This scenario describes the session setup for a GSM originating SMS. This sequence diagram describes the SMS signaling and data transfer between the mobile subscriber and the SMS service center. Before any message of CM-sub layer is delivered, a Mobility Management MM connection must be established between MS and MSC, then RPDO is transferred over the connection. Then MM-connection is released by SMC with a flag indicating whether or not the transmission was successful.

### SMS Protocol stack

1. **SM Application layer (AL)**: Transfers SM-AL messages.
2. **SM Transfer layer (TL)**: Transfers SM-TL messages.
3. **SM-RL** handles the delivery and storage of SM messages.
4. **SM-RL** handles the delivery and storage of SM messages.
5. **SC** talks to MSC via TCAP/MAP.

### Short Message Transfer

- **Destination directory number**
- **Service center address**
- **Short message data**
- **Message validity period**
- **Send status report**

The Mobile sends the short message transfer to establish a SMS originating session setup. The message contains the following fields:

- **Message type indicator (MTI)**
- **Reject Duplicate (RD)**
- **Status report request (SRR)**
- **Relay Path (RP)**
- **SM-AL-Mobile Short message transfer information**

### SMS Session Related Information

- **Originating address**
- **Terminating address**
- **User-data**

### SMS Connection Establishment

- **BSS**
- **MSC**
- **SM-Sub-MSC**
- **SM-RL-MSC**

### RR and MM Setup

- **RR CHANNEL REQUEST**
- **RR IMMEDIATE ASSIGNMENT**
- **Apply the time and frequency corrections**
- **Tune to the frequency and timeslot**
### GSM Mobile Originated SMS Call Flow (GSM Mobile Originated SMS)

<table>
<thead>
<tr>
<th>Cell</th>
<th>Mobile Station</th>
<th>Mobile Network</th>
</tr>
</thead>
<tbody>
<tr>
<td>User</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SMS User</td>
<td>Mobile</td>
<td>SM-AL Mobile</td>
</tr>
<tr>
<td>GSM/Mobile</td>
<td>BSS</td>
<td>Mobile Switching Center</td>
</tr>
<tr>
<td></td>
<td>BSS</td>
<td>MSC</td>
</tr>
</tbody>
</table>

#### Call Establishment

**RR SABM + MM CM SERVICE REQUEST**

<table>
<thead>
<tr>
<th>RR SABM</th>
<th>CM Request = SM</th>
</tr>
</thead>
<tbody>
<tr>
<td>SDCCH, BSS</td>
<td></td>
</tr>
</tbody>
</table>

**SCCP CONNECTION REQUEST + MM CM SERVICE REQUEST**

<table>
<thead>
<tr>
<th>SCCP</th>
<th>CM Request = SM</th>
</tr>
</thead>
<tbody>
<tr>
<td>BSS</td>
<td></td>
</tr>
</tbody>
</table>

**MM AUTHENTICATION REQUEST**

<table>
<thead>
<tr>
<th>MM AUTHENTICATION REQUEST</th>
<th>Obtain the tuple of (RAND, SRES, Kc)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RAND</td>
<td></td>
</tr>
<tr>
<td>SRES</td>
<td></td>
</tr>
</tbody>
</table>

**Expect ciphered data from the mobile**

**RR CIPHERING MODE COMMAND**

<table>
<thead>
<tr>
<th>RR CIPHERING MODE COMMAND</th>
<th>mode = CLEAR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enable ciphering for received and transmitted data</td>
<td></td>
</tr>
</tbody>
</table>

**RR CIPHERING MODE COMPLETE**

<table>
<thead>
<tr>
<th>RR CIPHERING MODE COMPLETE</th>
<th>mode = CIPHERED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enable ciphering of data transmitted to the mobile</td>
<td></td>
</tr>
</tbody>
</table>

**BSSMAP CIPHER MODE COMPLETE**

| BSSMAP CIPHER MODE COMPLETE | |
|-----------------------------| |

At this point a connection has been setup between the Mobile and the MSC. From this point onward, the BSS is just acting as a conduit for transporting the signaling messages between the Mobile and the MSC.

#### SMS sent from Mobile to MSC

**SAPI 3 Establishment**

<table>
<thead>
<tr>
<th>SAPI 3 Establishment</th>
<th>Initiate endframe mode in SAP3 with the normal LAPDm SABM procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDCH, SAPI = 3</td>
<td></td>
</tr>
</tbody>
</table>

**RR SABM**

The Mobile initiates a LAPm connection with the BSC by sending a Set Asynchronous Balanced Mode (SABM) message.

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This is the first message that is sent after tuning to the channel. The CM Service Request is sent to the MSC.

The BSS replies with Unnumbered Acknowledge (UA) to complete the LAPm setup handshake.

The BSS receives the CM Service Request message from the mobile and forms a "BSSMAP COMPLETE LAYER 3 INFORMATION". The BSS then piggybacks the message on the SCCP connection request message.

LEG: Initiate Authentication Procedure

Since the subscriber has been successfully authenticated, the MSC initiates ciphering of the data being sent on the channel. The channel is ciphered so as to protect the call from eavesdropping.

Ciphering on the radio link is enabled in three steps. As a first step, the BSS starts expecting ciphered data from the mobile but continues to send data in clear. Since the mobile has not been informed about the ciphering, all data received from the mobile will be in error.

The BSS sends the CIPHERING MODE COMMAND to the mobile. The mobile will be able to receive this message as the transmission from the BSS is still in clear.

As a second step, the Mobile receives the message and enables ciphering in transmit and receive directions. This action will result in all BSS data being received in error. (The BSS is still transmitting data in clear.)

Ciphering has already been enabled, so this message is transmitted with ciphering. The BSS will receive this message as it is already expecting ciphered data in the receive direction.

The third and final step in the ciphering handshake. The BSS enables the ciphering in transmit direction. From this point on ciphering is enabled in both directions.

The BSS replies back to the MSC, indicating that ciphering has been successfully enabled.
The BSS replies with Unnumbered Acknowledge (UA) to complete the LAPm setup handshake.

The SMS content is being carried in CP-DATA messages sent from the mobile to the MSC. The SMS payload is carried in the RPDU contained in the RPDATA.

The CM-Sub layer on the MSC passes the message to the relay layer. The RP-DATA is passed in this interaction.

On successful transmission over Radio Connection CP-ACK is sent.

Ack is received, so the timer can be stopped.

SM-RL-DATA-Ind is a message used by SM-RL to pass SMS-SUBMIT TPDU and the associated RP-DATA to SM-TL at SC.

The MSC requests the subscriber related information for mobile originated SMS.

LEG: Successful VLR Response

SMS service is provisioned and there is no operator initiated barring.

LEG: No Data Errors In Confirmation

If no data errors are found, the MSC sends MAP_FORWARD_SHORT_MESSAGE to SMS interworking MSC.

LEG: SMS Forward Short message data content is valid

Validation of the content passes, so the Interworking MSC and SC establish a connection.

Once the connection is established, the short message is transmitted to the SC.

LEG: SM is accepted by SC

SC signals successful delivery of the SMS.

SMS-IWMSC informs MSC about the successful delivery of the SMS to the SC.

SM-RL-REPORT-Req message is a request used by SM-TL to relay RP-ACK containing the SMS STATUS REPORT.

A request to send RP-ACK RPDU on established CM connection is sent from SM-RL to CM-Sub-MSC.

The MSC now sends a Delivery Report to the Mobile, informing about the successful delivery of the SMS.

After the receipt of the Delivery Report, the Mobile initiates the connection release. MNSMS-REL_Req is a request to release the CM connection.
SM-RL-REPORT-Ind is an indication used by SM-RL to the RP-ACK to SM-TL.

Call release has been completed, now the RR connection is released by the MSC.

The BSS initiates RR release with the mobile.

The BSS informs the the MSC that the RR connection has been released.

The mobile sends a disconnect message to release the LAPm connection.

The BSS replies with an Unnumbered Acknowledge message.

The BSS releases the SDCCH channel.

The network releases the SDCCH with the RR Channel Release message. This implies a closure of the MM sublayer and triggers the release of L2 and L1.

Mobile goes back to the default display to indicate that SMS session has been completely released.