

# Agilent PXT Wireless Communications Test Set (E6621A)

## Guide to Data Throughput Measurements



### Application Note



**Agilent Technologies**

# 1. Introduction

The purpose of this guide is to provide you with the basic steps to making data throughput measurements with your E6621A PXT.

Your test set will help you meet your stringent time-to-market schedules and design quality goals. From protocol development through RF conformance and interoperability testing, the PXT is a powerful, scalable user equipment (UE) test platform. The advanced capabilities of the PXT include real-time, system-rate network and base station emulation. The test set also provides bench-top network emulation for quick and easy UE application and performance testing. Downlink MIMO, RF measurements and end-to-end IP data connections are just a few of the many features that will make your UE development process more efficient and successful.



Figure 1. Agilent E6621A PXT Wireless Communications Test Set

## General capabilities of the Agilent E6621A PXT

- Real-time 3GPP LTE downlink (DL) signal modulation
- Real-time 3GPP LTE uplink (UL) demodulation
- eNodeB simulation with L1, L2 and L3 protocol stack
- Settable eNodeB, UE, and network operation parameters
- Settable frequency, power and modulation schemes
- MIMO testing capabilities
- 3GPP LTE UE testing with call-setup and loop-back mode using data transfer and PER measurement
- Spectrum measurements with adjustable frequency, span, channel bandwidth, and resolution bandwidth
- Power versus time
- 3GPP LTE RF and modulation measurements
- Sub-carrier power flatness
- 3GPP LTE UE L1, L2 and L3 layer verification and performance tests, including power control and measurements, handovers, and abnormal test cases.

## *Additional Applications*

The following PC application software is available to enhance the capabilities of the Agilent PXT.

### **Agilent N6061A Protocol Logging and Analysis Tool**

This application software is developed for use on systems running the Microsoft (MS) Windows XP or Windows 7 operating system. It displays and stores protocol and event logs of Agilent E6621A PXT. The stored log files can be replayed and analyzed using this software and other advanced post-processing tools. Please consult the “Agilent LTE Protocol Logging and Analysis User’s Guide” for more information.

### **Agilent N6062A Protocol Message Editor Tool**

This application software is developed for use on systems running the MS Windows XP or Windows 7 operating system. N6062A provides the ability to define RRC/NAS messages and event-driven scenarios which can be utilized during the Base Station Emulator (BSE) operating mode of the Agilent E6621A PXT. Please consult the “Agilent LTE Message Editor User’s Guide” for more information.

### **Agilent N6070A Series Signaling Conformance Test System**

The N6070A series signaling conformance test system verifies the protocol characteristics of LTE UEs. It provides a standards-based and flexible development environment for the LTE protocol stack development, regression test, pre-conformance and conformance. The system uses the Agilent E6621A PXT with TTCNv3 test scripts released from ETSI. Please consult the “Agilent N6070 Series Signaling Conformance Test User’s Guide” for more information.

### **Anti-Virus Protection and Firewalls**

The PXT is shipped with the Windows XP firewall enabled. No anti-virus software is shipped with the instrument. It is recommended that you **do not** install anti-virus protection.

**WARNING:** Take care to verify that USB memory devices used with the Agilent E6621A PXT are virus-free before use with the instrument.

### **Software Licensing**

The following third-party software is used in the examples in this Note. Other software with similar functionality may be available. The use of these particular software tools does not constitute an endorsement by Agilent Technologies. Software licensing, where required, is the responsibility of the user.

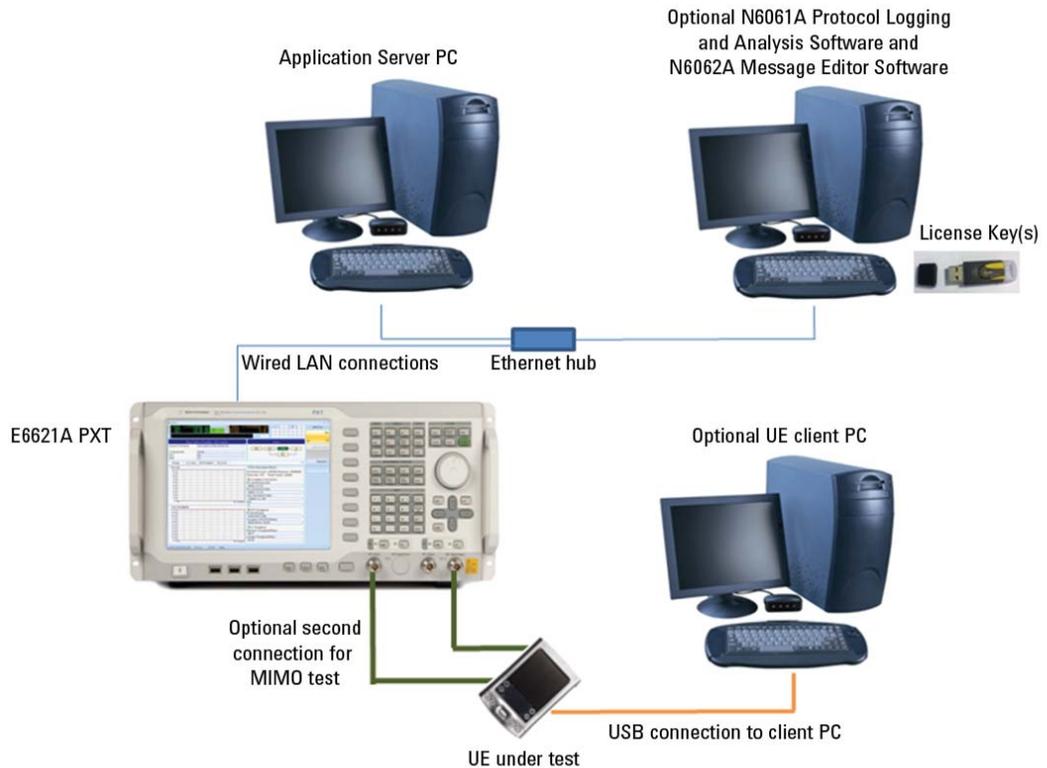
Brekeke SIP Server  
CounterPath X-lite  
FileZilla  
Iperf  
VideoLAN VLC

## 2. Setting Up the Equipment

To ensure you have the required options and licenses to begin using Agilent E6621A PXT, see the PXT Getting Started Guide, and for more detailed user information, see the PXT Users Guide. The latest versions are available at [www.agilent.com/find/pxt](http://www.agilent.com/find/pxt)

### Equipment list

- E6621A PXT with appropriate options and current software technical support contract
- Application Server PC for data throughput testing applications
- Optional PC for N6061A Protocol Logging and Analysis and N6062A Message Editor software applications
- Optional UE client PC, depending on test requirements
- USB License keys for software applications
- Ethernet cables and hub as required
- Cables to attach device under test



## Setting network addresses

To set the Network setting of the PXT, press the front panel Config button, and select Network Setup. The default is set as shown below. If change is needed, set each address and press OK to complete the change

- IP address to 192.168.1.60
- Subnet Mask 255.255.255.0
- Gateway 192.168.1.230

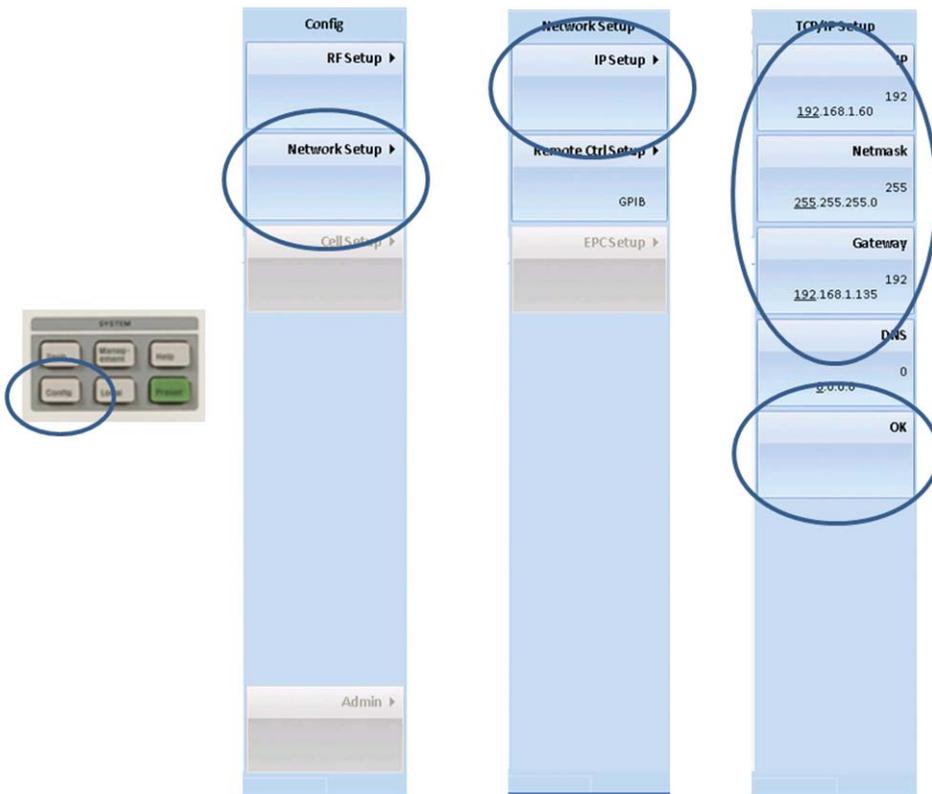


Figure 3. PXT Network Setting

	App Server PC	PXT	Logging and analysis PC
IP	192.168.1.230	192.168.1.60	192.168.1.135
Subnet Mask	255.255.255.0	255.255.255.0	255.255.255.0
Gateway	192.168.1.60	192.168.1.230	192.168.1.60

Table 1. The recommended network settings for the computers are shown above.

**NOTES:**

1. Connecting the instrument to a LAN with internet connectivity is not recommended.
2. The instrument and connected PCs operate using fixed IP addresses.
3. If the UE requires a client PC, it will normally be connected via USB. The UE's IP address is assigned (DHCP) by the PXT, and is set in the Scenario File. The default address used in this Note is 192.168.1.51. For detailed instructions on setting and changing the client IP address, see the latest version of the Message Editor User's Guide at [www.agilent.com/find/pxt](http://www.agilent.com/find/pxt). See the UE documentation for connection details and operating information. The client PC should not be connected to the same LAN as the other equipment except through the UE.
4. On both the Application Server PC and the UE client PC, turn off Windows Firewall to ensure communications between them are not blocked. Select "Control Panel", "Administrative Tools", "Services" and scroll to the Windows Firewall entry. Right click, select "Properties", set the Startup Type to "Disabled" and stop the service.

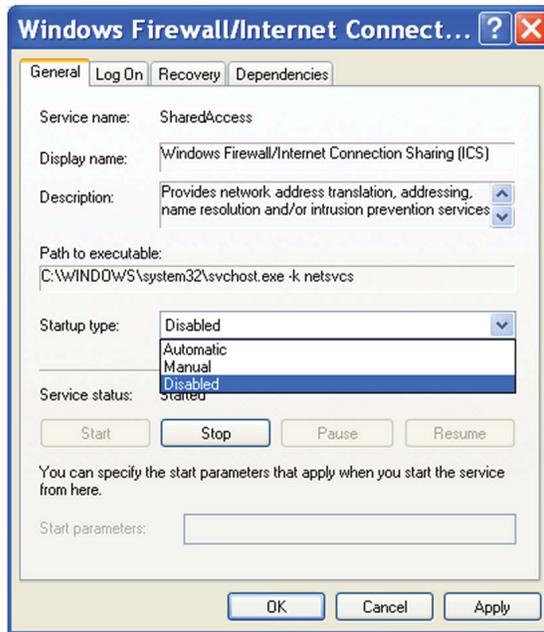


Figure 4. Disable Windows Firewall Service

5. The N6061A Protocol Logging and Analysis software and N6062A Message Editor software may be installed on the same PC. It is recommended that no other applications are running on this PC to ensure real-time logging is not compromised.

### 3. Connecting the UE

The UE under test is normally connected to the PXT via the RF I/O interfaces. The UE can also be connected using baseband I/O interface at the rear panel with BNC cables. The connection configuration will depend on the required test setup.

#### **Single Input Single Output (SISO)**

Connect the UE antenna directly to the RF1 Input / Output connector. If the UE has receive diversity antennas, connect both to RF1 Input / Output via a power combiner.

#### **Downlink Transmit Diversity and Multiple Input Single Output (MISO)**

Connect RF1 Input / Output and RF2 Output to the UE via a power combiner.

#### **Downlink Multiple Input Multiple Output (MIMO)**

Connect RF1 Input / Output to the UE primary receive antenna. Connect RF 2 Output to the UE secondary receive antenna.

## 4. Setting Up a Data Connection

Follow these steps on the PXT to set up a connection to the UE.

1. Press **PRESET, Preset** to return the instrument to its power-on state.
2. Press **FREQ** and set the uplink and downlink frequencies to match your device.
3. Press **BSE, MODE SETUP, MORE 2/2, Phy Setup**, and set the **CFI** to 1.
4. Press **CONFIG, Network Setup, IP Setup** and check that the IP address, subnet mask and gateway are correctly set as detailed in Section 3. Press **OK** to confirm any changes.
5. Press **BSE, MODE SETUP** and set **EPC** (Evolved Packet Core) to Embed. Ensure the EPC block in the upper right of the main display is illuminated.
6. Load the Scenario File that matches the attributes of your device. Press **BSE, MODE SETUP, Call Scenario**, choose the file you need from the list and press **Load**. For details of creating and modifying scenario files and downloading them to the PXT, see the *Agilent N6062A Message Editor User's Guide*. The latest version is available for download from [www.agilent.com/find/pxt](http://www.agilent.com/find/pxt). When the file is loaded, the filename will appear in the "Base Station Emulator Information" section of the display.
7. Press **BSE, MODE** and set the **Emulator Mode** to Run.
8. On the UE, or UE client control interface PC, initiate the connection. On the PXT screen, you can see the protocol message exchange between the BSE and UE as the connection is authenticated and established, and the CON icon in the BSE status block illuminates when the connection is complete.
9. Check that the EPC indicator in the status panel is on (solid yellow background).
10. On the UE Client PC, open a command window and enter "ipconfig" to check the assigned IP address. The default used in this note is 192.168.1.51.

```
C:\WINDOWS\system32\cmd.exe
C:\Documents and Settings\ian.johns>ipconfig

Windows IP Configuration

Ethernet adapter Wireless Network Connection:

    Media State . . . . . : Media disconnected

Ethernet adapter Local Area Connection:

    Connection-specific DNS Suffix  . : 
    IP Address. . . . . : 192.168.1.51
    Subnet Mask . . . . . : 255.255.255.0
    IP Address. . . . . : fe80::21f:29ff:fe79:777e5
    Default Gateway . . . . . : 

Ethernet adapter Network Connect Adapter:

    Media State . . . . . : Media disconnected

Tunnel adapter Teredo Tunneling Pseudo-Interface:

    Connection-specific DNS Suffix  . :
```

Figure 5. Check the UE IP address

11. To check that a data connection exists from the UE client to the application server, enter "ping 192.168.1.230" and check the responses from the Application Server PC
12. Repeat step 11 in the reverse direction. On the Application Server, open a command window, enter "ping 192.168.1.51" and check the responses from the UE.

```
C:\WINDOWS\system32\cmd.exe
C:\Documents and Settings\ian.johns>ping 192.168.1.230

Pinging 192.168.1.230 with 32 bytes of data:

Reply from 192.168.1.230: bytes=32 time=1ms TTL=128
Reply from 192.168.1.230: bytes=32 time=4ms TTL=128
Reply from 192.168.1.230: bytes=32 time=1ms TTL=128

Ping statistics for 192.168.1.230:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 4ms, Average = 1ms
```

Figure 6. Ping result

## 5. Data Throughput Tests

### Downlink and uplink throughput tests

Before running these tests, locate, download and install the freeware server application “Iperf” on both the application server and UE client PCs.

#### Downlink throughput test

1. On the PXT, set the **BSE, MODE SETUP, MORE 2/2, Phy Settings, DL Resource Allocation** configuration to Resource Allocation Mode Auto, and set the **I\_MCS and RB Size** to match your application test requirements.

**NOTE:** When the scenario file specifies MIMO (tm3), set the resource allocation using the **Type0 Bitmap** characteristics instead of RB Size. See 3GPP standard 36.213 section 7.1 and 36.306 section 4 for resource allocation details.

2. On the UE Client PC, launch the Windows Command Prompt. Go to the directory where the IPERF program is installed, and then type the appropriate command for the data rate you want to test. For example: **iperf -s -i1 -u -l10000 -w20m** sets up reception of 100Mbps.
3. On the Application Server PC, launch the Windows Command Prompt. Go to the directory where the IPERF program is installed, and then type the appropriate command for the data rate you want to test. For example, **iperf -c {host IP address} -u -i1 -l2900 -t600 -b102m -w20m** for 102Mbps. The “host IP address” required is that of the client UE, set in the Scenario File you loaded in section 4. Check the data rate shown in the command window..
4. You can use different combinations of scenario file and iperf command string to test other data rates that your device can support. Refer to 3GPP specifications 36.213 Tables 7.1.7.1-1 and 7.1.7.2.1-1 and 36.306 Table 4.1-1 for details of appropriate settings.

**NOTE:** If the NACK rate is too high, the iperf server may stop. If this happens, check that the client is capable of receiving the specified rate and that the connection is working reliably.

#### **IPERF command explanations** (type <iperf - h> for a complete list):

- c sets the client mode, requires host IP address
- s sets the server mode
- u sets the mode to UDP
- i sets the reporting interval in seconds
- l sets the packet size in bytes
- t sets the time in seconds
- b sets the data rate in Mbps
- w sets the window size in MHz

### Uplink throughput test

5. On the PXT, set the **BSE, MODE SETUP, MORE 2/2, Phy Settings, UL Resource Allocation** configuration to Resource Allocation Mode Fixed MAC Padding, and set the **I\_MCS** and **RB Size** to match your application test requirements.
6. On the Application Server PC, launch the Windows Command Prompt. Go to the directory where the IPERF program is installed, and then type the following command: **iperf -s -i1 -u -w20m**
7. On the UE Client PC, launch the Windows Command Prompt. Go to the directory where the IPERF program is installed, and then type the following command: **iperf -c {host IP address} -u -i1 -l2900 -t600 -b20m -w20m**, where the "host IP address" required is that of the application server PC (192.168.1.230).

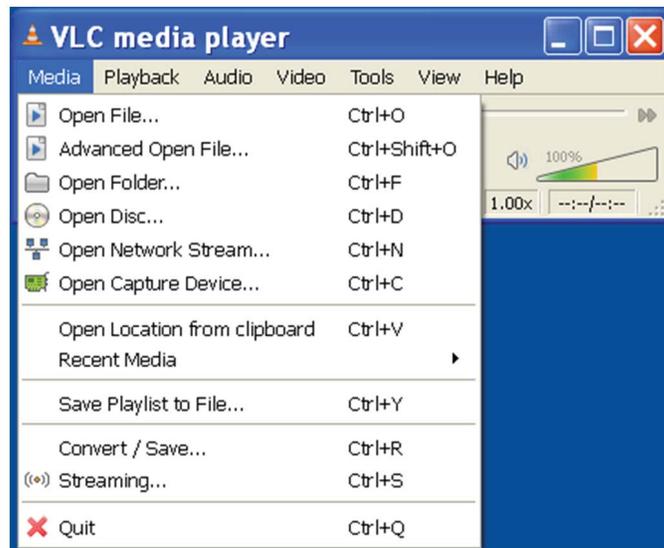
**NOTE:** In uplink mode, the PXT has an upper data throughput limit of 20Mbps.

### Video streaming test

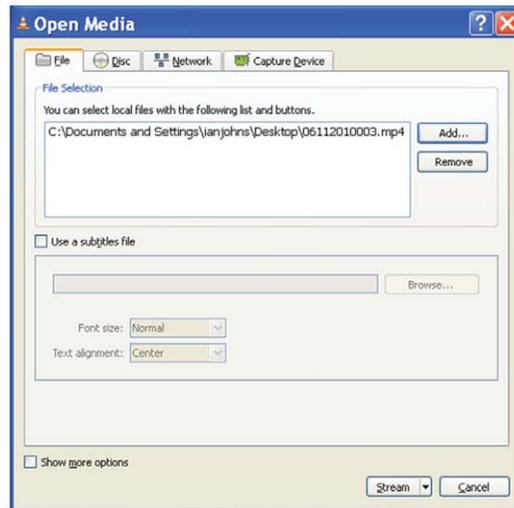
Before running this test, locate, download and install the freeware media server application "VLC" by VideoLAN on both the application server and client PCs.

#### On the Application Server PC:

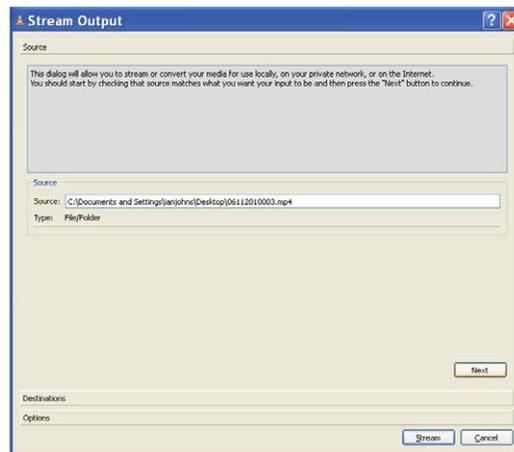
1. Run the VLC application.



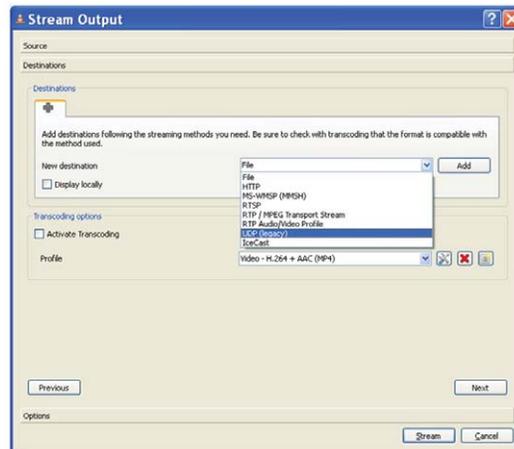
2. In the main menu, select “Streaming” from the **Media** tab.
3. On the **File** tab, click the Add button to add a local video file to be streamed.



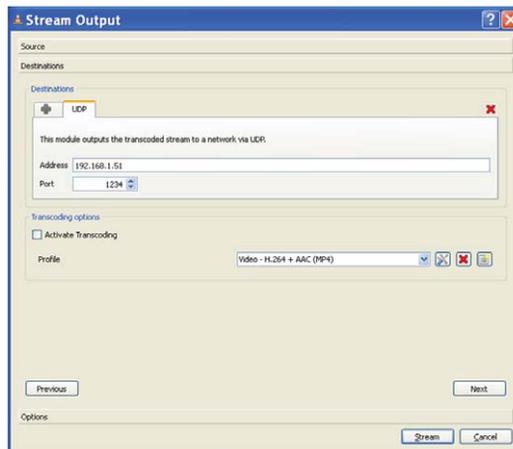
4. Click the **Stream** button and the following dialog box will be displayed.



5. Make sure the name and directory of the selected video file are correct. Click **Next** to proceed to next step.



- Open the “File” drop-down menu, select the “UDP” option and click **Add**.



- Enter the IP address allocated to the UE (192.168.1.51). Set the port number to 1234. Uncheck the “Active Transcoding” option.

- Click Stream to begin streaming the video.

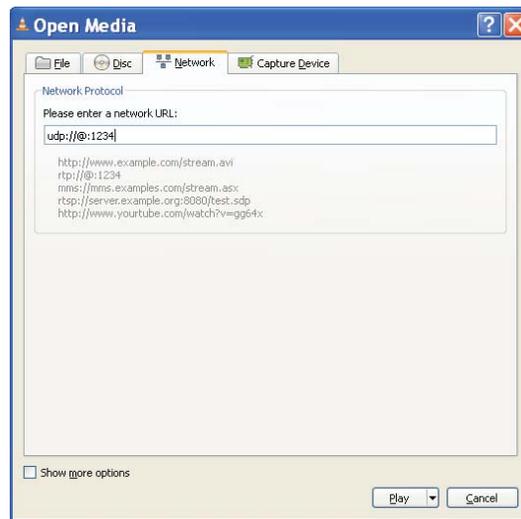
**NOTE:** To stream more than one video, repeat the above procedures and enter the next port setting (1235, 1236, and so forth).

#### On the UE Client PC:

- Run the VLC Media Player. From the top menu, select “Open Network Stream” from the **Media** tab.



10. Enter the following as the network URL: `udp://@:1234` followed by the port number (1234)



11. Click **Play** to play the video stream. While the video is streaming, you can adjust the channel capacity by changing the **PHY** settings on the PXT.

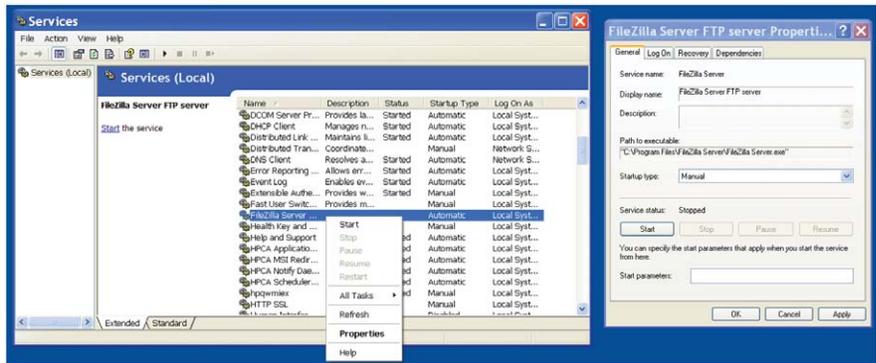
## FTP throughput test

Before running this test, locate, download and install the freeware ftp application “FileZilla” on both the application server and client PCs. Install the Filezilla server application on the Application Server PC and the Filezilla client application on the UE client PC.

### On the Application Server PC:

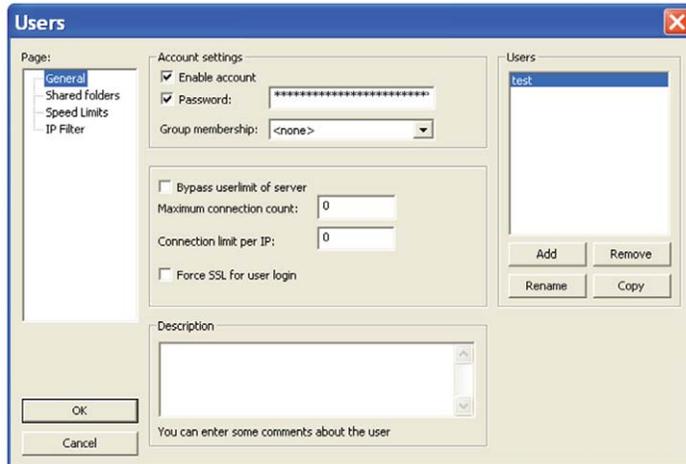
1. Start the FileZilla FTP Server Interface program.

**NOTE:** Filezilla Server runs as a service, and once installed, will remain running in the background. To manage the service, go to “Control Panel”, “Administrative Tools” and select “Services”. To prevent the service re-starting when Windows starts, right-click Filezilla Server, select “Properties” and change the “Startup Type” to “Manual”.

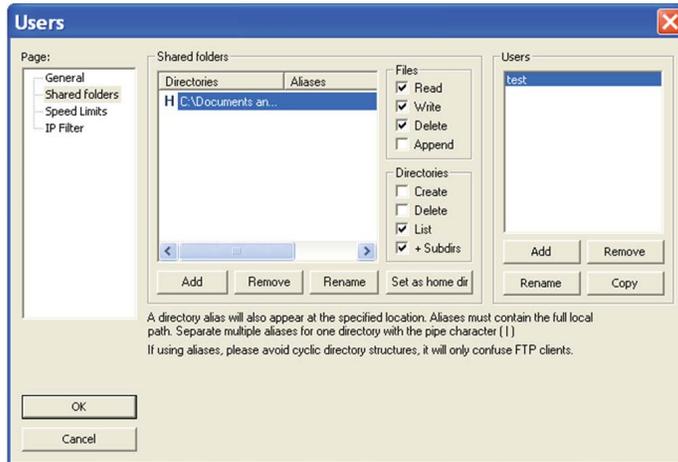


2. Create a new user account:

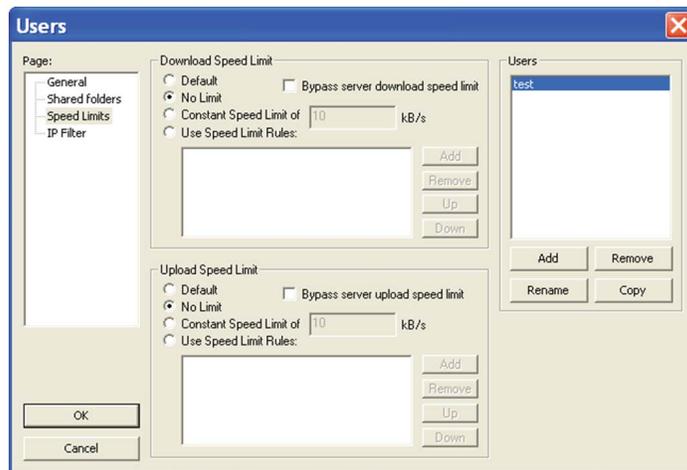
- a. From the top menu, select “Users” from the **Edit** tab.
- b. In the “General” section, click **Add** and create a new account with “test” as both the account name and password.



- In the “Shared Folders” section, click **Add** and select the folder where the test files are located. Check the “Read”, “Write”, “Delete” and “List” boxes to allow bi-directional movement of files between the server and client PCs.



- In the “Speed Limits” section, select the No Limit option for both Downlink and Uplink Speed Limit, then click **OK** to save the settings.

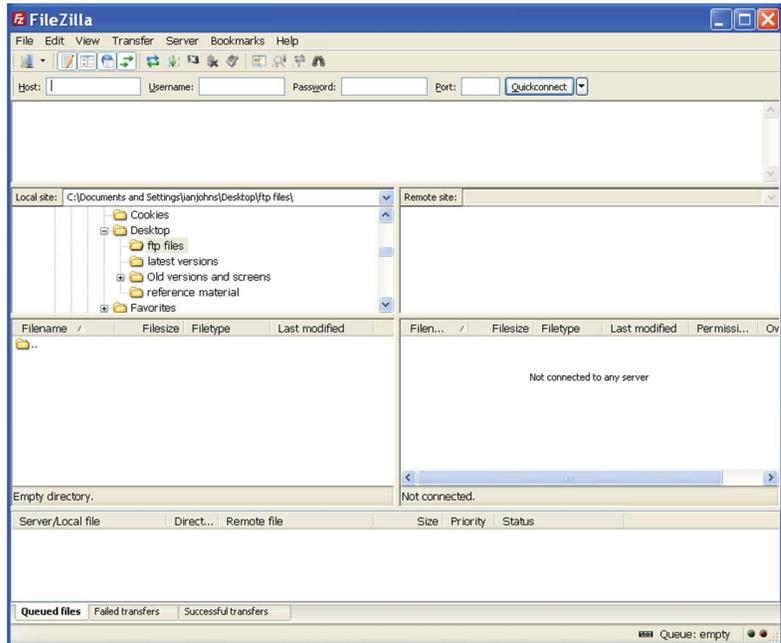


#### On the PXT:

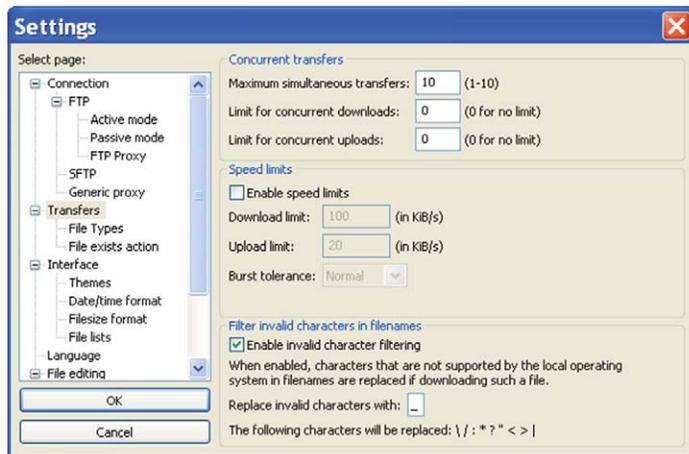
Set the **DL Resource Allocation** to Auto, and **I\_MCS** and **RB Size** to match the Scenario file (Inno 28/50), and **UL Resource Allocation** to Fixed MAC Padding and **I\_MCS** and **RB Size** to match your application test requirements.

## On the UE Client PC:

5. Start the FileZilla FTP client application.

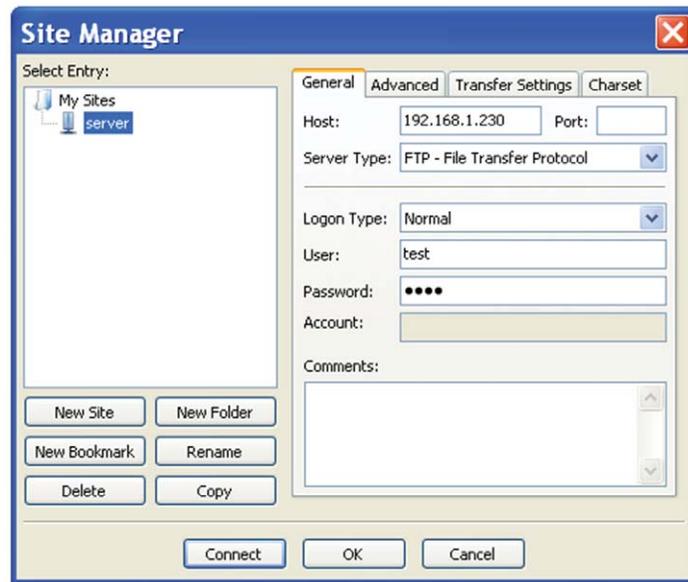


6. Select the Edit tab on the main menu, go to the "Transfers" section of the "Settings" tab and change the Maximum simultaneous transfers to 10.



7. Select the File tab on the top menu, and go to "Site Manager".
8. In the General tab, click "New Site" and the server name (server), the IP address of the Application Server PC (192.168.1.230), the logon type (normal) and the userID and password (both "test").

9. Click **Connect** to connect to the Application Server PC.

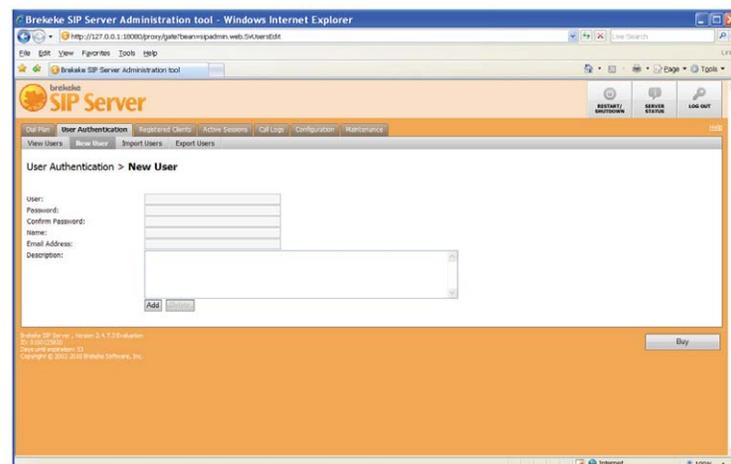
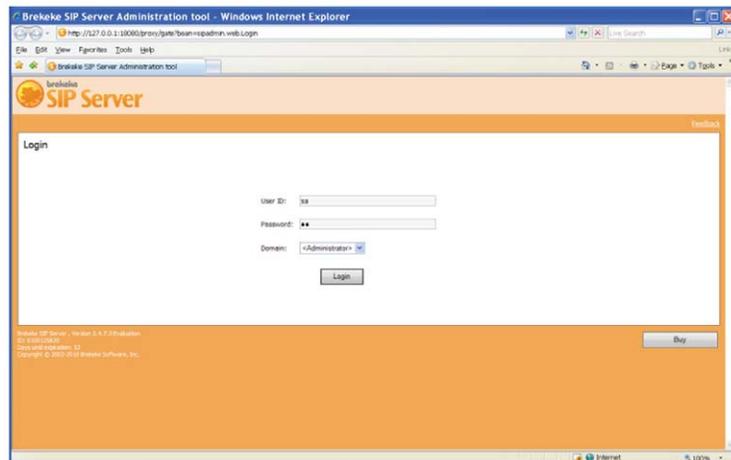


Once the connection is established, drag and drop files between the remote and local PCs and observe the transfer times. Change the PXT modulation type and resource block allocations to modify the available transmission bandwidth and observe the effects.

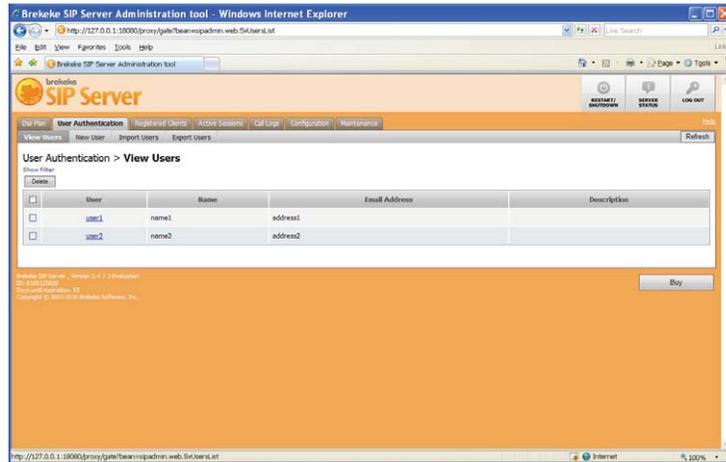
## VoIP test

Before running this test, locate, download and install the Brekeke SIP server application and the freeware X-lite VoIP client on the application server PC, and the X-lite VoIP client on the UE Client PC. Note that you must arrange the purchase of a product ID for the SIP server application to continue to use the product after an initial evaluation period.

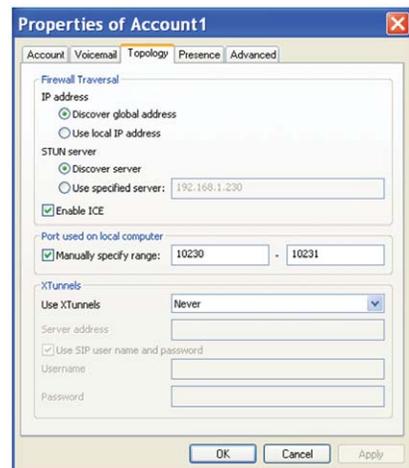
1. On the PXT, set the **BSE, MODE SETUP, MORE 2/2, Phy Settings, UL Resource Allocation** configuration to **Resource Allocation Mode Fixed MAC Padding**, and set the **I\_MCS** and **RB Size** to match your application test requirements.
2. Run "Brekeke SIP Server Admintool" and enter your product ID and then click [I agree] button. If you do not have a product ID, click [Need a Product ID] to get an evaluation version product ID. Type "sa" for both the username and password to login to the SIP Server.



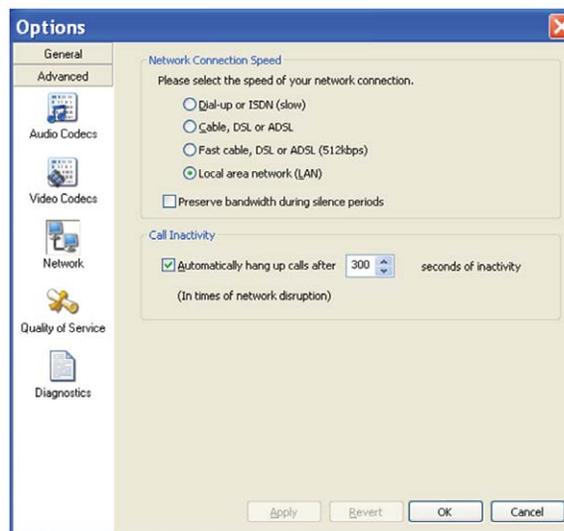
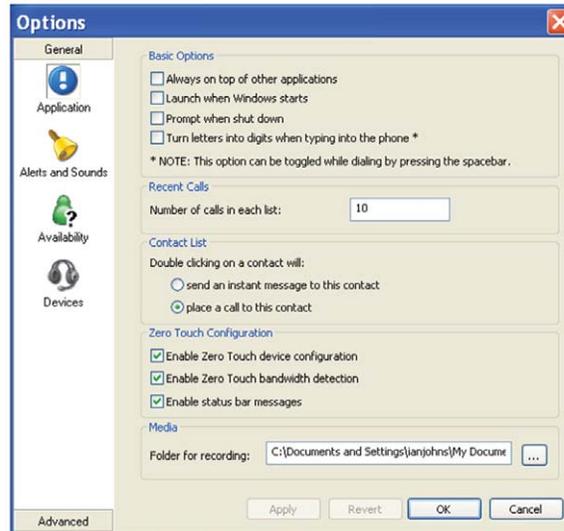
- From the top menu, select the User Authentication tab, then select New User, and then create two new user accounts, for example, “user1” with display name “user1” and address “address1”, and “user2” with display name “user2” and address “address2”. Select View Users and check that the two user accounts are displayed.



- Run the X-Lite application in the Application Server PC. From the top menu, select “SIP Account Settings”, and enter the “user1” details from the SIP server setup and the server PC IP address (192.168.1.230) for the Domain as shown in the following figure. Select “Properties”, choose the “Topology” tab, check the box “Manually specify range” and set the port numbers that X-lite can use to 10230 and 10231 as shown.



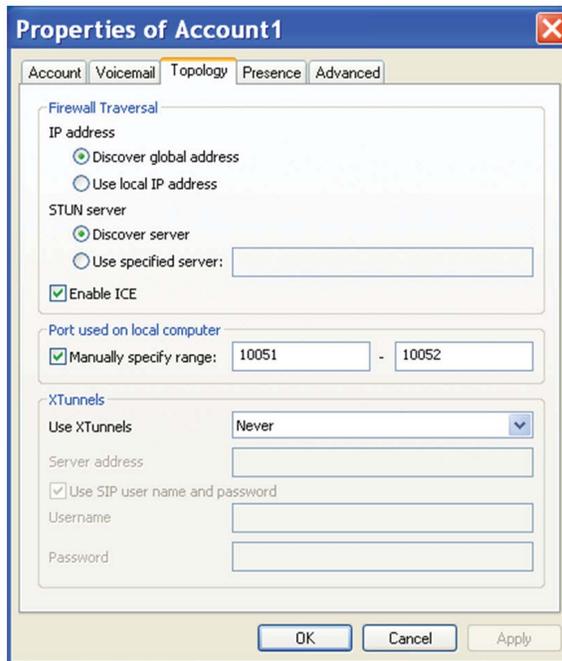
5. From the top menu, select "Options", click on Advanced, select "Network", set the connection speed to LAN and click "Apply".



- Run the X-Lite application in the UE Client PC. From the top menu, select “SIP Account Settings”, and enter the “user2” details from the SIP server setup and the Application Server PC IP address (192.168.1.230) for the Domain as shown in the following figure.

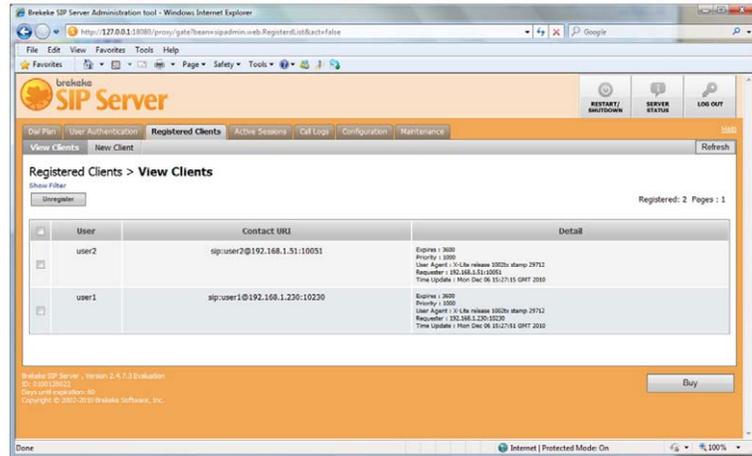


- Select “Properties”, choose the “Topology” tab, check the box “Manually specify range” and set the port numbers that X-lite can use to 10051 and 10052 as shown.



- From the top menu, select “Options”, click on Advanced, select “Network”, set the connection speed to LAN and click “Apply”.

- In the top menu of the SIP Server installed in the Application Server PC, select the "Registered Clients" tab and "View Clients" to see the registered clients list.



- Make a VOIP call from "user1" (X-Lite in the Application Server PC) to "user2" (X-Lite in the UE Client PC) by entering the contact details (name@<PC IP address:portnumber>) in the softphone contacts area as shown.



And add video . . .



## 6. Appendix – LTE structure

### Multiple access technology

Downlink and uplink transmission in LTE are based on the use of multiple access technologies: specifically, orthogonal frequency division multiple access (OFDMA) for the downlink, and single-carrier frequency division multiple access (SC-FDMA) for the uplink.

### Transmission bandwidth

In order to address the international wireless market and regional spectrum regulations, LTE includes varying channel bandwidths selectable from 1.4 to 20 MHz, with sub-carrier spacing of 15 kHz. In the case of multimedia broadcast multicast service (MBMS), a sub-carrier spacing of 7.5 kHz is also possible. Sub-carrier spacing is constant regardless of channel bandwidth. To allow for operation in different sized spectrum allocation, the transmission bandwidth is instead altered by varying the number of OFDM sub-carriers as shown in Table 6-1.

### Frame structure

There are two radio frame structures for LTE: frame structure type 1 (FS1) for full duplex and half duplex Frequency Division Duplex (FDD), and frame structure Type 2 (FS2) for Time Division Duplex (TDD). FS1 is optimized to co-exist with 3.84Mbps UMTS systems. This structure consists of ten 1ms sub-frames, each composed of two 0.5ms slots, for a total duration of 10ms. The FS1 is the same in the uplink and downlink in terms of frame, sub-frame, and slot duration although the allocation of the physical signals and channels is quite different. Uplink and Downlink transmissions are separated in the frequency domain.

### Resource block

The smallest time-frequency unit used for downlink transmission is called a resource element, defined as one symbol on one sub-carrier. A group of contiguous sub-carriers and symbols form a resource block (RB). Data is allocated to each user in terms of RB. For a Type 1 frame structure using normal cyclic prefix (CP), a RB spans 12 consecutive sub-carriers at a sub-carrier spacing of 15kHz, and seven consecutive symbols over a slot duration of 0.5ms. Even though a RB is defined as 12 sub-carriers during one 0.5ms slot, scheduling is carried out on a sub-frame (1 ms) basis. Using normal cyclic prefix, the minimum allocation the base station uses for user equipment (UE) scheduling is 1 sub-frame (14 symbols) by 12 sub-carriers. The size of a RB is the same for all bandwidths; therefore, the number of available physical RBs depends on the transmission bandwidth as shown.

Channel bandwidth [MHz] for LTE FDD	1.4	3	5	10	15	20
Number of resource blocks	6	15	25	50	75	100
Number of sub-carriers	72	180	300	600	900	1200

*Table 6.1 LTE transmission parameters*

Physical signals and physical channels are summarized in the tables below. In the downlink, primary, and secondary synchronization signals encode the cell identification, allowing the UE to identify and synchronize with the network. In both the downlink and the uplink, there are reference signals (RSs), known as pilot signals in other standards, which are used by the receiver to estimate the amplitude and phase flatness of the received signal. Alongside the physical signals are physical channels, which carry the user and system information.

DL signals	Full name	Modulation sequence	Purpose
P-SS	Primary synchronization signal	One of 3 Zadoff-Chu sequences	Used for cell search and identification by the UE; carries part of the cell ID (one of 3 orthogonal sequences)
S-SS	Secondary synchronization signal	Two 31-bit BPSK M-sequence	Used for cell search and identification by the UE; carries the remainder of the cell ID (one of 168 binary sequences)
RS	Reference signal (pilot)	Complex I+jQ pseudo random sequence (length-31 Gold sequence) derived from cell ID	Used for DL channel estimation; exact sequence derived from cell ID, (one of $3 * 168 = 504$ pseudo random sequences)

UL signals	Full name	Modulation sequence	Purpose
DM-RS	Demodulation reference signal	$u^{\text{th}}$ root Zadoff-Chu	Used for synchronization to the UE and UL channel estimation
S-RS	Sounding reference signal	Based on Zadoff-Chu	Used to monitor propagation conditions with UE

DL channels	Full name	Modulation format	Purpose
PBCH	Physical broadcast channel	QPSK	Carries cell-specific information
PDCCH	Physical downlink control channel	QPSK	Scheduling, ACK/NACK
PDSH	Physical downlink shared channel	QPSK, 16QAM, 64QAM	Payload
PMCH	Physical multicast channel	QPSK, 16QAM, 64QAM	Payload for multimedia broadcast multicast service (MBMS)
PCFICH	Physical control format indicator channel	QPSK	Carries information about the number of PDCCH OFDMA symbols per sub-frame (1, 2, or 3)
PHICH	Physical hybrid ARQ indicator channel	BPSK with I & Q CDM	Carries the hybrid-ARQ ACK/NAK

UL channels	Full name	Modulation format	Purpose
PRACH	Physical random access channel	$u^{\text{th}}$ root Zadoff-Chu	Call setup
PUCCH	Physical uplink control channel	On/Off Keying BPSK,QPSK	Scheduling, ACK/NACK
PUSCH	Physical uplink shared channel	QPSK, 16 QAM, 64 QAM	Payload

Table 6.2 LTE Uplink and Downlink Signals and Channels

## 7. Calling Agilent Technologies

Agilent Technologies has offices around the world to provide you with complete support for your wireless test set. To obtain servicing information or to order replacement parts, contact the nearest Agilent Technologies office listed below. In any correspondence or telephone conversations, refer to your test set by its product number, full serial number, and software revision.

Press the **INFO** front panel key to view the product number (E6621A), serial number, and software revision information. A serial number label is also attached to the rear panel of the test set.

### Locations for Agilent Technologies

For online assistance, go to: <http://www.agilent.com/find/assist>

### Software and Technical Support Contracts

If you have a Software and Technical Support Contract you can contact Agilent at the appropriate email address:

- [wireless\\_test\\_support\\_americas@agilent.com](mailto:wireless_test_support_americas@agilent.com)
- [wireless\\_test\\_support\\_japan@agilent.com](mailto:wireless_test_support_japan@agilent.com)
- [wireless\\_test\\_support\\_europe@agilent.com](mailto:wireless_test_support_europe@agilent.com)
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- [wireless\\_test\\_support\\_korea@agilent.com](mailto:wireless_test_support_korea@agilent.com)

### Where to Find the Latest Information

Agilent will periodically update product documentation. For the latest information about the E6621A PXT Wireless Communications Test Set, including software upgrades, operating and application information, and product and accessory information, see the following URL: <http://www.agilent.com/find/pxt>

### Is your product software up-to-date?

Agilent will periodically release software updates to fix known defects and incorporate product enhancements. To search for software updates for your product, log on with your credentials to the Agilent Technical Support website at <http://www.agilent.com/find/softwaremanager>



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For more information on Agilent Technologies' products, applications or services, please contact your local Agilent office. The complete list is available at:

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Other AP Countries	(65) 375 8100

#### Europe & Middle East

Belgium	32 (0) 2 404 93 40
Denmark	45 70 13 15 15
Finland	358 (0) 10 855 2100
France	0825 010 700*
	*0.125 €/minute
Germany	49 (0) 7031 464 6333
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Israel	972-3-9288-504/544
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United Kingdom	44 (0) 118 9276201

*For other unlisted Countries:*

[www.agilent.com/find/contactus](http://www.agilent.com/find/contactus)

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