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

Dial the called person's number

The user keys in the phone number for the landline subscriber and ..

Send Button

.. presses the Send button

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.

Apply the time and frequency corrections

Adjust the frequency and timing based on the advice from the BSS. This step is required so that transmissions from the mobile reach the base station at the precise time and with the correct frequency.

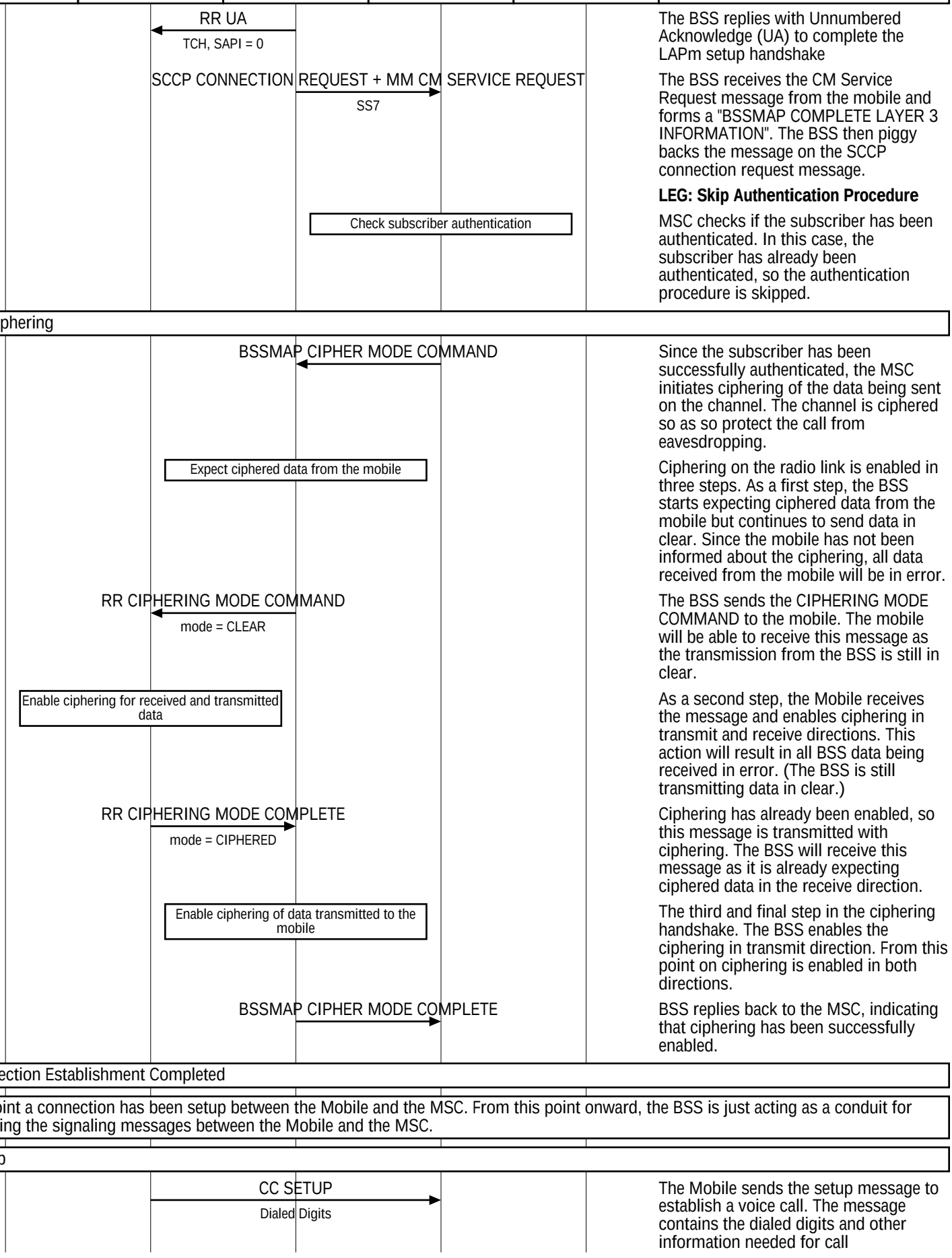
Tune to the frequency and timeslot

The mobile detunes from the AGCH and tunes to the specified radio channel.

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.



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 piggy backs the message on the SCCP connection request message.

LEG: Skip Authentication Procedure

MSC checks if the subscriber has been authenticated. In this case, the subscriber has already been authenticated, so the authentication procedure is skipped.

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.

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.

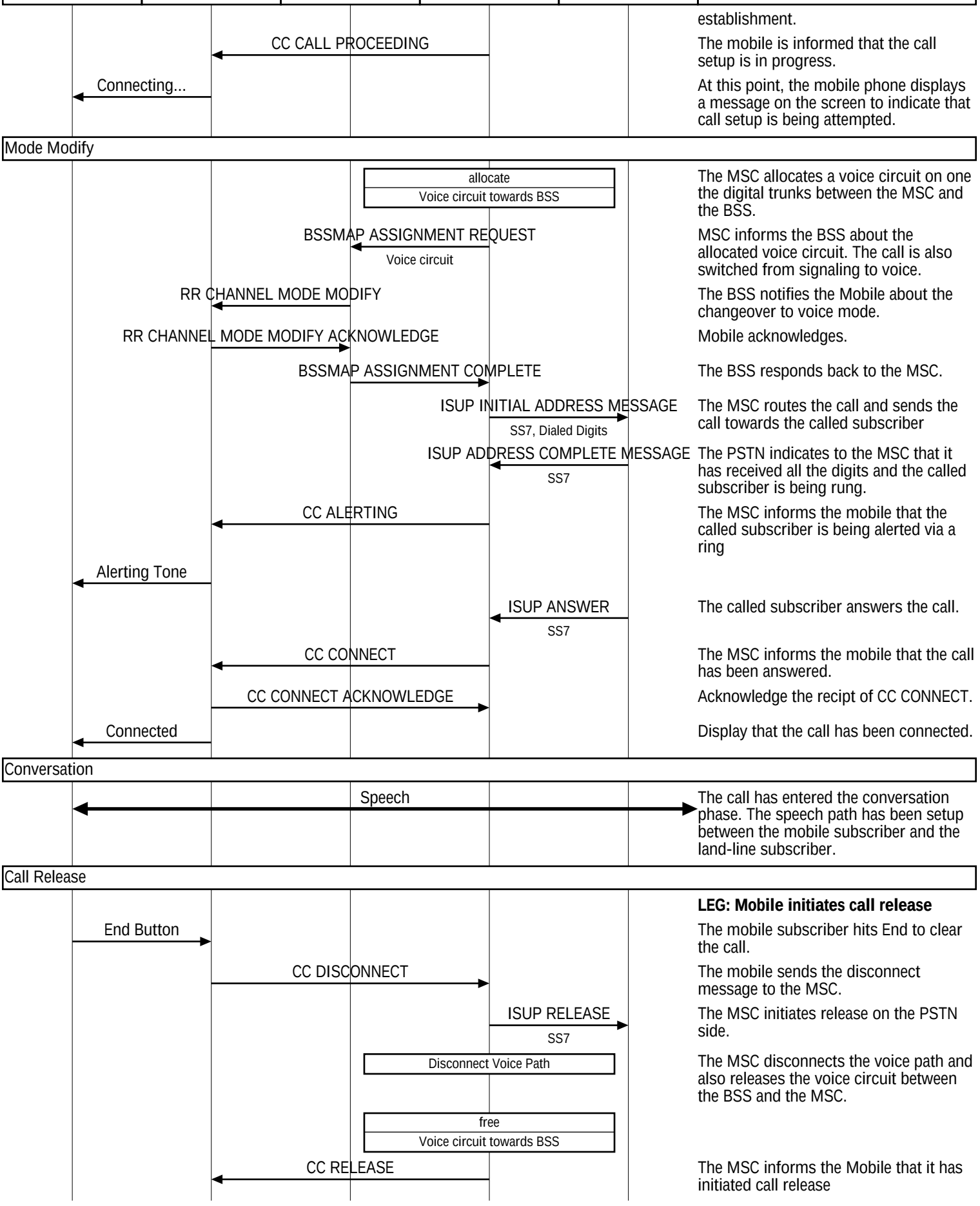
As a second step, the Mobile receives the message and enables ciphering in transmit and receive directions. This action will result in all BSS data being received in error. (The BSS is still transmitting data in clear.)

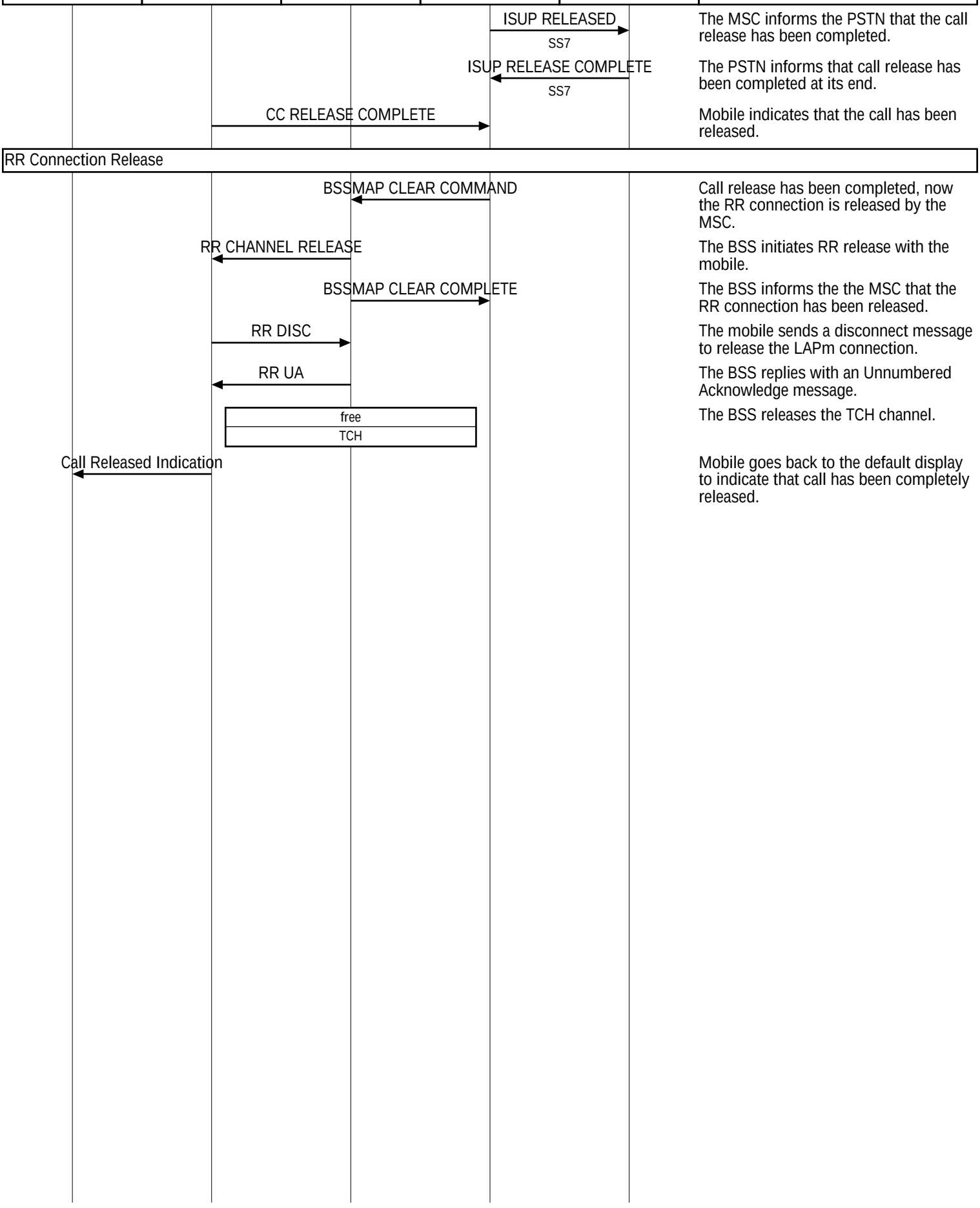
Ciphering has already been enabled, so this message is transmitted with ciphering. The BSS will receive this message as it is already expecting ciphered data in the receive direction.

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.

BSS replies back to the MSC, indicating that ciphering has been successfully enabled.

The Mobile sends the setup message to establish a voice call. The message contains the dialed digits and other information needed for call


establishment.
CC CALL PROCEEDING
The mobile is informed that the call setup is in progress.
Connecting...
At this point, the mobile phone displays a message on the screen to indicate that call setup is being attempted.
Mode Modify
allocate
Voice circuit towards BSS
The MSC allocates a voice circuit on one the digital trunks between the MSC and the BSS.
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.
ISUP INITIAL ADDRESS MESSAGE
SS7, Dialed Digits
The MSC routes the call and sends the call towards the called subscriber
ISUP ADDRESS COMPLETE MESSAGE
SS7
The PSTN indicates to the MSC that it has received all the digits and the called subscriber is being rung.
CC ALERTING
The MSC informs the mobile that the called subscriber is being alerted via a ring
Alerting Tone
ISUP ANSWER
SS7
The called subscriber answers the call.
CC CONNECT
The MSC informs the mobile that the call has been answered.
CC CONNECT ACKNOWLEDGE
Acknowledge the recipt of CC CONNECT.
Connected
Display that the call has been connected.
Conversation
Speech
The call has entered the conversation phase. The speech path has been setup between the mobile subscriber and the land-line subscriber.
Call Release
LEG: Mobile initiates call release
End Button
The mobile subscriber hits End to clear the call.
CC DISCONNECT
The mobile sends the disconnect message to the MSC.
ISUP RELEASE
SS7
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 BSS and the MSC.
free
Voice circuit towards BSS
CC RELEASE
The MSC informs the Mobile that it has initiated call release


ISUP RELEASED
SS7
The MSC informs the PSTN that the call release has been completed.
ISUP RELEASE COMPLETE
SS7
The PSTN informs that call release has been completed at its end.
CC RELEASE COMPLETE
Mobile indicates that the call has been released.
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.
Call Released Indication
Mobile goes back to the default display to indicate that call has been completely released.