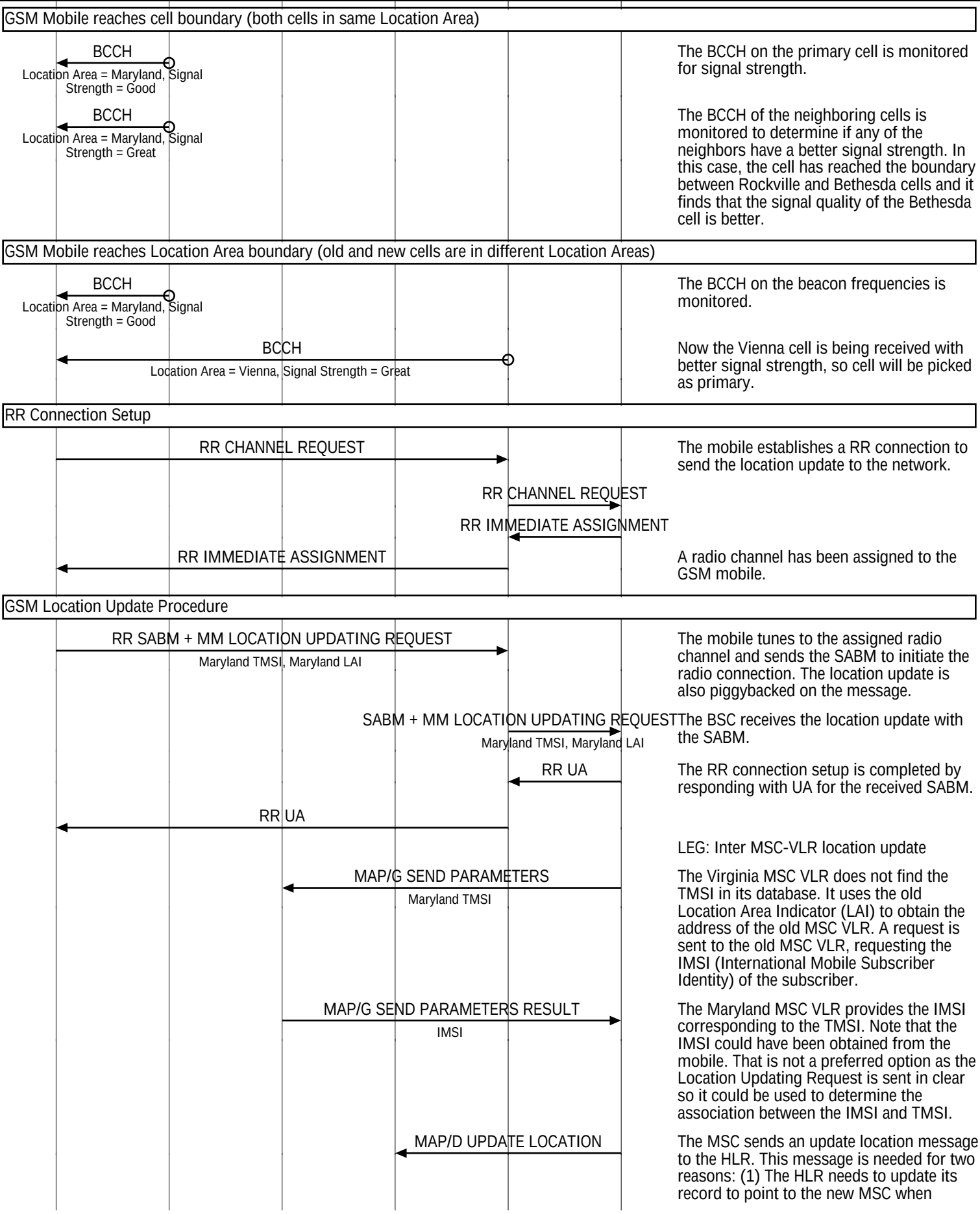
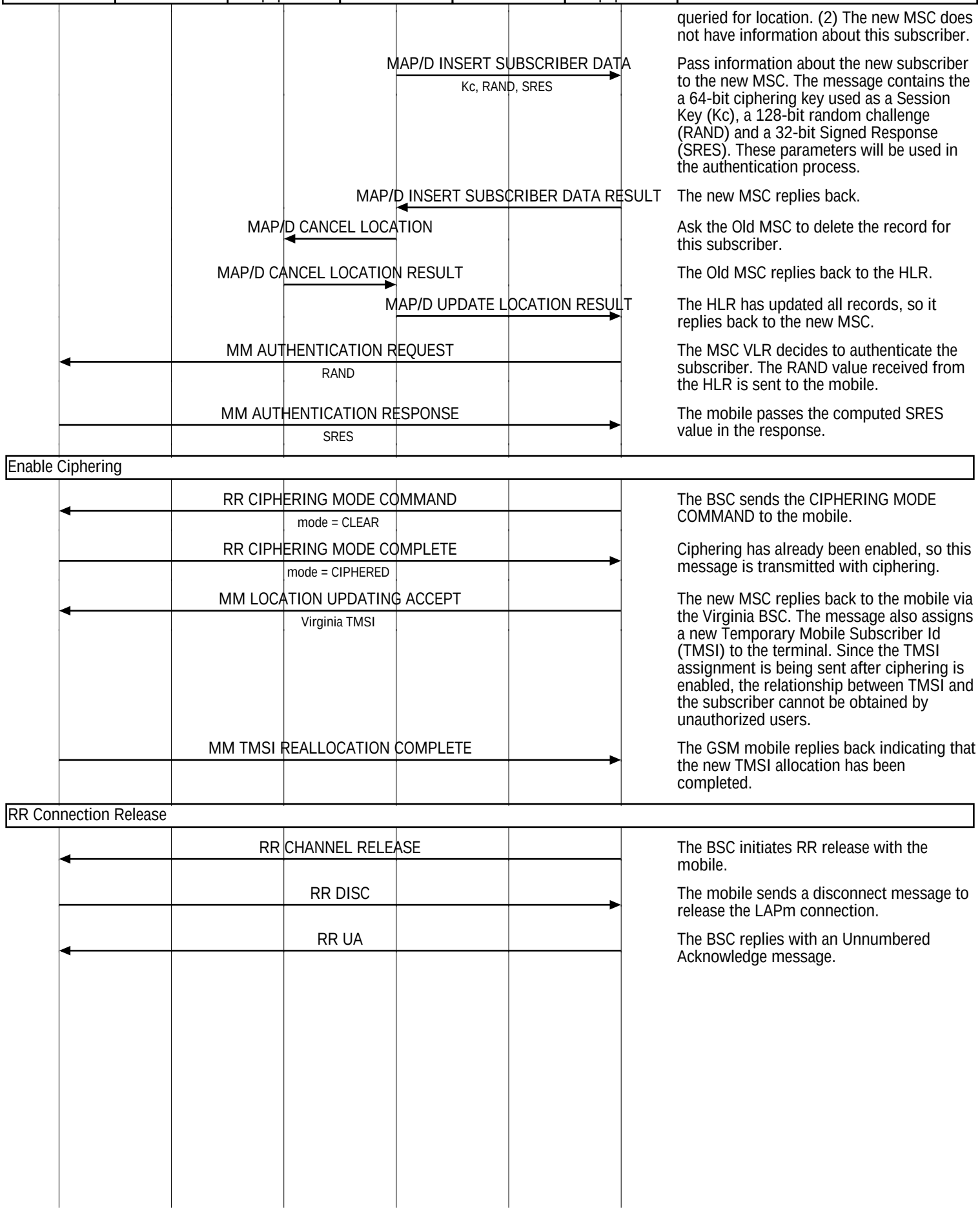

GSM Mobile reaches cell boundary (both cells in same Location Area)
BCCH
Location Area = Maryland, Signal Strength = Good
The BCCH on the primary cell is monitored for signal strength.
BCCH
Location Area = Maryland, Signal Strength = Great
The BCCH of the neighboring cells is monitored to determine if any of the neighbors have a better signal strength. In this case, the cell has reached the boundary between Rockville and Bethesda cells and it finds that the signal quality of the Bethesda cell is better.
GSM Mobile reaches Location Area boundary (old and new cells are in different Location Areas)
BCCH
Location Area = Maryland, Signal Strength = Good
The BCCH on the beacon frequencies is monitored.
BCCH
Location Area = Vienna, Signal Strength = Great
Now the Vienna cell is being received with better signal strength, so cell will be picked as primary.
RR Connection Setup
RR CHANNEL REQUEST
The mobile establishes a RR connection to send the location update to the network.
RR CHANNEL REQUEST
RR IMMEDIATE ASSIGNMENT
RR IMMEDIATE ASSIGNMENT
A radio channel has been assigned to the GSM mobile.
GSM Location Update Procedure
RR SABM + MM LOCATION UPDATING REQUEST
Maryland TMSI, Maryland LAI
The mobile tunes to the assigned radio channel and sends the SABM to initiate the radio connection. The location update is also piggybacked on the message.
SABM + MM LOCATION UPDATING REQUEST
Maryland TMSI, Maryland LAI
The BSC receives the location update with the SABM.
RR UA
The RR connection setup is completed by responding with UA for the received SABM.
RR UA
LEG: Inter MSC-VLR location update
MAP/G SEND PARAMETERS
Maryland TMSI
The Virginia MSC VLR does not find the TMSI in its database. It uses the old Location Area Indicator (LAI) to obtain the address of the old MSC VLR. A request is sent to the old MSC VLR, requesting the IMSI (International Mobile Subscriber Identity) of the subscriber.
MAP/G SEND PARAMETERS RESULT
IMSI
The Maryland MSC VLR provides the IMSI corresponding to the TMSI. Note that the IMSI could have been obtained from the mobile. That is not a preferred option as the Location Updating Request is sent in clear so it could be used to determine the association between the IMSI and TMSI.
MAP/D UPDATE LOCATION
The MSC sends an update location message to the HLR. This message is needed for two reasons: (1) The HLR needs to update its record to point to the new MSC when



queried for location. (2) The new MSC does not have information about this subscriber.

Pass information about the new subscriber to the new MSC. The message contains the a 64-bit ciphering key used as a Session Key (Kc), a 128-bit random challenge (RAND) and a 32-bit Signed Response (SRES). These parameters will be used in the authentication process.

The new MSC replies back.

Ask the Old MSC to delete the record for this subscriber.

The Old MSC replies back to the HLR.

The HLR has updated all records, so it replies back to the new MSC.

The MSC VLR decides to authenticate the subscriber. The RAND value received from the HLR is sent to the mobile.

The mobile passes the computed SRES value in the response.

The BSC sends the CIPHERING MODE COMMAND to the mobile.

Ciphering has already been enabled, so this message is transmitted with ciphering.

The new MSC replies back to the mobile via the Virginia BSC. The message also assigns a new Temporary Mobile Subscriber Id (TMSI) to the terminal. Since the TMSI assignment is being sent after ciphering is enabled, the relationship between TMSI and the subscriber cannot be obtained by unauthorized users.

The GSM mobile replies back indicating that the new TMSI allocation has been completed.

The BSC initiates RR release with the mobile.

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

The BSC replies with an Unnumbered Acknowledge message.