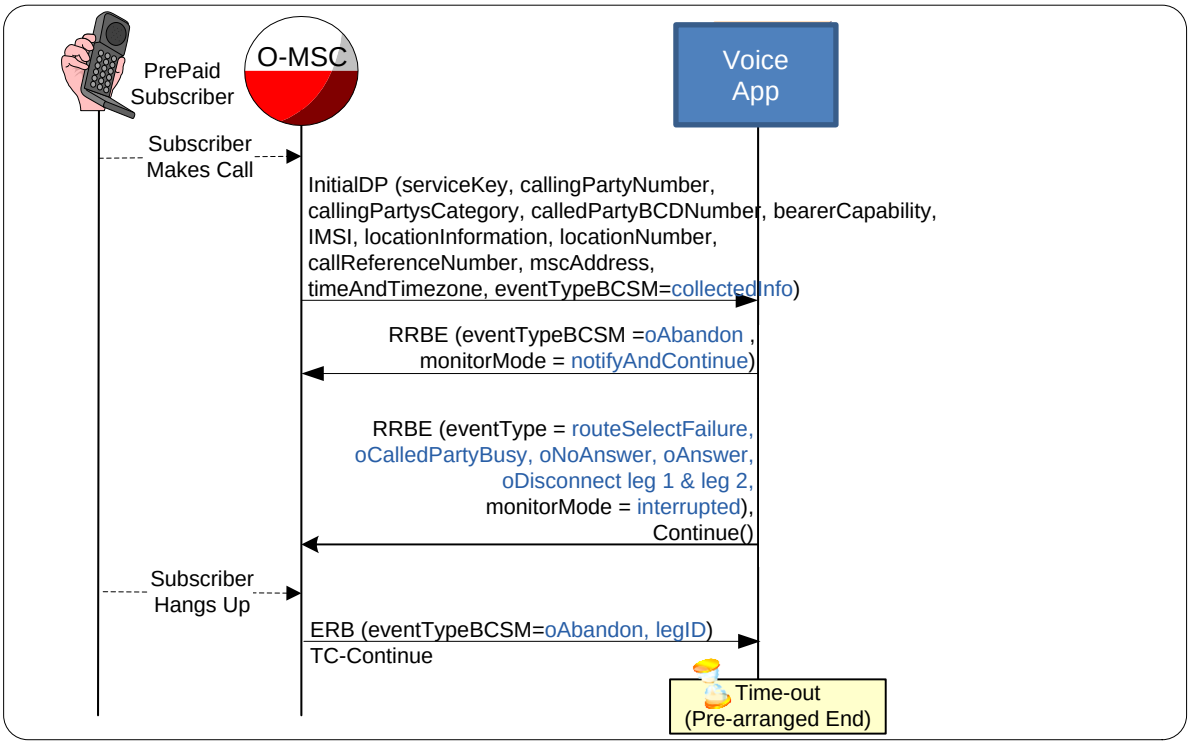


Figure 2-8 CAMEL MO – Caller Abandon – Basic End

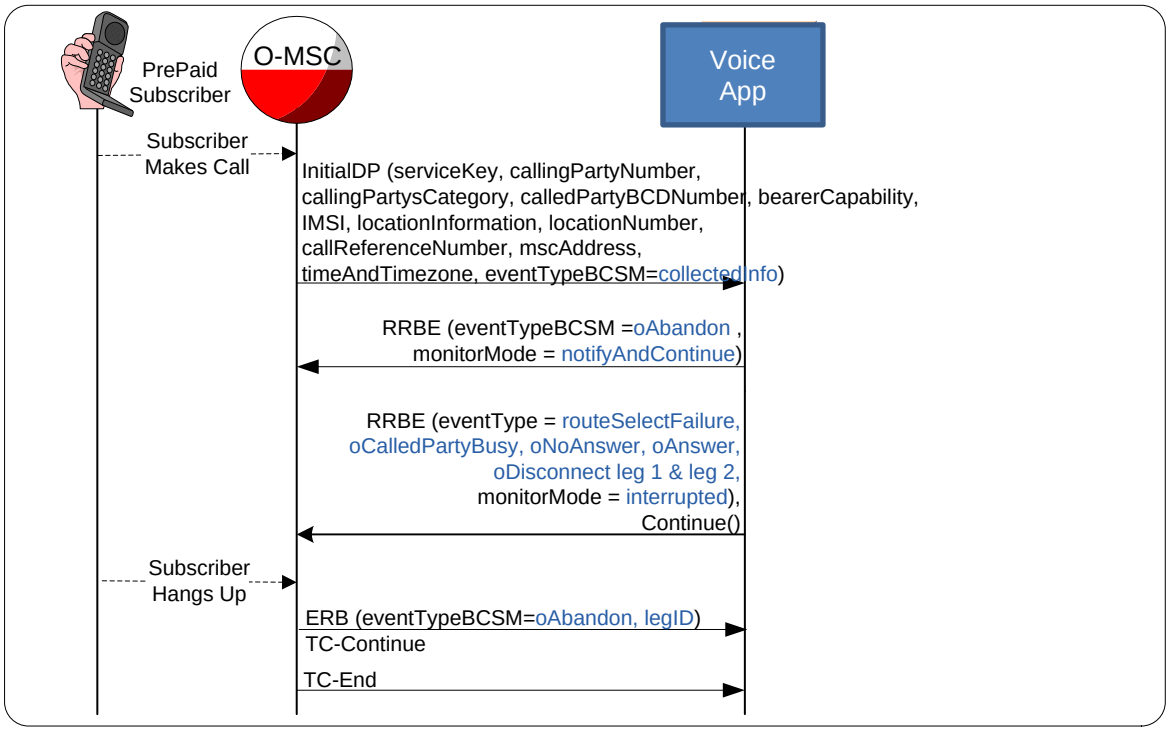


Figure 2-9 CAMEL MO – Caller Abandon Reported in TC-End

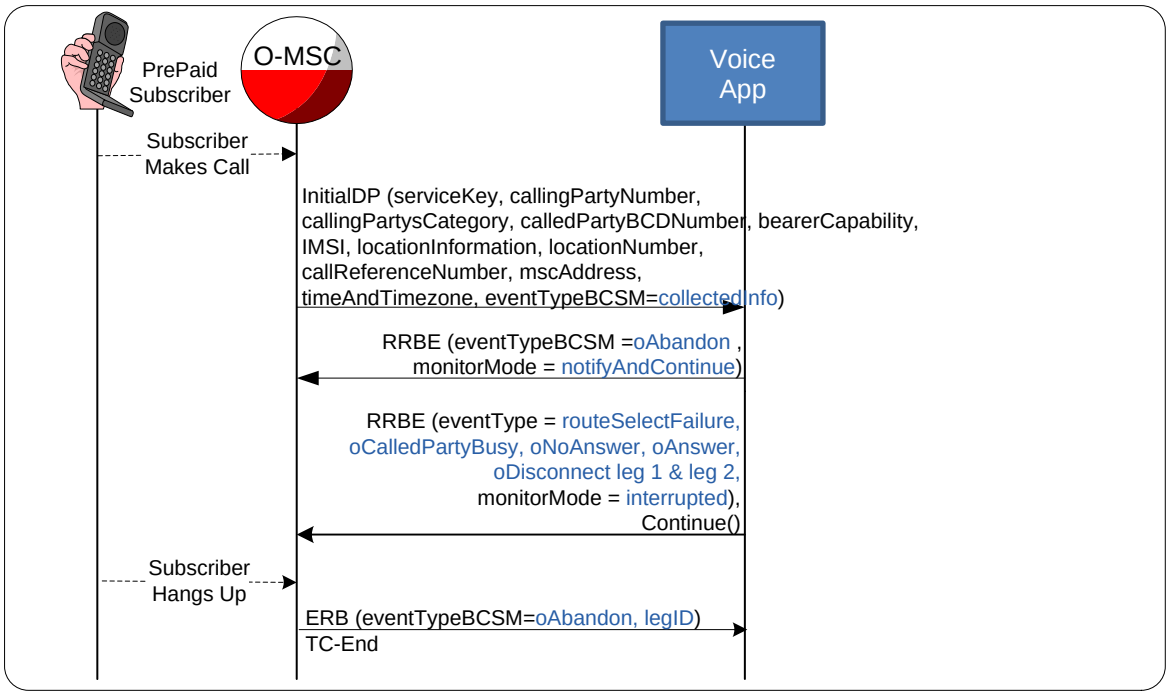


Figure 2-10 – CAMEL MO – Caller Abandon after First RRBE

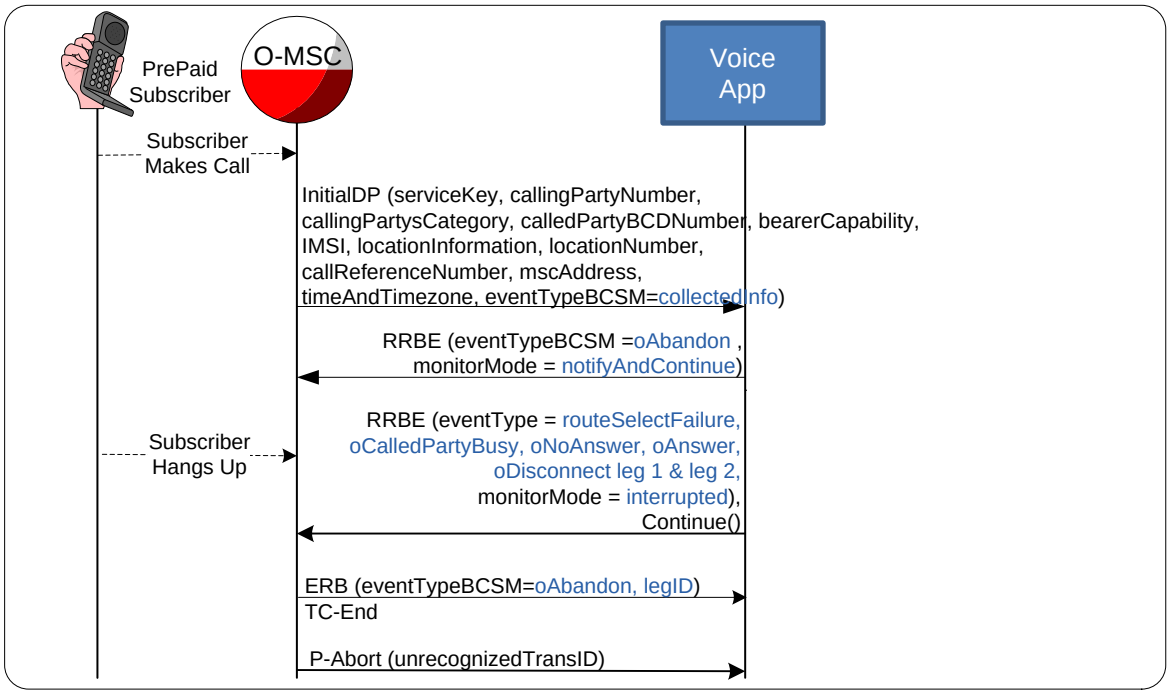
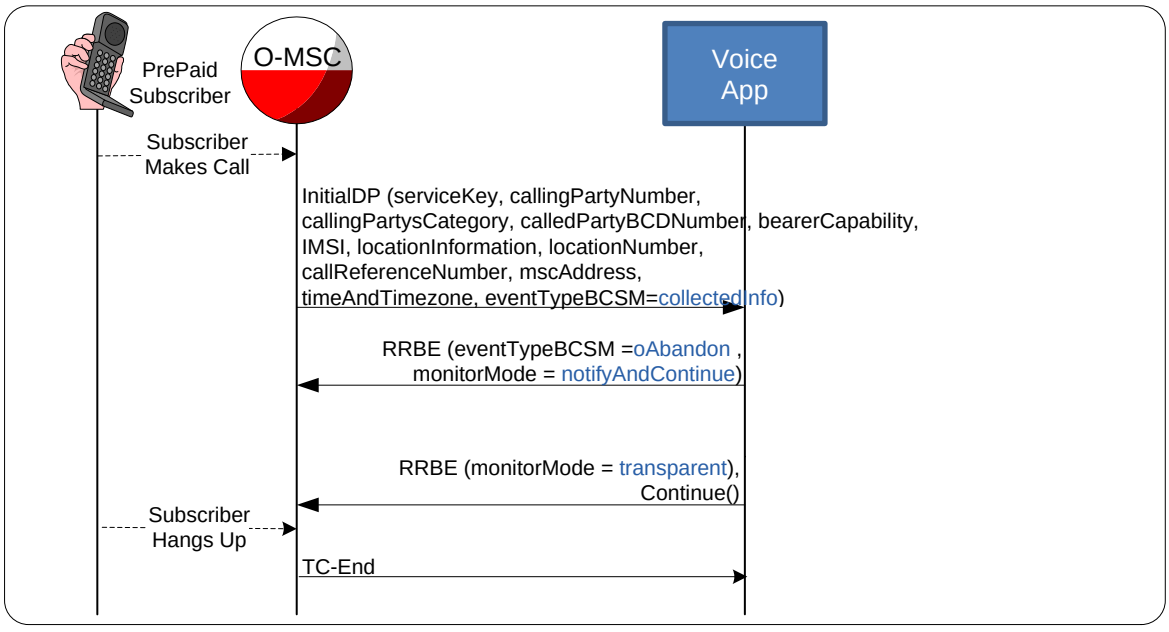


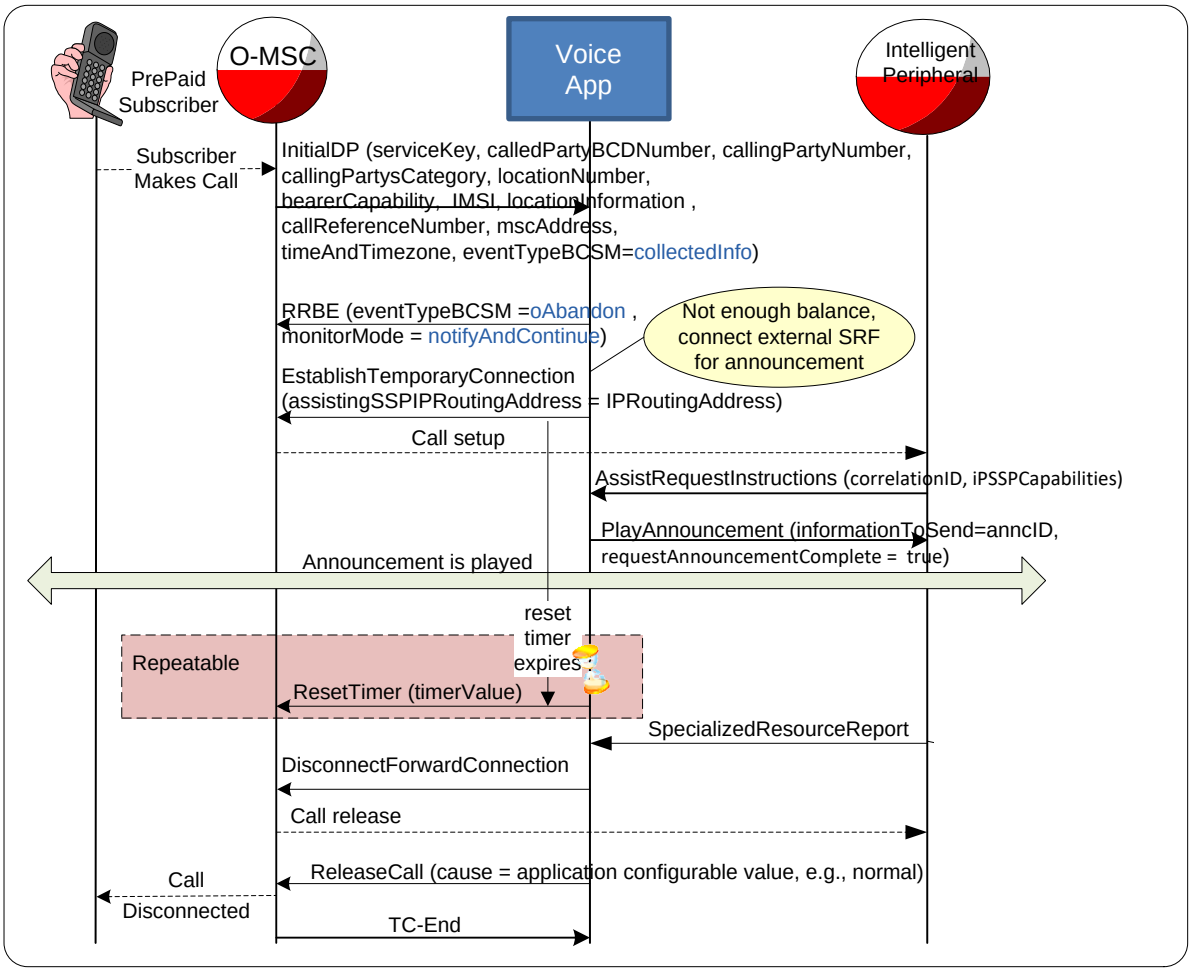
Figure 2-11 – CAMEL MO – Caller Abandon – Free Call



2.6 Denied - Insufficient Balance during Set-up

This section illustrates a denied call due to not enough balance to allow the call. In this example, an announcement is played to the originating subscriber from an external SRF.

Figure 2-12 CAMEL MO Denied Call for Insufficient Balance – External SRF



2.7 Error Scenarios

Error scenarios include failure in the application and failures in the messaging between the MSC and the application. It is important to include error handling for all known scenarios. As new scenarios are found, this section is updated.

NOTE: CALL FLOW INFORMATION REMOVED.

3. Mobile Forwarded Voice

Call forwarding occurs when the subscriber cannot be reached during a call termination attempt.

There are two types of call forwarding.

- Unconditional Call Forwarding: All incoming calls will be redirected to the Forward-To number defined by the subscriber. In this case, the HLR returns the Forward-To number to the MSC to automatically divert the call.
- Conditional Call Forwarding: The incoming call is redirected to the Forward-To number based on one of the following conditions.
    - ❖ The subscriber's line is busy (Call Forwarding Busy)
    - ❖ The subscriber does not answer the call (Call Forwarding No Answer)
    - ❖ The subscriber's handset is powered off, not reachable from the VLR, or other failures are encountered such as no paging response and radio congestion (Call Forwarding Not Reachable/No Paging Response)

In all scenarios, the call is forwarded to the Forward-To number provisioned for the subscriber at the HLR. According to standards, each call forwarding type may be provisioned with a different Forward-To number. Note: Voice Mail Deposit is a Call Forwarding scenario where the Forward-To number is set to route the call to the Voice Mail system.

Note: when the call is forwarded, it is moved from the Terminating BCSM to the Originating BCSM at the GMSC/VMSC. The forwarded call is then handled in a similar fashion as a Mobile Originated Voice Call. The CAMEL T-BCSM for A to B party and the CAMEL O-BCSM for B to C party are created and handled independently.

Both GSM CAMEL Phase 2 and 3 wireless network protocols are supported. Messages and parameters of CAMEL Phase 2 and 3 used in the call flows are the same.

NOTE: CALL FLOW INFORMATION REMOVED.

4. Mobile Terminated Voice

In call termination, the voice application determines the number of seconds (quanta) to allow the call. When the balance is depleted, the application will direct the MSC to disconnect the call.

Call termination is allowed for free in the subscriber's home network and charged in the intersystem call termination scenario.

The CAMEL control relationship between MSC and the voice application is established when the MSC invokes TDP Terminating_Attempt_Authorised. The table below lists CAMEL DPs supported for mobile terminated voice.

CAMEL DP	DP Type
DP12 Terminating_Attempt_Authorised	TDP-R
DP 13 T_Busy	EDP-N, EDP-R
DP 14 T_No_Answer	EDP-N, EDP-R
DP15 T_Answer	EDP-N, EDP-R
DP17 T_Disconnect (Leg1 and Leg2)	EDP-N, EDP-R
DP 18 T_Abandon	EDP-N

GSM CAMEL Phase 2 wireless network protocol is supported for call termination.

NOTE: CALL FLOW INFORMATION REMOVED.

5. Assumptions

1. Emergency numbers are directly routed by the MSC without triggering the application.
2. The subscriber number in MO, MT, and MF voice calls is expected to have an NOA set to International, National, or Subscriber Number. Otherwise, the call will be blocked.
3. Monitoring of Free calls (using CallInformationReport) is not supported.

6. References

[1] ETSI TS 101 441 V7.8.1 (2002-08) Digital cellular telecommunications system (Phase 2+); Customised Applications for Mobile network Enhanced Logic (CAMEL) Phase 2; Stage 2

[2] ETSI TS 101 046 V7.1.0 (2000-07) Digital cellular telecommunications system (Phase 2+);Customised Applications for Mobile network Enhanced Logic (CAMEL); CAMEL Application Part (CAP) (GSM 09.78 version 7.1.0 Release 1998) specification

[3] ETSI TS 123 078 V4.11.1 (2004-04) Digital cellular telecommunications system (Phase 2+);Universal Mobile Telecommunications System (UMTS); Customized Applications for Mobile network Enhanced Logic (CAMEL); Stage 2

[4] ETSI TS 129 078 V4.8.0 (2003-03) Digital cellular telecommunications system (Phase 2+);Universal Mobile Telecommunications System (UMTS); Customized Applications for Mobile network Enhanced Logic (CAMEL); CAMEL Application Part (CAP) specification

[5] ETSI TS 123 090 V4.0.0 (2001-03) Digital cellular telecommunications system (Phase 2+);Universal Mobile Telecommunications System (UMTS); Unstructured Supplementary Service Data (USSD) – Stage 2 (3GPP TS 23.090 version 4.0.0 Release 4)

[6] ETSI TS 100 974 V7.10.0 (2002-01) Technical Specification Digital cellular telecommunications system (Phase 2+); Mobile Application Part (MAP) specification (3GPP TS 09.02 version 7.10.0 Release 1998)

[7] 3GPP TS 22.060 V4.4.0 (2002-06), 3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; General Packet Radio Service (GPRS); Service description, Stage 1 (Release 4).

[8] 3GPP TS 23.060 V4.11.0 (2006-12), 3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; General Packet Radio Service (GPRS); Service description; Stage 2 (Release 4).

[9] ETSI TS 129 002 V4.18.0 (2007-10) Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); Mobile Application Part (MAP) specification (3GPP TS 29.002 version 4.18.0 Release 4)