

Agilent
Testing Video Call Capabilities of
W-CDMA User Equipment with
E6703E W-CDMA Lab Application or
E1963A-401 End-to-End Video or
E1963A-402 Video Loopback Option

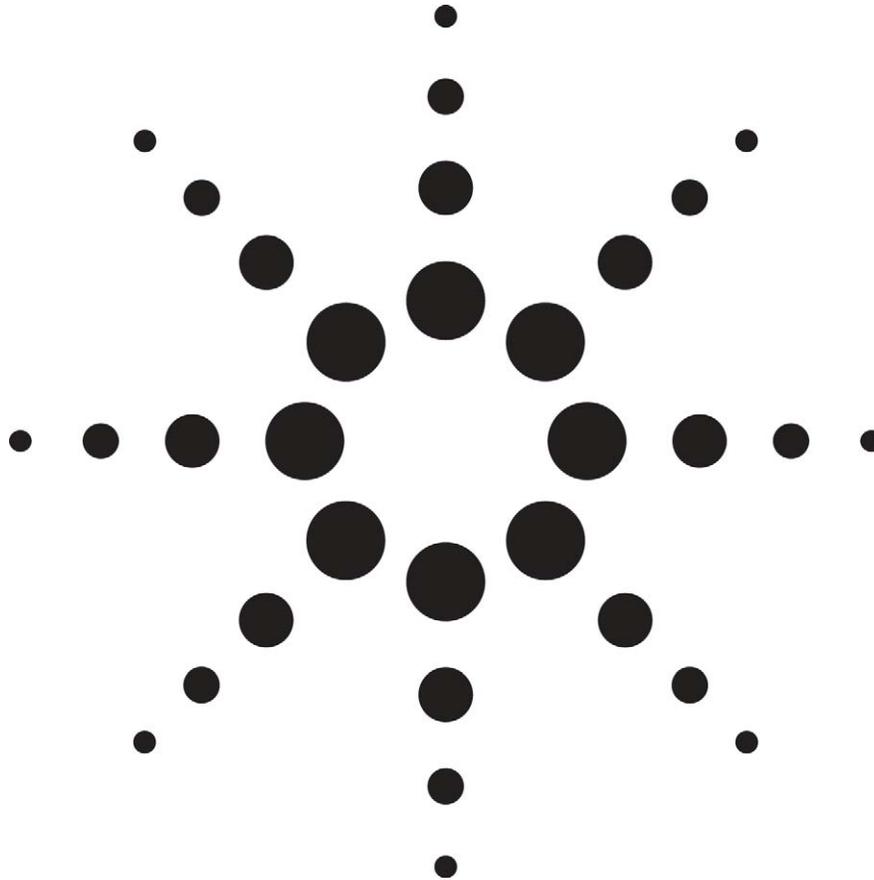


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Introduction

The advent of video capabilities in W-CDMA user equipment (UE) has presented new testing challenges to R&D engineers and video phone manufacturers. This paper discusses the use of Agilent Technologies' 8960 (E5515C) test set with the E6703C/D/E W-CDMA/HSPA Lab Application or the E1963A W-CDMA/HSPA Test Application with E1963A-401 End-to-End Video and E1963A-402 Video Loopback options to perform UE-to-UE video or video loopback testing. This test set up provides a controlled and repeatable test environment for accurate testing of new devices. In addition, the E6703E Lab Application supports UE-to-8960 LAN video call functionality, which will not be detailed in this paper (for details on UE-to-8960 LAN video call, see the Online User's Guide at: http://wireless.agilent.com/rfcomms/refdocs/wcdma/wcdma_gen_call_video_call.php#CIHCBCCD).

The Synchronous/Transparent CS Data Service¹ is used to make the following types of video calls:

- The **UE-to-UE video call** can be used to make a 3G-324M (derived from H.324M) video call between two UEs connected to two test sets. This configuration allows the 3G-324M layers in the two UE's to communicate as they would in a real network to provide a video call service.
- The **loopback video call** provides a way for a UE to establish an H.324M video call directly with one test set without requiring any external entities (as are required for UE-to-UE video call and UE-to-8960 LAN video call). The video and audio streams are simply looped back from the uplink to the downlink. That is, the UE will display the same data that its video camera is sending.

Overview of UE-to-UE Video Test Procedure

The synchronous/transparent circuit switched (CS) data service can be used to make an H.324M UE-to-UE video call. Before making a UE-to-UE video call, you must first establish an external device connection between two 8960s. The external device connection allows the two 8960s to coordinate the setup and release of the CS data service and exchange the traffic plane data being sent by the UEs. This configuration allows the H.324M layers in the two UEs to communicate as they would in a real network to provide a video call service.

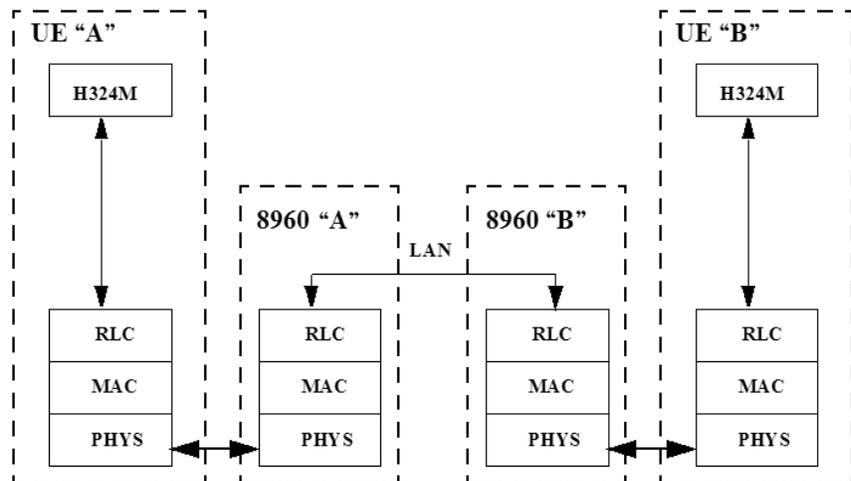


Figure 1. UE-to-UE video call protocol diagram

¹ See Appendix B for details on the CS data services.

Once you have established an external device connection between the two 8960s and have camped the UEs to the 8960s, you can originate a video call from one of the UEs, and answer the call on the other. The 8960 connected to the originating UE commands the other 8960 to set up a CS data synchronous/transparent call to its UE. Once the call has been connected (the UE has responded to the page and you've answered the call), the call setup is completed to the originating UE and H.324M traffic data begins to flow (see Figure 1). You can release the video call from either of the UEs (see *Appendix A: UE-initiated video call release*), or from either of the 8960s (see *Appendix A: Test set-initiated video call release*).

While on a UE-to-UE video call, you can perform many transmitter measurements on the UEs. You can also monitor the over-the-air messaging between the 8960s and the UEs using the Wireless Protocol Advisor's (WPA's) protocol logging functionality (when using the E6703 lab application). The WPA will not capture the proprietary messages sent between the 8960s, nor will it decode the H.324M application layer messages from the UE.

Hardware/Software Requirements

To perform UE-to-UE video call testing, the following hardware is required:

- Two 8960 test sets, each configured with the E6703X W-CDMA lab application (C.01 and above) or the E1963A W-CDMA/HSPA test application (A.06 and above) with E1963A-401 end-to-end video option
- LAN connection between the two 8960 test sets
- One PC with WPA if protocol logging is desired (when using E6703 LA)
- Two video phones (in this application note, the demo phones are fitted with Agilent USIMs)

Hardware Configuration

To perform UE-to-UE video testing, the basic hardware configuration is illustrated in Figure 2. If protocol logging is desired, hardware should be configured as noted in Figure 3.

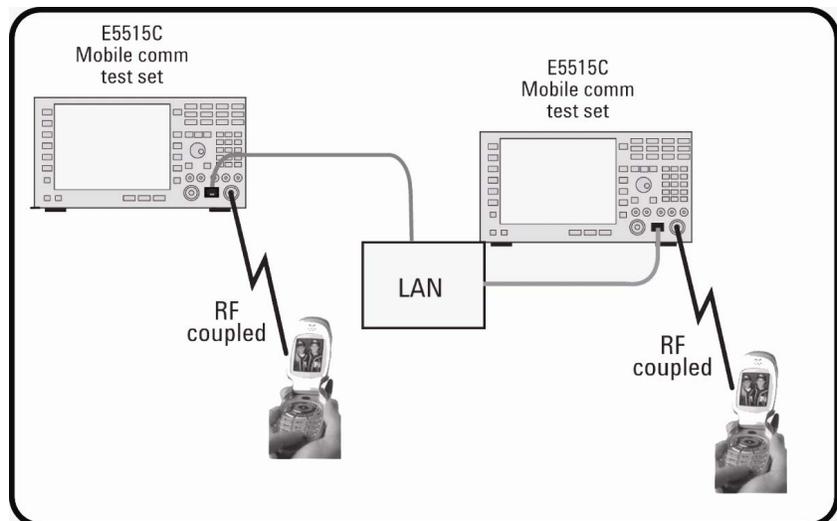


Figure 2. UE-to-UE video call hardware configuration

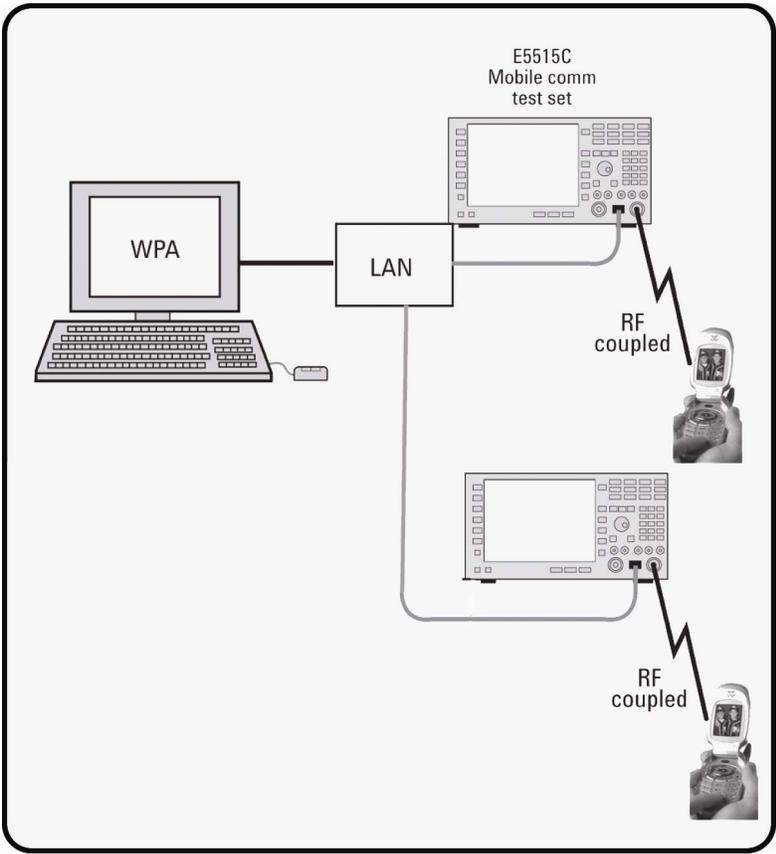


Figure 3. UE-to-UE video call hardware configuration for protocol logging

8960 configuration

As UE-to-UE video testing requires a connection between two 8960s, we must first set up the 8960s to connect to each other.

Configure 8960s' IP address

1. On one of the 8960 (#1), press the **System Config** key to access the System Config Screen
2. Press the **Instrument Setup (F1)**, and enter a proper IP address and subnet mask for the 8960 #1
3. Repeat the steps 1 and 2 on another 8960 (#2) to set a proper IP address and subnet mask for 8960 #2
4. Go back to the 8960 #1. On the System Config Screen, press the left **More** button
5. Press the **External Device Connection** (screen shown in Figure 4)
6. Press the **Ext 8960 IP Addr** button and enter the IP address of 8960 #2 you've set in step 3
7. Press **Connect to External 8960**
8. The external device connection field should read "Connected"

The external device connection is not affected by a partial preset. However, the external device connection is disconnected as a result of a full preset.

System Config Screen																									
Ext 8960 Ctrl		External Device Connection Setup						Utilities																	
Ext 8960 IP Addr		<table border="1"> <thead> <tr> <th colspan="4">LAN Connection Information</th> </tr> </thead> <tbody> <tr> <td colspan="4">External Device Conn Status: Not Connected</td> </tr> <tr> <td colspan="4">Connected Device IP Address:</td> </tr> <tr> <td colspan="4">LAN (Self) IP Address: 130.29.183.40</td> </tr> </tbody> </table>						LAN Connection Information				External Device Conn Status: Not Connected				Connected Device IP Address:				LAN (Self) IP Address: 130.29.183.40				Message Log	
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Return																									
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						Logging: No Conn.																			
		IntRef						1 of 2																	

Figure 4. Access System configuration screen to set testing parameters

Verifying test set connections

Before initiating an external device connection between two 8960s, you can verify that the two test sets are able to communicate by pinging one test set from the other. To do so, on 8960 #1:

1. Press the **Call Setup** key, then the left **More** key until "Ping" is available
2. Select **Ping**, then **Ping Setup** (F1)
3. Set **Device to Ping** to "Alternate"
4. Set **Alt Ping addr** to the IP address of 8960 #2
5. Select **Start Ping** (F3)

System Config Screen	
Ext 8960 Ctrl	External Device Connection Setup
Ext 8960 IP Addr	
130.29.183.128	
	LAN Connection Information
	External Device Conn Status: Connected
	Connected Device IP Address: 130.29.183.128
	LAN (Self) IP Address: 130.29.183.40

Figure 5. 8960 #1 external device connection setup screen

Note that, as Figure 5 illustrates, the Connected Device IP Address on 8960 #2 is the LAN IP Address of 8960 #1, but is not necessarily equal to the Ext 8960 IP Addr setting of 8960 #2, as 8960 #2 did not initiate the connection (see Figure 6).

System Config Screen	
Ext 8960 Ctrl	External Device Connection Setup
Ext 8960 IP Addr	
130.29.183.40	
	LAN Connection Information
	External Device Conn Status: Connected
	Connected Device IP Address: 130.29.183.40
	LAN (Self) IP Address: 130.29.183.128

Figure 6. 8960 #2 external device connection setup screen

UE configuration

There is really nothing special about the set up of the UE. For the most part it is just like making a voice call.

1. Turn the video camera on the UE to face you
2. Connect the UE to the antenna coupler and power up the UE
3. Check the Active Cell status on the test set is showing idle. If the UE automatically establishes a PDP context (the connection status displays PDP Active), then press **End Call** (F3 on Call Control 1 of 5 screen)

UE-to-UE Video Test Procedure

1. Set up the test set and UE equipment as described in the previous sections.
2. On the logging PCs start up WPA and connect one to each 8960. This will be used to browse through the protocol to get a better understanding of the interactions between the UE and the network. (Appendix A: Video call origination gives a detailed ladder diagram for comparison.)
3. From one of the UEs, type in any number (e.g. 12345) and hit the video call origination button



4. The call should proceed and the UE connected to the 8960 should ring. Once a video call is established, the Current Service Type becomes CS Data – 64k Video Call.
5. Answer the other UE.
6. Play with the feature. When the video call is active, there is a split screen on the phone. The top large screen is the video being received from the other phone, and the small section is the video being transmitted from your own phone.

Other considerations

If one of the 8960s is partially preset while up on a video call, the call to its UE is dropped with no over-the-air signaling. If the other UE does not recognize that the call has dropped (and thus ends the call), you should manually end the call or partially preset its 8960 as well.

If one of the 8960s is fully preset while up on a video call, the external device connection is disconnected. This causes both 8960s to end the call with their respective UEs.

Overview of Video Loopback Test Procedure

The **loopback video** call provides a way for a UE to establish an H.324M video call directly with the test set without requiring any external entities (as are required for UE-to-UE video calls). For this type of video call, the video and audio streams are simply looped back from the uplink to the downlink. That is, the UE will display the same data that its video camera is sending. The test set mimics a true H.325M peer to UE since it has the control plane layer (H.245) and the multiplexing layer (H.223) fully implemented. Since the test set is looping back data sent from the UE rather than generating data, it relies on the UE to initiate the H.324 procedures and simply agrees to any requests from the UE.

Hardware/Software Requirements

To perform loopback video call testing, the following hardware is required:

- One 8960 test set, configured with the E6703E W-CDMA/HSPA lab application (E.01 and above) or the E1963A W-CDMA/HSPA test application (A.06 and above) with option E1963A-402 video loopback
- LAN connectivity if protocol logging is desired (when using the E6703E LA)
- One PC with WPA if protocol logging is desired (when using the E6703E LA)
- One video phone (in the application note, the demo phone fitted with Agilent USIM)

Hardware Configuration

To perform video loopback testing, the basic hardware configuration is illustrated in Figure 7. If protocol logging is desired, the hardware should be configured as noted in Figure 8

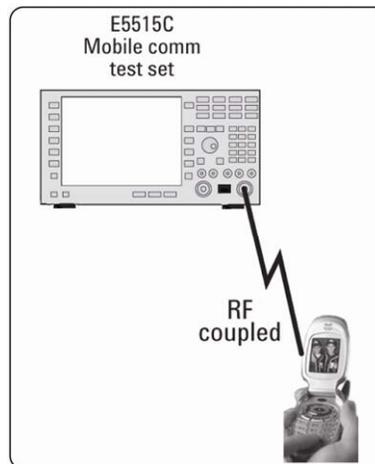


Figure 7. Loopback video call hardware configuration

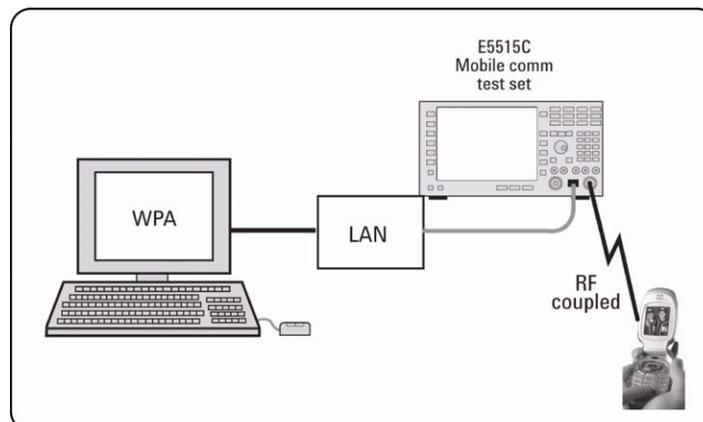


Figure 8. Loopback video call hardware configuration for protocol logging

Video Loopback Test Procedure

1. Connect the UE (video phone) to the test set.
2. Test set configuration:
 - Power up the test set
 - Set the **Cell Power (F7)** on Call Control) to a proper value (such as -65 dBm)
 - Go to Call Control **5 of 5** screen by pressing the left **More** button. Press the Video **Call Info (F1)** and set the **Video Call Type (F1)** to **Loopback**.
3. UE configuration
 - Insert the Test SIM into the demo phone (if not using Test SIM, you must set the security key on the test set to match your phone.)
 - Turn on the UE and check the UE shows 00101 on its screen as the connected cell
 - Check the Active Cell status on the test set is showing idle. If the UE automatically establishes a PDP context (the connection status displays PDP Active), then press **End Call (F3)** on Call Control **1 of 5** screen).
4. (Available for E6703E LA) If protocol logging is desired, start up WPA on the logging PC. This will be used to browse through the protocol to get a better understanding of the interactions between the UE and the network.
5. Originate a video call from the UE (the loopback video call can not be initiated from the test set). For example, type in a number (e.g. 12345), select "options" to show the choices of voice call or video call. Select video call and initiate the call connection. Note: originating a video call might be different for different type of phones (for example, some phones have a "video call connection" button to allow you directly make a video call.).
6. Once a video call is established, observe the phone screen. There is a split screen on the phone. The top large screen is the video being looped back from the test set, and the small section is the video being transmitted from the phone
7. View the Loopback Video Call Counters screen on the test set (as shown in figure 9) to see the video and audio data transmitted from the phone and looped back to the phone by the test set.

Call Setup Screen																																																																																																						
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Figure 9. Loopback video call counters screen

Appendix A

The following ladder diagrams are provided to help illustrate the communication process in UE-to-UE video testing.

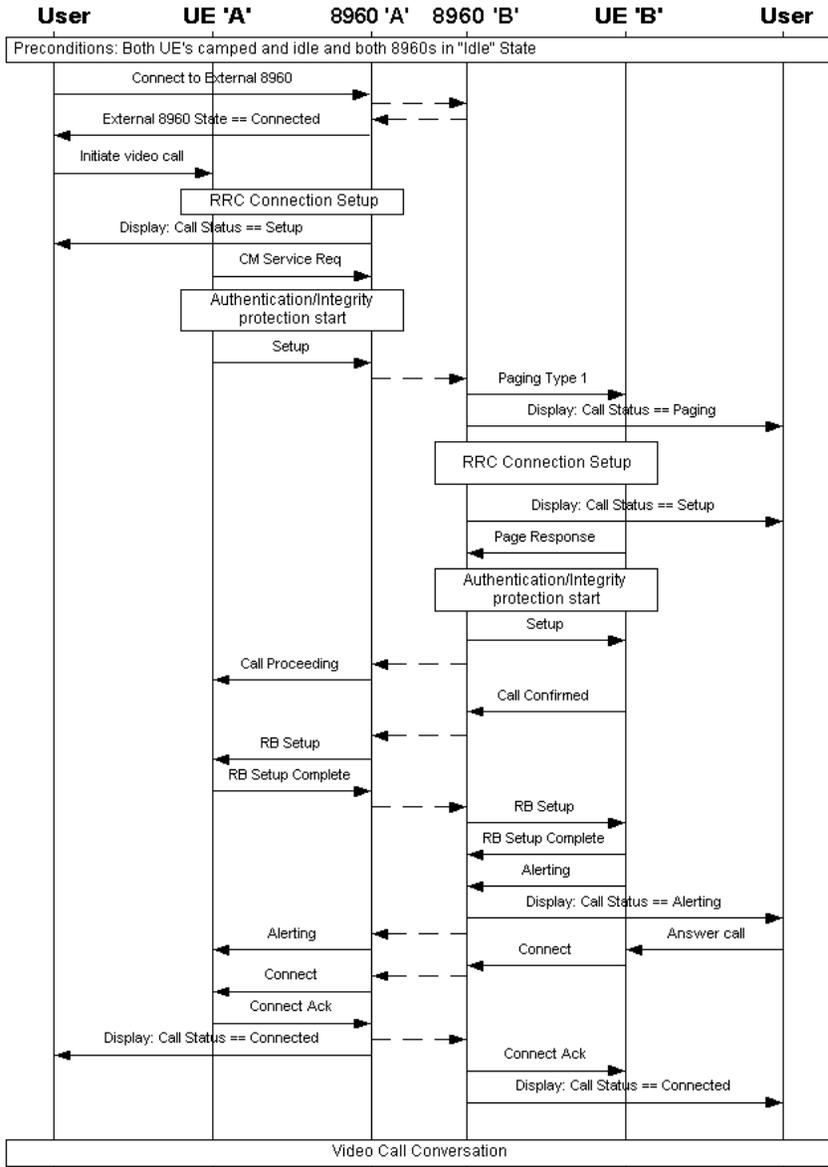


Figure A.1. Video call origination

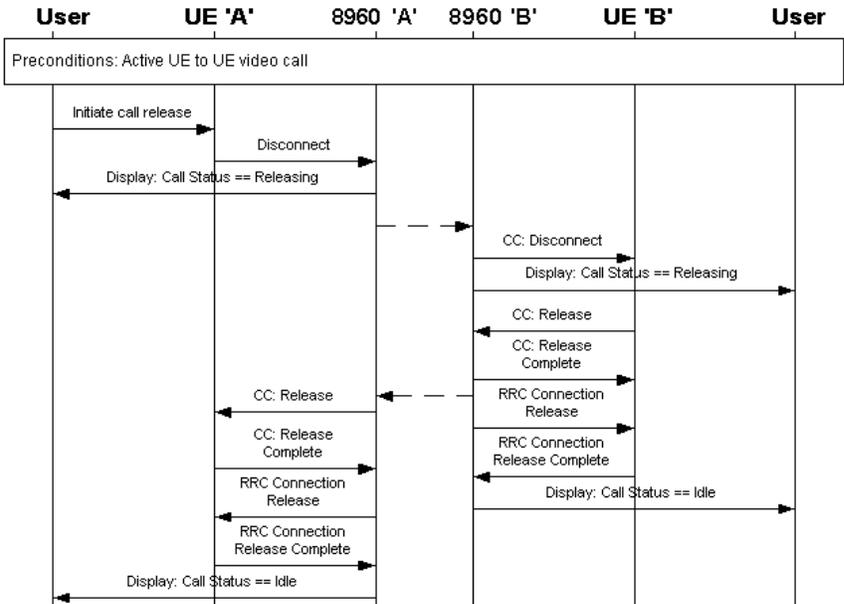


Figure A.2. UE-initiated video call release

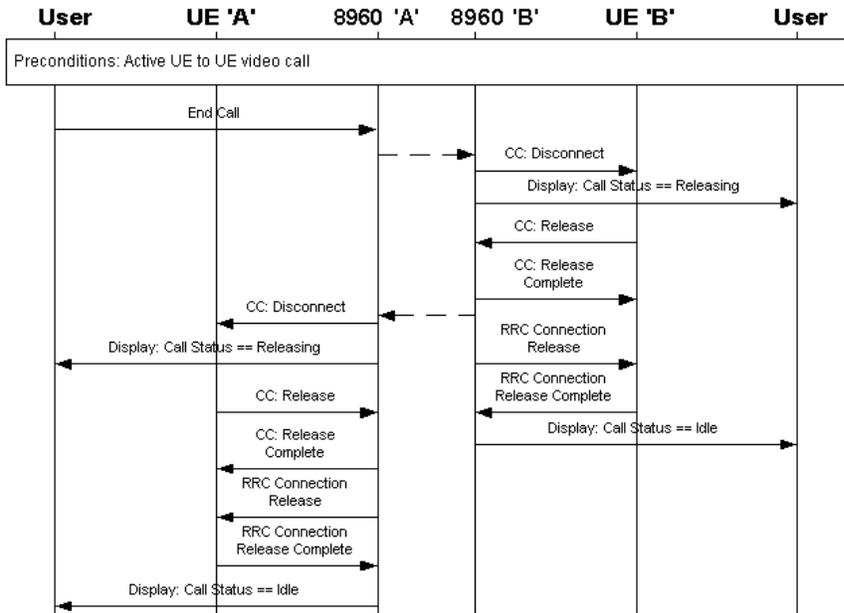


Figure A.3. Test set-initiated video call release

Appendix B

Circuit switched (CS) data service

The test set supports two types of CS data service:

- Asynchronous/non-transparent CS data service
- Synchronous/transparent CS data service

The synchronous/transparent service is used by H.324M multi-media applications (for example, video phones), whereas the asynchronous/non-transparent service is used by more bursty data, such as IP traffic. The primary difference between the two services is that they use different radio bearer configurations, and the asynchronous/non-transparent configuration includes the RLP layer above the RLC entities (the RLC entities connect directly to the application in the synchronous/transparent configuration).

Synchronous/transparent CS data service

The synchronous/transparent CS data service allows you to make an H.324M video call.

One radio bearer is supported: 64k UL/DL CS Data RAB (see 3GPP TS 34.108, 6.10.2.4.1.13). You may specify the downlink DPCH channel code for this RAB using the **DPCH 120 ks/s (OVSF 32) Channelization Code** setting.

Asynchronous/non-transparent CD data service

The test set only supports UE-originated asynchronous/non-transparent CS data service, but both test set and UE-initiated release from the CS data service are supported.

Two radio bearers are supported:

- 57.6k UL/57.6k DL CS Data RAB (see 3GPP TS 34.108, 6.10.2.4.1.17)
- 14.4k UL/14.4k DL CS Data RAB (see 3GPP TS 34.108, 6.10.2.4.1.15)

You may specify the downlink DPCH channel codes for these two radio access bearers (RABs) using the **DPCH 120 ks/s (OVSF 32) Channelization Code and DPCH 30 ks/s (OVSF 128) Channelization Code** keys.

Async CS Data Source

You may choose what application protocol uses the CS data service using the **Async CS Data Source** setting. (To access this setting, use the left **More** button to reach the third menu screen. Select the **Data Channels** button, followed by the **CS Data Setup**.) This setting can only be changed when the call status is "Idle." This setting allows you to specify the access point to the traffic plane data stream as follows:

- **Serial port** – connects the top of the L2R/RLP layer directly to the rear panel of serial 3 port of the test set. When **Async CS Data Source** is set to "Serial Port," debug access to the serial port is shut off, and the serial port is configured for "CS data operation" (data rate of 115,000 b/s, 8 bits, no parity, 1 stop bit). Software flow control (i.e. XON/XOFF characters) is used across the serial port to control the data flow. The L2R/RLP entity obeys the flow control commands from the UE and will similarly command the UE to stop sending data if its internal buffers begin to fill up.
- **IP** – connects the top of the L2R/RLP layer to a PPP/IP layer that is fed to the test set's LAN PORT. As Figure 7 illustrates, the PPP layer operates in asynchronous framing mode.

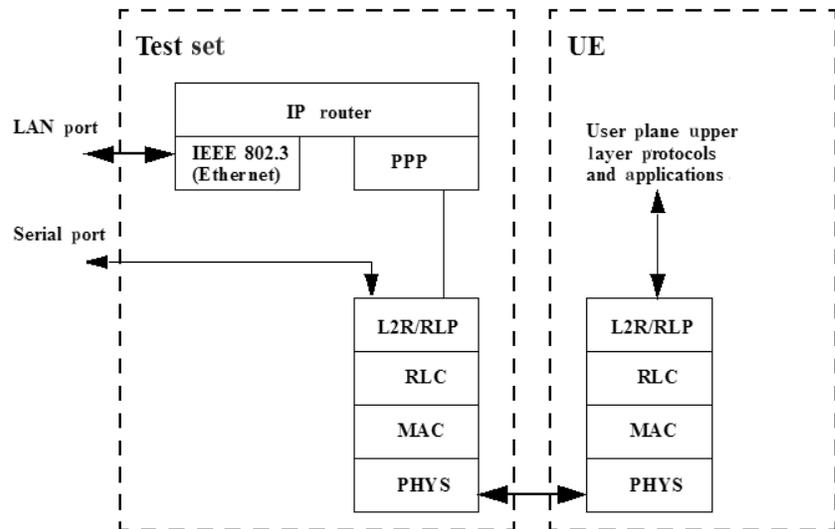


Figure B.1. CS data asynchronous bearer user plane protocol configuration.



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