How does a GSM mobile phone receive a call?

We have already seen that GSM mobiles keep the GSM network informed about their current location area. The knowledge of the location area is not adequate for setting up a terminating call as the location area might spawn several cells.

In this call flow we will look at how a terminating call is handled in GSM. Setting up a terminating call is a two step process. (1) Interrogation procedure to locate the subscriber (2) Actual call setup after the subscriber has been located.


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Now the MSC VLR needs to locate the subscriber in the location area. Since the location area might spawn several cells, a paging mechanism is used to locate the subscriber. The MSC VLR uses a TMSI (Temporary Mobile Subscriber Identify) to address the mobile phone. The TMSI is used so as to protect the privacy of the called subscriber. Note that, the BSSMAP PAGING message will be sent to all the BSCs that handle the Maryland Location Area.

The Maryland BSC receives the page message. The BSC will send the Page message to all the cells that serve the subscriber's location area.

All cells in the location area will broadcast the Page message on the Paging Channel (PCH). All mobile phones listen to this channel every few seconds. The mobile is located in the Bethesda cell. It receives this page message.

The mobile finds that the TMSI specified in the page message matches its own TMSI. The mobile decides to respond to the page. An RR connection establishment is initiated by sending a channel request to the network.

The network assigns a channel to the terminal and sends the assignment and time/frequency corrections in the immediate assignment message.

The mobile tunes to the assigned channel and transmits the page response and the SABM to initiate the RR session.

The BSC sends a SCCP connection request to the MSC VLR. The page response message is piggy backed with the request.
**GSM Mobile Terminating Call Flow (GSM Mobile Terminated Call)**

<table>
<thead>
<tr>
<th>Highway</th>
<th>Maryland</th>
<th>Fixed Network</th>
</tr>
</thead>
<tbody>
<tr>
<td>GSM Mobiles</td>
<td>Other GSM Mobiles</td>
<td>Network</td>
</tr>
<tr>
<td>GSM Common Equipment</td>
<td>PSTN</td>
<td></td>
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</tbody>
</table>

### Enable Ciphering

- **RR UA**: The BSC acknowledges the SABM to establish the RR connection. Note that UA messages are used in the entire session for acknowledging packets. They will be omitted here for clarity.

### Call setup

- **RR UA**: The MSC initiates ciphering of the data being sent on the channel.
- **BSSMAP CIPHER MODE COMMAND**: The BSC sends the CIPHERING MODE COMMAND to the mobile.
- **RR CIPHERING MODE COMPLETE** (mode = CLEAR): Ciphering has already been enabled, so this message is transmitted with ciphering.
- **BSSMAP CIPHER MODE COMPLETE**: BSC replies back to the MSC, indicating that ciphering has been successfully enabled.

- **CC SETUP**: The MSC VLR receives the page response and sends a call setup to the mobile.
- **CC CALL CONFIRMED**: The mobile acknowledges the receipt of the setup by sending the call confirmed message.
- **Ring**: Ring the subscriber.
- **CC ALERTING**: The mobile notifies the MSC that the subscriber is being alerted.
- **ISUP ADDRESS COMPLETE MESSAGE**: The MSC receives the alert indication and sends an ISUP address complete message to the GMSC.
- **ISUP ADDRESS COMPLETE MESSAGE**: The GMSC sends the address complete to the PSTN switch.
- **OK Button**: The subscriber answers the call by hitting the "OK" button.
- **CC CONNECT**: Notify the MSC that the subscriber has answered the call.
- **ISUP ANSWER**: The call has now entered the conversation phase.

### Conversation phase

### Call Release

- **End Button**: LEG: Mobile initiates call release
  - The mobile subscriber hits End to clear the call.
### CC DISCONNECT
- The mobile sends the disconnect message to the MSC.

### ISUP RELEASE
- The MSC initiates release on the PSTN side.

### Disconnect Voice Path
- The MSC disconnects the voice path and also releases the voice circuit between the BSC and the MSC.

### CC RELEASE
- The MSC informs the mobile that it has initiated call release.

### ISUP RELEASE COMPLETE
- The MSC informs the PSTN that the call release has been completed.

### ISUP RELEASED
- The PSTN informs that call release has been completed at its end.

### CC RELEASE COMPLETE
- Mobile indicates that the call has been released.

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### RR Connection Release

#### RR CHANNEL RELEASE
- Call release has been completed, now the RR connection is released by the MSC.

#### BSSMAP CLEAR COMMAND
- The BSC initiates RR release with the mobile.

#### BSSMAP CLEAR COMPLETE
- The BSC informs the MSC that the RR connection has been released.

#### RR DISC
- The mobile sends a disconnect message to release the LAPm connection.

#### RR UA
- The BSC replies with an Unnumbered Acknowledge message.

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#### Call Released Indication
- Mobile goes back to the default display to indicate that call has been completely released.