LEG: GSM Mobile Originated Call

This scenario describes the call setup for a GSM originating call. A mobile user calling a land line subscriber is covered here.

Begin RR Connection Establishment

Call related information needs to be transported from the mobile phone to the Mobile Switching Center (MSC). This requires the establishment of a Radio Resource (RR) connection to MSC. The first phase of the call setup just sets up this RR connection.

RR CHANNEL REQUEST

RACH

RR connection establishment is triggered by sending the Channel Request message. This message requests the Base Station System (BSS) for allocation for radio resources for the RR connection setup. The mobile now waits for an assignment on the Access Grant Channel (AGCH). At this point the mobile is listening to the AGCH for a reply.

Note: The RR CHANNEL REQUEST is sent on a Random Access Channel (RACH). This is a slotted aloha channel that can be used at random, without any coordination between the mobiles. Any mobile can transmit on this channel whenever it wishes. If two mobiles transmit on the channel at the same time, their messages will be lost in a collision. The mobiles will detect the collision via a timeout and retransmit the message after a random back off.

allocate

TCH

The BSS allocates a Traffic Channel (TCH) to the mobile. The TCH allocation assigns a specifies a frequency and a timeslot on that frequency. After the mobile receives this message, the mobile shall only use the specified resources for communication with the mobile network.

RR IMMEDIATE ASSIGNMENT

AGCH, Radio_Resource = (TCH, Frequency, Timeslot), Time Correction, Frequency Correction

The BSS transmits the radio resource assignment to the Mobile via the AGCH channel. The message also contains the time and frequency corrections. The time corrections allow the mobile to time it's transmissions so that they reach the BSS only in the specified slot. The frequency corrections correct for the Doppler shift caused by the mobile's motion.

RR SABM + MM CM SERVICE REQUEST

TCH, SAPI = 0

This is the first message that is sent after tuning to the channel. The Mobile initiates a LAPm connection with the BSC by sending a Set Asynchronous Balanced Mode (SABM) message. The service request message meant for the MSC is also sent in this message.

RR UA

TCH, SAPI = 0

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

SCCP CONNECTION REQUEST + MM CM SERVICE REQUEST

SS7

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

LEG: Skip Authentication Procedure

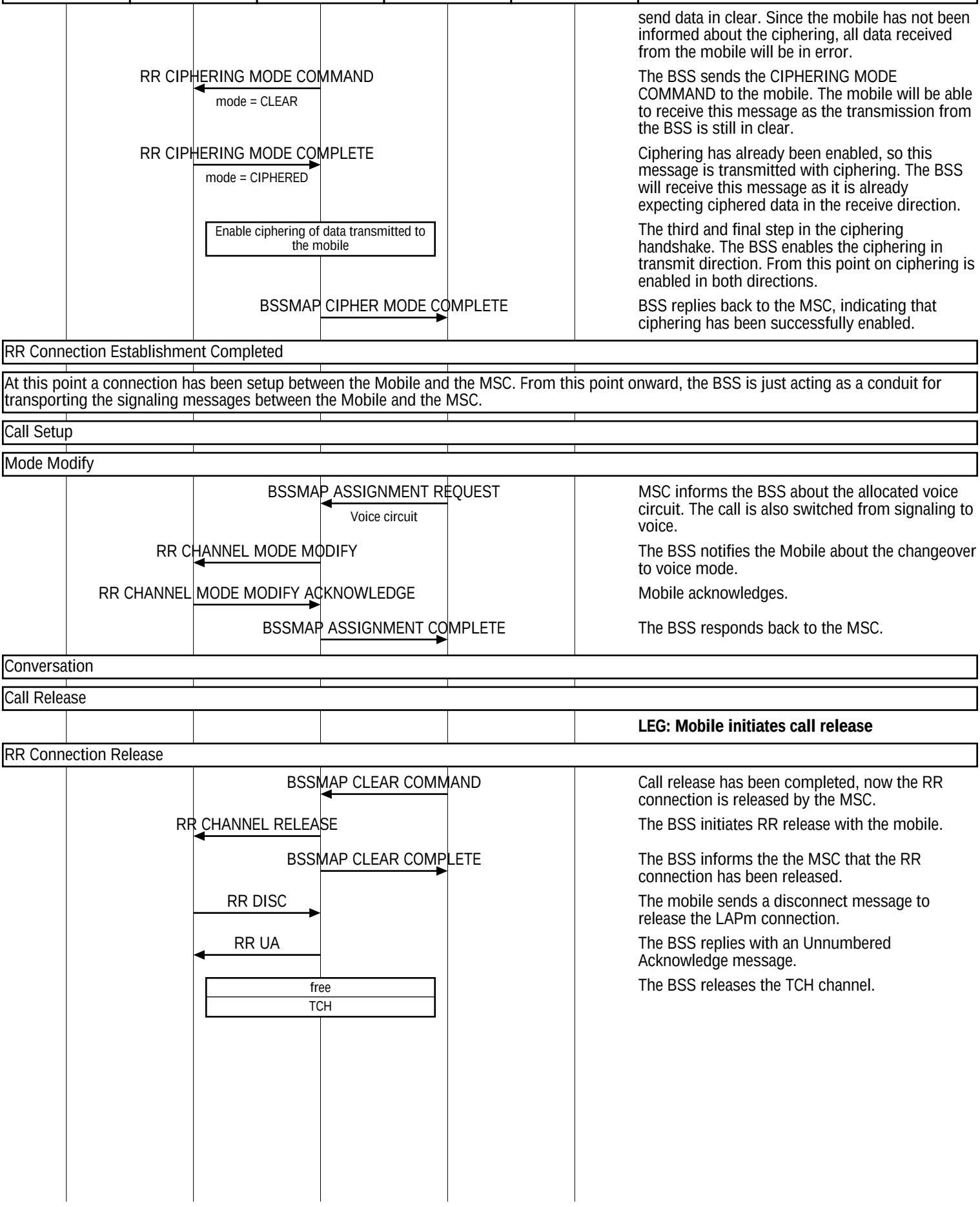
Enable Ciphering

BSSMAP CIPHER MODE COMMAND

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 so protect the call from eavesdropping.

Expect ciphered data from the mobile

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.
RR CIPHERING MODE COMMAND
mode = CLEAR
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.
RR CIPHERING MODE COMPLETE
mode = CIPHERED
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.
Enable ciphering of data transmitted to the mobile
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.
BSSMAP CIPHER MODE COMPLETE
BSS replies back to the MSC, indicating that ciphering has been successfully enabled.
RR Connection Establishment Completed
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.
Call Setup
Mode Modify
BSSMAP ASSIGNMENT REQUEST
Voice circuit
MSC informs the BSS about the allocated voice circuit. The call is also switched from signaling to voice.
RR CHANNEL MODE MODIFY
The BSS notifies the Mobile about the changeover to voice mode.
RR CHANNEL MODE MODIFY ACKNOWLEDGE
Mobile acknowledges.
BSSMAP ASSIGNMENT COMPLETE
The BSS responds back to the MSC.
Conversation
Call Release
LEG: Mobile initiates call release
RR Connection Release
BSSMAP CLEAR COMMAND
Call release has been completed, now the RR connection is released by the MSC.
RR CHANNEL RELEASE
The BSS initiates RR release with the mobile.
BSSMAP CLEAR COMPLETE
The BSS informs the 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 BSS replies with an Unnumbered Acknowledge message.
free
TCH
The BSS releases the TCH channel.