# **Agilent PXT Wireless Communications Test Set (E6621A)**



# Guide to Data Throughput Measurements

**Application Note** 





# 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

### **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	РХТ	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. 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.

Windows F	Firewall/Internet Connect ? 🔀					
General Log Or	Recovery Dependencies					
Service name:	SharedAccess					
Display name:	Windows Firewall/Internet Connection Sharing (ICS)					
Description:	Provides network address translation, addressing, 🔥					
Path to executa	ble:					
C:\WINDOWS	system32\svchost.exe -k netsvcs					
Startup type:	Disabled					
	Automatic					
Service status:	Disabled Stateu					
Start	Stop Pause Resume					
You can specify from here. Start parameters	the start parameters that apply when you start the service					
	OK Cancel Apply					

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.
- 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. 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).
- 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\ianjohns>ipconfig Uindous IP Configuration	
Ethernet adapter Vireless Network Connection:	
Media State Media disconnected Ethernet adapter Local Area Connection:	
Connection-specific DNS Suffix : 192.168.1.51 IP Address. : 192.168.1.51 Subnet Maak : 255.255.8 IP Address. : 688::21f:29ff:fe79:777ex5 Default Gateway :	
Ethernet adapter Network Connect Adapter:	
Hedia State : Hedia disconnected Tunnel adapter Teredo Tunneling Pseudo-Interface: Compartiencementic NW Suffix	-

Figure 5. Check the UE IP address

- 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
- 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\ianjohns>ping 192.168.1.230	-
Pinging 192.168.1.230 with 32 bytes of data:	
Reply from 192.168.1.230: bytes=32 time=1ns ITL=128 Reply from 192.168.1.230: bytes=32 time=41ns ITL=128 Reply from 192.168.1.230: bytes=32 time=1ns ITL=128 Reply from 192.168.1.230: bytes=32 time=1ns ITL=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 = Ins, Maximum = 41ns, Average = 11ns	

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

 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.

- 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.
- 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 -I2900 -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
- I 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

- 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**
- 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 -I2900 -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.

≜ VL	C media	play	er			
Media	Playback	Audio	Video	Tools	View	Help
<ul> <li>Open File</li> <li>Advanced Open File</li> <li>Open Folder</li> <li>Open Disc</li> <li>Open Network Stream</li> </ul>				Ctrl+O Ctrl+St Ctrl+F Ctrl+D Ctrl+N	nift+O	()) 100% 1.00x:/:
Ope Ope Rec	n Capture [ n Location f ent Media	evice Fom clip	board	Ctrl+C Ctrl+V	•	
Sav	Save Playlist to File			Ctrl+Y		
Con ((*)) Stre	vert / Save. aming			Ctrl+R Ctrl+S		
🗙 Quit	:			Ctrl+Q		

- 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.

Open Media	?
Ele 💮 Disc 📲 Network 👹 Capture Device	
File Selection You can select local files with the following list and buttons. C. \Dog ments and Settings\landshas\Deskton\D6112010003 mod	odd
	Remove
Use a subglies file	
Brows	ie
Font size: Normal V Text alignment: Center V	
Tetam many athlese	
j snow more options ⊋tream ▼	Gancel

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

Strea	m Output	? 🛽
ource		
This dialo You shoul	g will allow you to stream or convert your media for use locally, on your private network, or on the Internet. If shart by checking that source matches what you want your input to be and then press the "Next" button to continu	r.
Source	Character and Entition/Incident/Auditor/Add 115010000 and	
Type:	FiniPolder	
	C	Next
Destination	s	
Options		
	[gream]	⊆ancel

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

stinations		
Destinations		
Add destinations following the streaming r the method used.	nethods you need. Be sure to check with transcoding that	the format is compatible with
New destination	Fle	Add
Display locally	File HTTP MS-WMSP (MMSH) RTSP RTSP / MPEG Transport Stream	
Activate Transcoding	RTP Audio/Video Prohie UDP (legacy) IceCast	
Profile	Video - H.264 + AAC (MP4)	💌 🔀 🗶 🔳
Previous		Next

6. Open the "File" drop-down menu, select the "UDP" option and click Add.

Stream (	Dutput		?
iource			
Destinations			
Destinations			
• u	DP		×
This module	outputs the transcoded strea	an to a network via UDP.	
Address 1	92.168.1.51		
Port	1234 🤤		
Profile		Video - H.264 + AAC (MP4)	M 🕅 関
Previous			Next
Previous Aptions			Next

- 7. Enter the IP address allocated to the UE (192.168.1.51). Set the port number to 1234. Uncheck the "Active Transcoding" option.
- 8. 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:

9. Run the VLC Media Player. From the top menu, select "Open Network Stream" from the **Media** tab.

🔺 VL	C media	play	er			
Media	Playback	Audio	Video	Tools	View	Help
Def Ope	en File vanced Oper en Folder	ı File		Ctrl+O Ctrl+Sł Ctrl+F	nift+O	(h) 100%
Ope Ope	en Disc en Network ! en Capture [	Stream )evice	ik	Ctrl+D Ctrl+N Ctrl+C		
Ope Rec	en Location f ent Media	from clip	board	Ctrl+V	,	
Sav	e Playlist to	File		Ctrl+Y		
Convert / Save			Ctrl+R Ctrl+S			
🗙 Qui	t			Ctrl+Q		

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

- FIG ISSUITC	Statement The state		
	The work Capture De	evice	
Network Protocol			
Please enter a networ	K URL:		
udp://@:1234	<u></u>		
http://www.evamp	le comístream avi		
rtp://@:1234	ierconitari eantra il		
mms://mms.exampl rtsp://server.examp	es.com/stream.asx ale.org:8080/test.sdp		
http://www.yourtu	be.com/watch?v=gg64x		

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".

Services								File7illa Se	rever CTD research 2 🔽
File Action View	/ Help							FileZilla Se	aver rir server rioperti : 🕅
+ → 🖬 🛃 🛛								General Log On	Recovery Dependencies
Services (Local)	👋 Services (Local)	Name	Description	Status	Startun Tuna	Lon On As		Service name: Display name:	FileZilla Server FileZilla Server FTP server
	Start the service	DCOM Server Pr DHCP Client Distributed Link DDS Client Error Reporting Event Log Extensible Authe Extensible Authe	Provides Ia Manages n Maintains II Coordinate Resolves a Allows er Enables ev Provides m	Started Started Started Started Started Started Started	Automatic Automatic Automatic Manual Automatic Automatic Automatic Manual Manual	Local Syst Local Syst Local Syst Network S Network S Local Syst Local Syst Local Syst Local Syst Local Syst		Description Path to executa C: Vhogram File Startup type:	Ser VFACZBa Server.VFACZBa Server.exea" Manual
		<ul> <li>FINZINA Server</li> <li>Health Key and</li> <li>Help and Support</li> <li>Help and Support</li> <li>HPCA Applicatio</li> <li>HPCA Notify Dae</li> <li>HPCA Notify Dae</li> <li>HPCA Notify Dae</li> <li>HPCA Notify Dae</li> <li>HPCA Scheduler</li> <li>HTIP SSL</li> </ul>	Start Stop Pause Resume Restart All Tasks	• 6 6 6 6 6 6	Automatic Manual Automatic Automatic Automatic Automatic Automatic Manual Manual Dasklard	Local Syst Local Syst	v	Service status: Stat You can specify from here. Start parameters	Stopped Stopped Paume Persone
< >	Extended / Standard /		Propertie	16				-	
			Help						

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.

Page: General Shared folders Speed Limits	Account settings	***********************	Users	2
IP Filter	Group membership:	<none></none>		
	Bypass userlimit of Maximum connection Connection limit per I	f server count: 0 p: 0 r login	Add	Remove
	Description		]	
		<		
ОК				
Cancel	rou can enter some o	comments about the user		

 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.

General Shared folders Speed limits IP Filter Directories Aliases F Read F F F Read F F F Read F F F F Read F F F F F F F F F F F F F F F F F F F		F1		ugoi
Add Rem		Fries Read Kest Lest Lest Lest Lest Lest Lest Lest L	Directories Aliases H CNDocuments an	General Shared folders Speed Limits IP Filter
Add         Remove         Rename         Set as home dir         Rename         Cop           A directory alias will also appear at the specified location. Aliases must contain the full local path. Separate multiple aliases for one directory with the pipe character (1)         Cop	Add Remove ename Copy n the full local	Image: Set as home dir     Add       Image: Set as home dir     Rename       Image: Set as home dir     Rename       Image: Set as home dir     Image: Set as home dir	Add Remove Rename A directory alias will also appear at the specific path. Separate multiple aliases for one directory	

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

Users		X
Page: General Shared folders Speed Limits IP Filter	Download Speed Limit     Default     Rypass server download speed limit     No Limit     Constant Speed Limit of     Use Speed Limit Rules:     Add     Remove     Up     Down	Lest
OK Cancel	Upload Speed Limit C Default Bypass server upload speed limit No Limit Constant Speed Limit of Use Speed Limit Rules: Add Remove Up Down	Add Remove Rename Copy

### 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.

E Filo7illa	
File Edit View Transfer Server Bookmarks Help	
Host: Password:	Port: Quickconnect V
	<u>.</u>
	×
Local site: C:\Documents and Settings\ianjohns\Desktop\ftp files\	Remote site:
Cookes     Cookes     Cookes	
the files	
Old versions and screens	
Eavorites	
Filename / Filesize Filetype Last modified	Filen / Filesize Filetype Last modified Permissi Ov
°	a
	Not connected to any server
Franki directore	<
emply directory.	Not connected.
Server/Local file Direct Remote file	Size Priority Status
Quauad Blar Bailed transfere Suscentful transfere	
Quedea mes i alla d'alisters ducessi di d'alisters	FEE Outrie empty
	ana Queue, empty

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.

elect page:	Concurrent transfers
Connection FTP Active mode FTP Passive mode FTP Proxy SFTP Generic proxy Transfers File Types File exists action Interface File types File exists action File types File ty	Maximum simultaneous transfers: 10 (1-10)     Limit for concurrent downloads: 0 (0 for no limit)     Limit for concurrent uploads: 0 (0 for no limit)     Speed limits     Enable speed limits     Download limit: 100 (in KB/s)     Upload limit: 20 (in KB/s)     Burst tolerance: Normal
Date/time format Filesize format File lists Language ∋ File editing	Filter invalid characters in filenames     Enable invalid character filtering     When enabled, characters that are not supported by the local operating     system in filenames are replaced if downloading such a file.
ОК	Replace invalid characters with:
Cancel	The following characters will be replaced: \/; *?" < >

- 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.

Site Manager						
Select Entry:	General Host:	Adv	anced	Transfer Set	tings Port	Charset
	Server T	/pe:	FTP - I	File Transfer P	rotoco	ı 💌
	Logon Ty	pe:	Norma	l		~
	User: Password	1:	test			
	Account:					
	Comment	:5:				
New Site New Folder						
New Bookmark         Rename           Delete         Copy						<u></u>
Connect	ОК			Cancel		

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.

- 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.
- 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.

© Brekeke SIP Server Administration tool - Windows Internet Explorer		
000 - 0 http://127.0.0.1:18080/broxy/gate/bean=spadmin.web.Login	💌 🏘 🔀 Live Search	P -
Elle Edit View Figurites Icols Help		Leis
📽 🛠 🧿 brekele SP Server Administration tool	<b>@</b> •⊡:⊕•8	Eage • O Tgols • "
Sip Server		
Login Gen Dr Pascott Domen: Childrenitator		tenko
Rada (B. Burr, Yone) L 1-15 kulube San Watan (B. David Californi B. Buran Antone, Nr.		Bay
	🕡 😁 Internet	× 100% ·

TORENCE SITE SETVET	Administration tool - Wildows internet Explorer		10172312211		
• • • http://127.0.0	1:10000/proxy/gate/bean=spadmin.web.SvUsersEdit		A DELEN LINE OF		18
B For Ann Havoures	Toor Reb		D		a di Tasia a
or O brekelke 50° Serve	r Administration tool		SK * 63	B 1 22 04	e • Ur igen •
SIP Ser	VOF		O	49	P
e si sci			SHUTDOWN	STATUS	LOG OUT
User Authentical	Ion Registered Clents Active Sessons Call Logi Configuration Hantenance				datt
View Users New User	Import Users Export Users				
Jser Authentication	> New User				
ser:					
ssword:					
ame:					
nall Address:		127			
	Add Dener	N.			
	Course descention				
inter SDI Server , Versen 3,4,7,5	Diskatory			-	
					buy
			Transat		# 100H

3. 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.



4. 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.

	Ċ				Properties of Acc	ount1	X
SIP Acc	ounts			X	Account Voicemail Topolog	y Presence Advanced	
Enabled	Domain 192.168.1.230 (default)	Username user2	Display Name user2	Add Remove Properties Mais Defack	Display Name User name Pasaword Authorization user name Domain - Domain Proxy I Register with domain and	User2 User2 192.166.1.230 dreceive incoming calls	
			D	Close	Send outbound vis: (a) domain (b) proxy Address (b) target domain Dialing plan	#1/a/a.1;match=1;prestrp=2; OK Cancel	Apply

7. 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.

Properties of Acco	ount1 🛛 🔀
Account Voicemail Topology	Presence Advanced
Firewall Traversal IP address Discover global addre Use local IP address STUN server Discover server Use specified server: Enable ICE	55
Port used on local computer	10051
Manually specify range:	
Use XTunnels	Never
Server address	
Use SIP user name and p	assword
Username	
Password	
	OK Cancel Apply

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

9. 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.



10. 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.

Call established User2 user2@192.168.1.51:10051	Calls & Contacts  Calls & Contacts  Calls & Contacts	2 Detach
1 2 X - Life XEER MOLD RECORD AA AC DUD OON RECORD AA AC DUD OON RECORD AA AC DUD OON	Name A Family Friends Work user2	Contacts Calls

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	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 <sup>th</sup> 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	uth 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
- wireless\_test\_support\_japan@agilent.com
- wireless\_test\_support\_europe@agilent.com
- wireless\_test\_support\_asia@agilent.com
- 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

# **Agilent Email Updates**

www.agilent.com/find/emailupdates Get the latest information on the products and applications you select.



Agilent Advantage Services is committed to your success throughout your equipment's lifetime. We share measurement and service expertise to help you create the products that change our world. To keep you competitive, we continually invest in tools and processes that speed up calibration and repair, reduce your cost of ownership, and move us ahead of your development curve.

www.agilent.com/find/advantageservices



#### www.agilent.com/quality

### www.agilent.com www.agilent.com/find/pxt

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

#### www.agilent.com/find/contactus

#### Americas

)

#### **Asia Pacific**

Australia	1 800 629 485
China	800 810 0189
Hong Kong	800 938 693
India	1 800 112 929
Japan	0120 (421) 345
Korea	080 769 0800
Malaysia	1 800 888 848
Singapore	1 800 375 8100
Taiwan	0800 047 866
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		
Ireland	1890 924 204		
Israel	972-3-9288-504/544		
Italy	39 02 92 60 8484		
Netherlands	31 (0) 20 547 2111		
Spain	34 (91) 631 3300		
Sweden	0200-88 22 55		
United Kingdom	44 (0) 118 9276201		

For other unlisted Countries: www.agilent.com/find/contactus Revised: October 14, 2010

Product specifications and descriptions in this document subject to change without notice.

© Agilent Technologies, Inc. 2011 Printed in USA, February 4, 2011 5990-7379EN



# **Agilent Technologies**