

Keysight 14565B

Automation Interface

WTM Programming
Guide

Legal Notices

Copyright Notice

© Keysight Technologies 2007, 2008, 2021

No part of this manual may be reproduced in any form or by any means (including electronic storage and retrieval, or translation into a foreign language) without prior agreement and written consent from Keysight Technologies, Inc. as governed by United States and international copyright laws.

Manual Part Number

14565-90003

Edition

Edition 2, February 2021

Printed in:

Printed in Malaysia

Published by

Keysight Technologies
Bayan Lepas Free Industrial Zone
11900 Penang, Malaysia

Technology Licenses

The hardware and or software described in this document are furnished under a license and may be used or copied only in accordance with the terms of such license.

U.S. Government Rights

The Software is “commercial computer software,” as defined by Federal Acquisition Regulation (“FAR”) 2.101. Pursuant to FAR 12.212 and 27.405-3 and Department of Defense FAR Supplement (“DFARS”) 227.7202, the U.S. government acquires commercial computer software under the same terms by which the software is customarily provided to the public. Accordingly, Keysight provides the Software to U.S. government customers under its standard commercial license, which is embodied in its End User License Agreement (EULA), a copy of which can be found at www.keysight.com/find/sweula. The license set forth in the EULA represents the exclusive authority by which the U.S. government may use, modify, distribute, or disclose the Software. The EULA and the license set forth therein, does not require or permit, among other things, that Keysight: (1) Furnish technical information related to commercial computer software or commercial computer software documentation that is not customarily provided to the public; or (2) Relinquish to, or otherwise provide, the government rights in excess of these rights customarily provided to the public to use, modify, reproduce, release, perform, display, or disclose commercial computer software or commercial computer software documentation. No additional government requirements beyond those set forth in the EULA shall apply, except to the extent that those terms, rights, or licenses are explicitly required from all providers of commercial computer software pursuant to the FAR and the DFARS and are set forth specifically in writing elsewhere in the EULA. Keysight shall be under no obligation to update, revise or otherwise modify the Software. With respect to any technical data as defined by FAR 2.101, pursuant to FAR 12.211 and 27.404.2 and DFARS 227.7102, the U.S. government acquires no greater than Limited Rights as defined in FAR 27.401 or DFAR 227.7103-5 (c), as applicable in any technical data.

This equipment does not contain any software.

Warranty

THE MATERIAL CONTAINED IN THIS DOCUMENT IS PROVIDED “AS IS,” AND IS SUBJECT TO BEING CHANGED, WITHOUT NOTICE, IN FUTURE EDITIONS. FURTHER, TO THE MAXIMUM EXTENT PERMITTED BY APPLICABLE LAW, KEYSIGHT DISCLAIMS ALL WARRANTIES, EITHER EXPRESS OR IMPLIED, WITH REGARD TO THIS MANUAL AND ANY INFORMATION CONTAINED HEREIN, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. KEYSIGHT SHALL NOT BE LIABLE FOR ERRORS OR FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES IN CONNECTION WITH THE FURNISHING, USE, OR PERFORMANCE OF THIS DOCUMENT OR OF ANY INFORMATION CONTAINED HEREIN. SHOULD KEYSIGHT AND THE USER HAVE A SEPARATE WRITTEN AGREEMENT WITH WARRANTY TERMS COVERING THE MATERIAL IN THIS DOCUMENT THAT CONFLICT WITH THESE TERMS, THE WARRANTY TERMS IN THE SEPARATE AGREEMENT SHALL CONTROL.

Safety Information

WARNING

A **WARNING** notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a **WARNING** notice until the indicated conditions are fully understood and met.

CAUTION

A **CAUTION** notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a **CAUTION** notice until the indicated conditions.

Contents

Legal Notices	3
Contents	4
1 - Introduction.....	5
2 - Getting Started	6
Adding the Keysight 14565B to the Wireless Test Manager.....	7
Adding the Provided Keysight 14565B Test Steps to the Wireless Test Manager	11
Run the Wizard to Complete Adding the Keysight 14565B to the Wireless Test Manager.....	13
3 - Using Test Steps	16
Using the Provided Keysight 14565B Test Steps	17
Test Step Examples	27
Test Step Example Using the Keysight Wireless Test Manager...	30
Index.....	35

1

Introduction

The Keysight 14565B Automation Interface is optimized for integrating the Keysight 14565B Device Characterization Software with the Keysight Wireless Test Manager (WTM). The Keysight 14565B Device Characterization Software adds current drain measurement capability to the WTM's automated testing of wireless devices.

In order to complete the integration, you will need the .NET development version of WTM. The run-time version of WTM is not sufficient to complete the integration process. The development version provides a Visual Basic .NET project that allows editing and writing new Test Steps for WTM. To see what versions of the WTM are available, go to <https://www.keysight.com/find/wtmanagers>

There are two steps that need to be completed in order to use the Keysight 14565B Automation Interface in WTM.

- The first step is to add a new instrument to WTM. A new instrument is just a WTM compatible driver and in this case this will be an Keysight 14565B Automation Interface wrapper named Agilent.WTM.ag14565BMoM.dll.
- The second step is to add Test Steps that will use the Keysight 14565B Automation Interface through the driver added in step 1. An example of a test step is to set up and start data logging.

NOTE

You can contact Keysight Technologies at one of the following telephone numbers for warranty, service, or technical support information.

In the United States: (800) 829-4444

In Europe: 31 20 547 2111

In Japan: 0120-421-345

Or use our Web link for information on contacting Keysight in your country or specific location: www.keysight.com/find/assist

Or contact your Keysight Technologies Representative.

The web contains the most up to date version of this manual. Go to <http://www.keysight.com/find/14565B> to get the latest version of the manual.

2

Getting Started

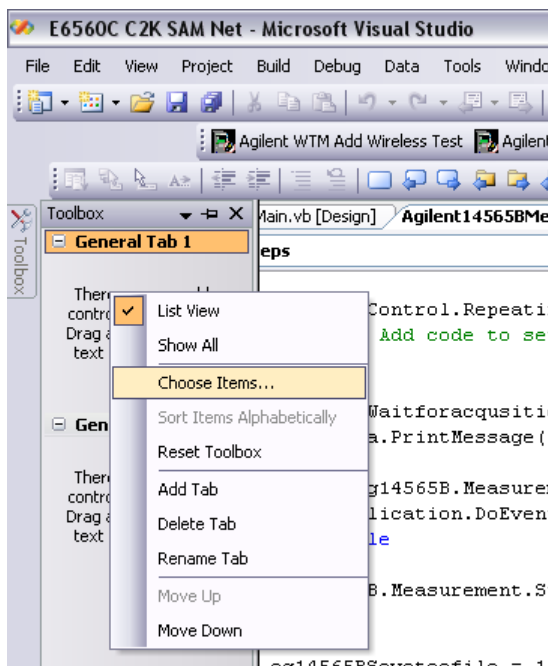
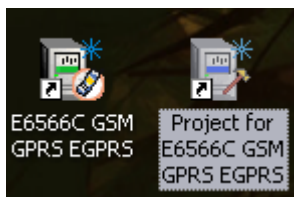
Adding the Keysight 14565B to the Wireless Test Manager.....	7
Adding the Provided Keysight 14565B Test Steps to the Wireless Test Manager	11
Run the Wizard to Complete Adding the Keysight 14565B to the Wireless Test Manager	13

The Keysight 14565B Automation Interface provides a separate driver for Wireless Test Manager that follows the schema of other WTM instrument drivers. It provides almost all the same functions as the standard Keysight 14565B Automation Interface except they are categorized.

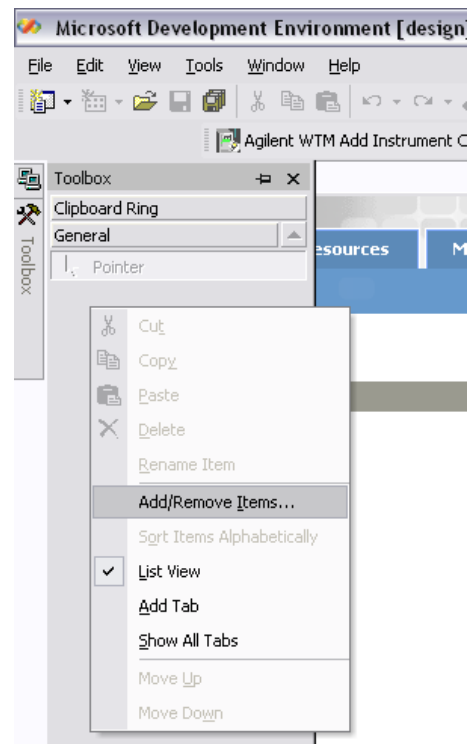
Adding the Keysight 14565B to the Wireless Test Manager

The driver can be found in the following directory: My Documents\Keysight\14565B\Development\14565B Examples.zip\WTM Driver\.

1. Open the WTM development solution using Visual Studio .Net 2003 or Visual Studio 2005. By default, the WTM installation places a shortcut to the solution on the desktop. In this example the solution was opened from the desktop by double-clicking Project for E6566C GSM GPRS EGPRS. This is a shortcut to [WTM Install Folder]\[WTM Version]\Development\ E6566C GSM GPRS EGPRS SAM Net.sn. The default WTM install folder is C:\Program Files\Keysight\WirelessTestManager\[WTM version].
2. Right click inside the Toolbox panel in Visual Studio and click on *Choose Items (VS2005)* or *Add Remove Items (VS2003)*. If the Toolbox is not visible, add it from the View menu.

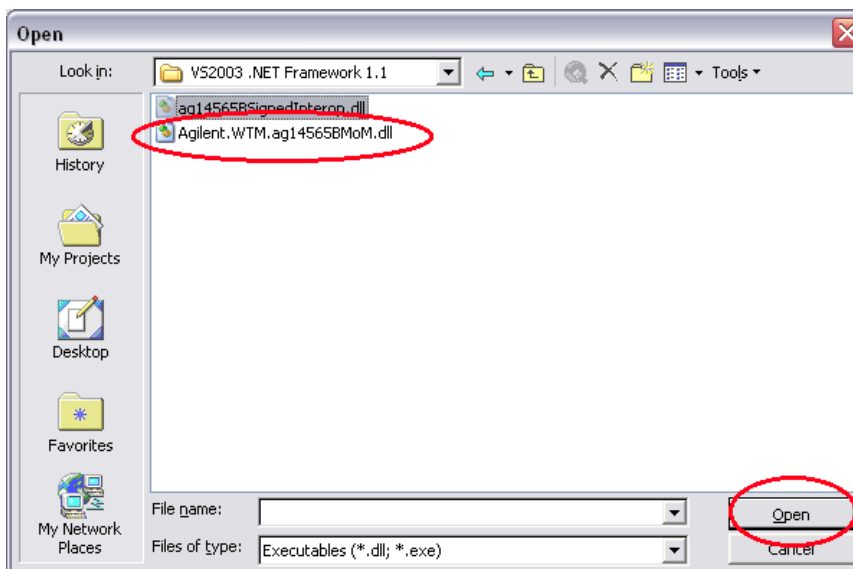
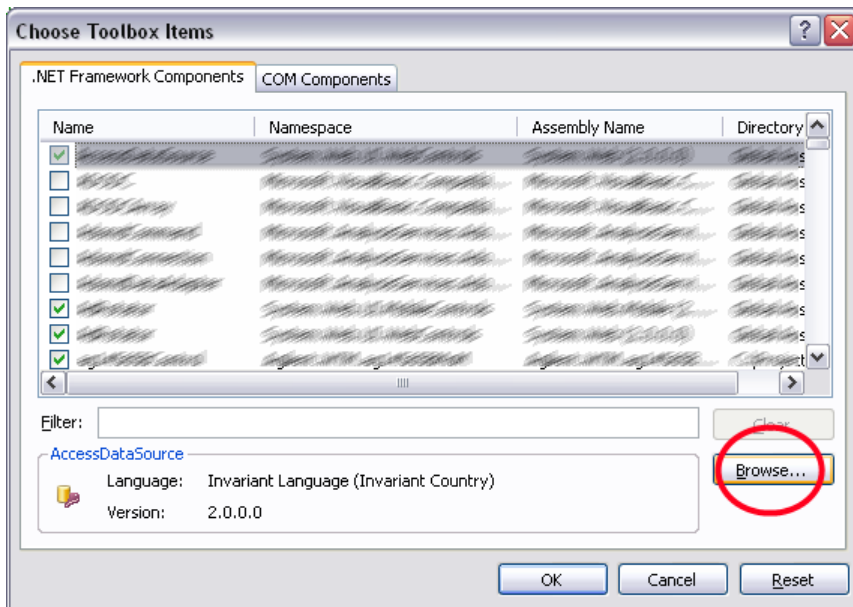


Visual Studio 2005

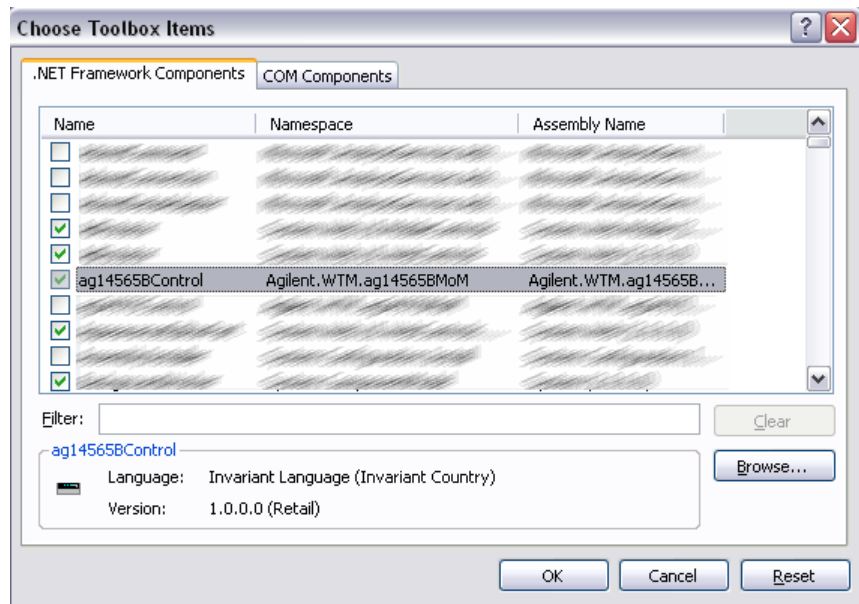


Visual Studio 2003

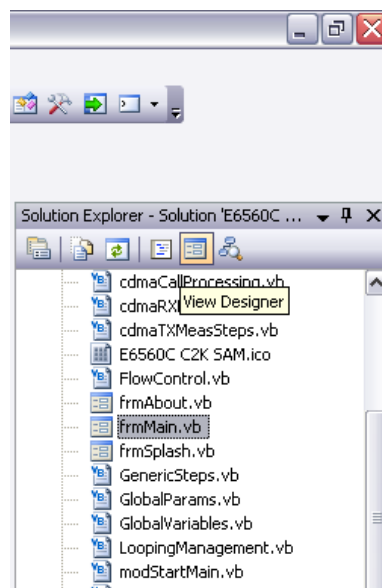
3. On the .NET tab, click the Browse button and select the file Agilent.WTM.ag14565BMoM.dll from My Documents\Keysight\14565B\Development\14565B Examples.zip\WTM Driver\. Then click Open.



After clicking Open, the ag14565BControl should appear in the list of .NET Framework Components. Click OK.

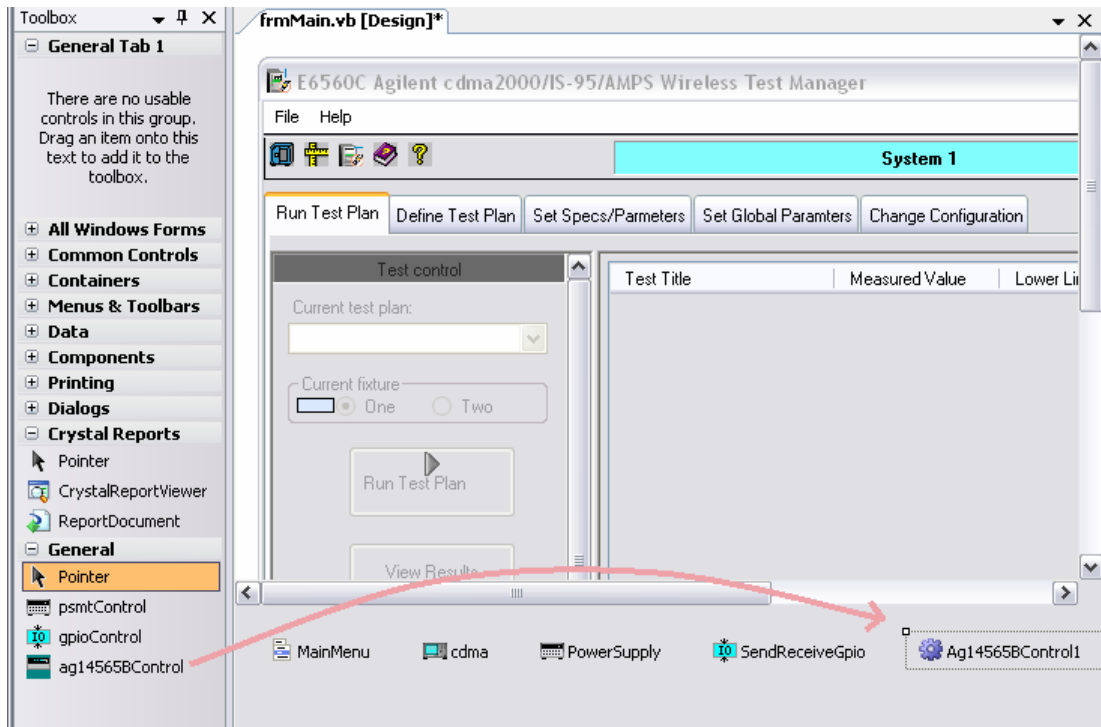


- From the Solution Explorer, open frmMain.vb in Designer view. The Solution Explorer is the solution and project file view. If it is not visible, you may enable it from the View menu.

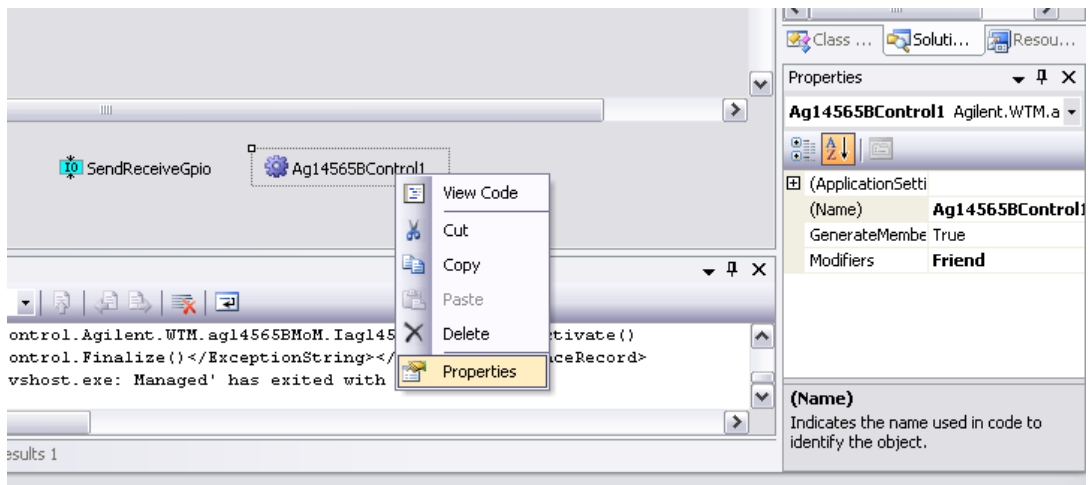


- Open the Toolbox. The ag14565BControl should now appear in the General Tab of the Toolbox. Drag the ag14565BControl component from the Toolbox to the non-visual components bar of the form, found on the bottom of the window (where the other instrument drivers reside).

6 Maintenance



6. In the properties of the newly added component, change the name from *Ag14565BControl1* to *ag14565B*. This name is required to be exactly *ag14565B* if you plan on using the provided 14565B WTM test steps. Note that the name is case sensitive. Save frmMain.vb.



To finalize adding a new instrument, you would normally run the WTM Add Instrument Control wizard at this time. Before continuing with the wizard however, the 14565B Test Steps class module must be added first.

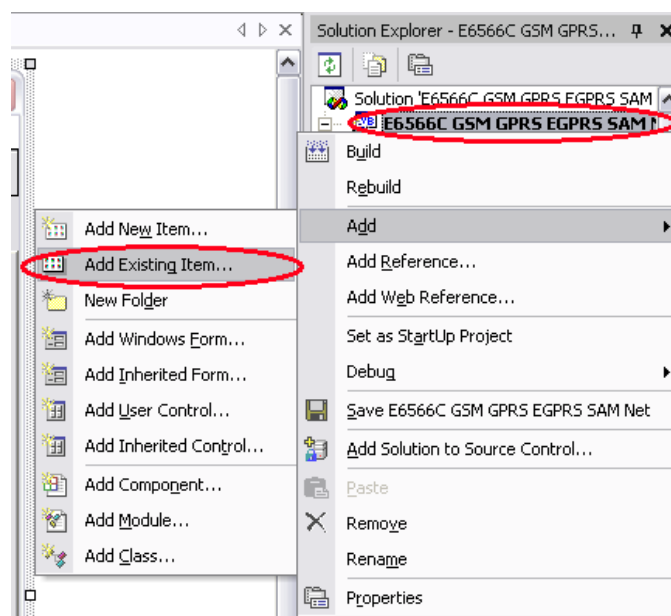
Adding the Provided Keysight 14565B Test Steps to the Wireless Test Manager

This procedure will add the 14565B Test Steps to WTM. The process involves adding the test step source file to the WTM development project and aligning the WTM database with the source code using the provided wizard. The alignment process involves parsing each file for WTM generated comments containing information such as test step specifications and parameters.

1. Copy the 14565B Test Steps source file from *My Documents\Keysight\14565B\Development\14565B Examples.zip\WTM Test Steps\Agilent14565BMeasSteps.vb* to *[WTM Install Folder]\Development*.

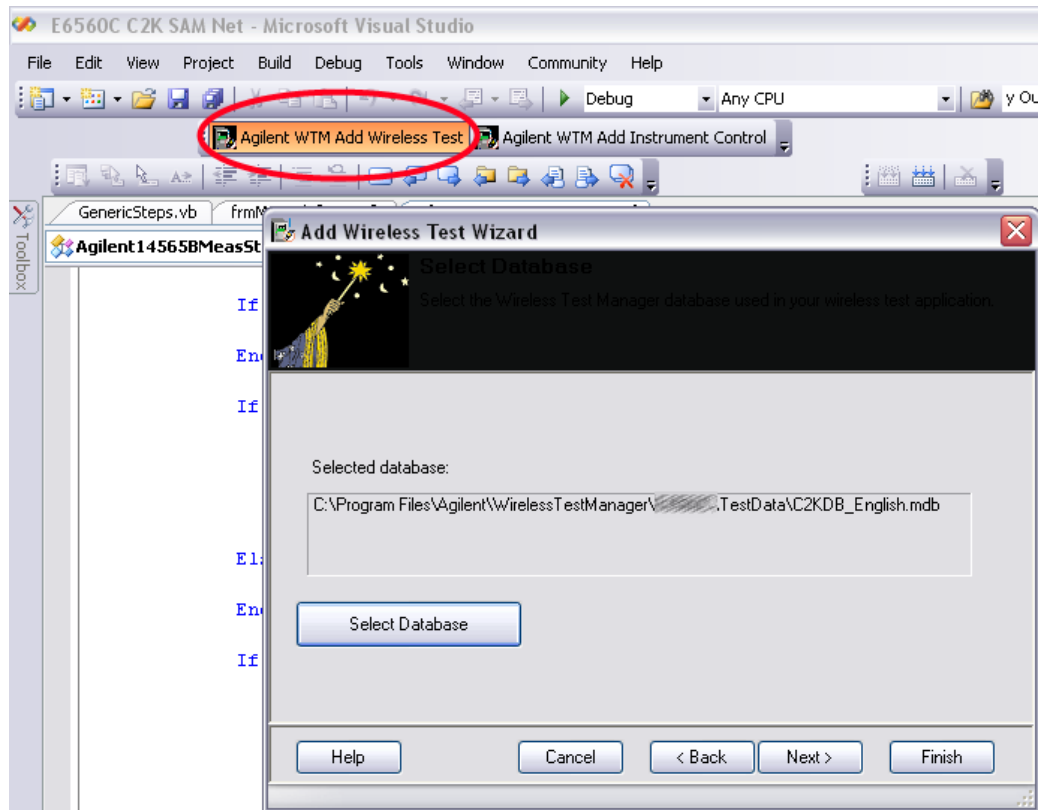
The default WTM install folder is *C:\Program Files\Keysight\WirelessTestManager\[WTM version]*.

2. In the WTM development project, from the Solution Explorer, right-click on the project name and click Add->Add Existing Item. Then choose the newly copied Test Steps source file *Agilent14565BMeasSteps.vb*.

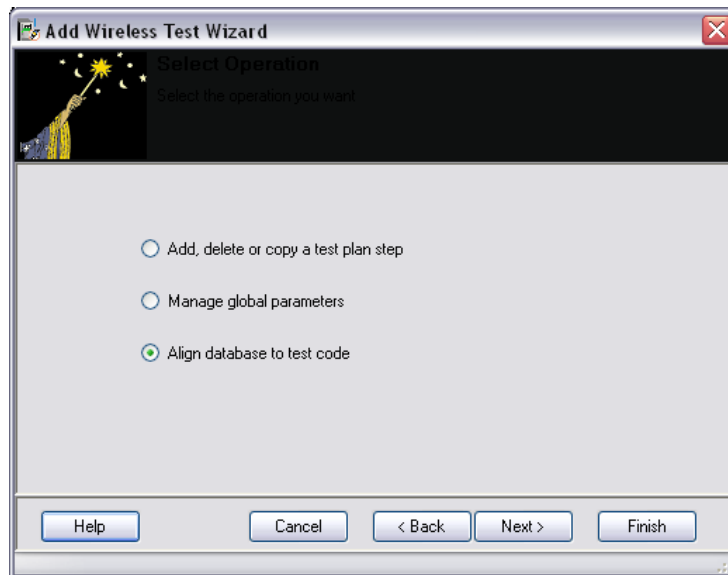


3. Click on the Keysight Add Wireless Test wizard button found in the Visual Studio toolbar. If the Wireless Test Manager wizard buttons are missing, right-click on the toolbar and enable *WTM Controls*. If *WTM Controls* is missing from the list, try reinstalling WTM.

On the first page of the wizard locate the WTM database file you want to use. The default location for database files is *[WTM Install Folder]\[WTM Version]\Development\TestData*. The default WTM install folder is *C:\Program Files\Keysight\WirelessTestManager [WTM version]*. Then click Next.



4. On the next screen choose Align database to test code. Click Next and let the wizard complete the alignment. Click Finish when done.

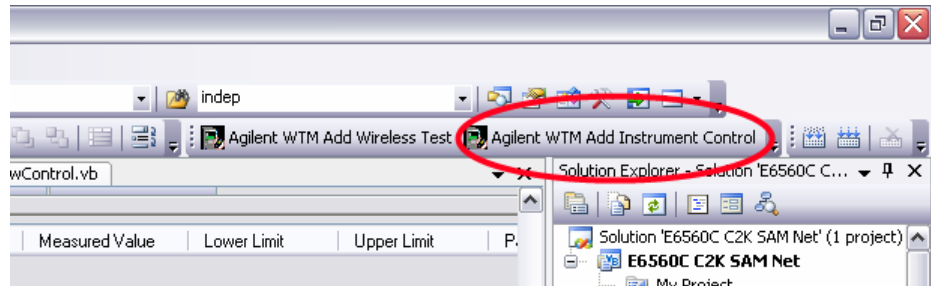


5. The final window will ask about updating the database revision number and viewing the database alignment log file. You may uncheck the view the log file. Click Finish. When prompted for a new database revision number, increment the last digit of the revision by 1. For example if the old database revision is 1.0.0, enter 1.0.1. Click Ok. Save All.

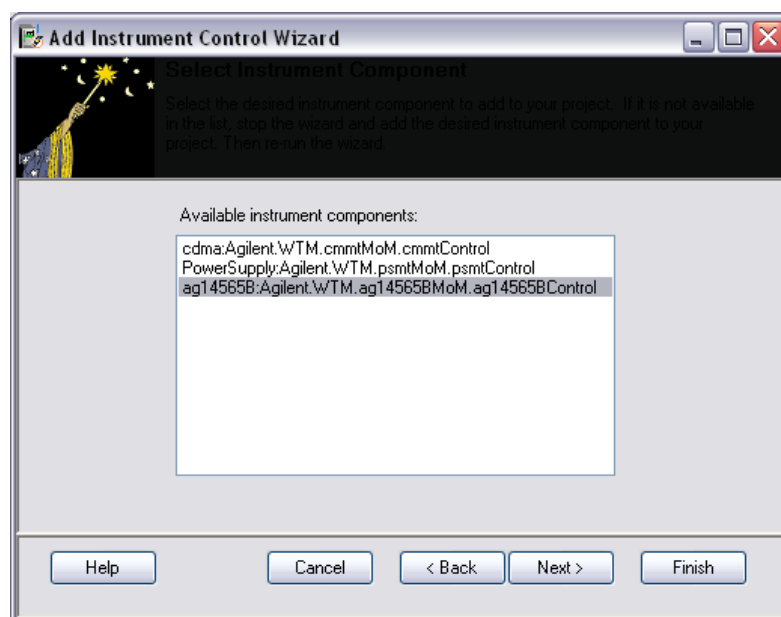
Run the Wizard to Complete Adding the Keysight 14565B to the Wireless Test Manager

The Add Instrument Control wizard lets you choose the instrument name and what test class modules (the source files) need the instrument

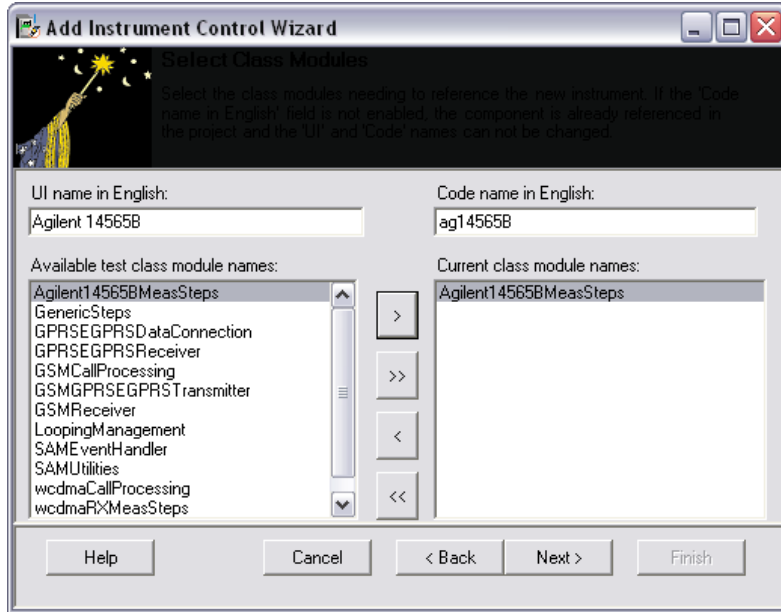
1. Click on the Keysight WTM Add Instrument Control wizard button. This opens a wizard that will guide you through adding a new instrument:



2. Choose Add Instrument and click on Next. In the next window you should see the newly added Keysight 14565B. Select it and click on Next.



3. In the next window type a UI name (the name that will appear in the WTM Instrument Control window), keep the code name as *ag14565B*, and select the *Agilent14565BMeasSteps* test class module to use the Keysight 14565B. The code name corresponds to the name of the *ag14565BControl* toolbox component that was added earlier.



Click on Next. At this point the wizard will add the ag14565B instrument driver to frmMain and also give access to the instrument in the Agilent14565BMeasSteps class. When the process is complete you will see the following message:

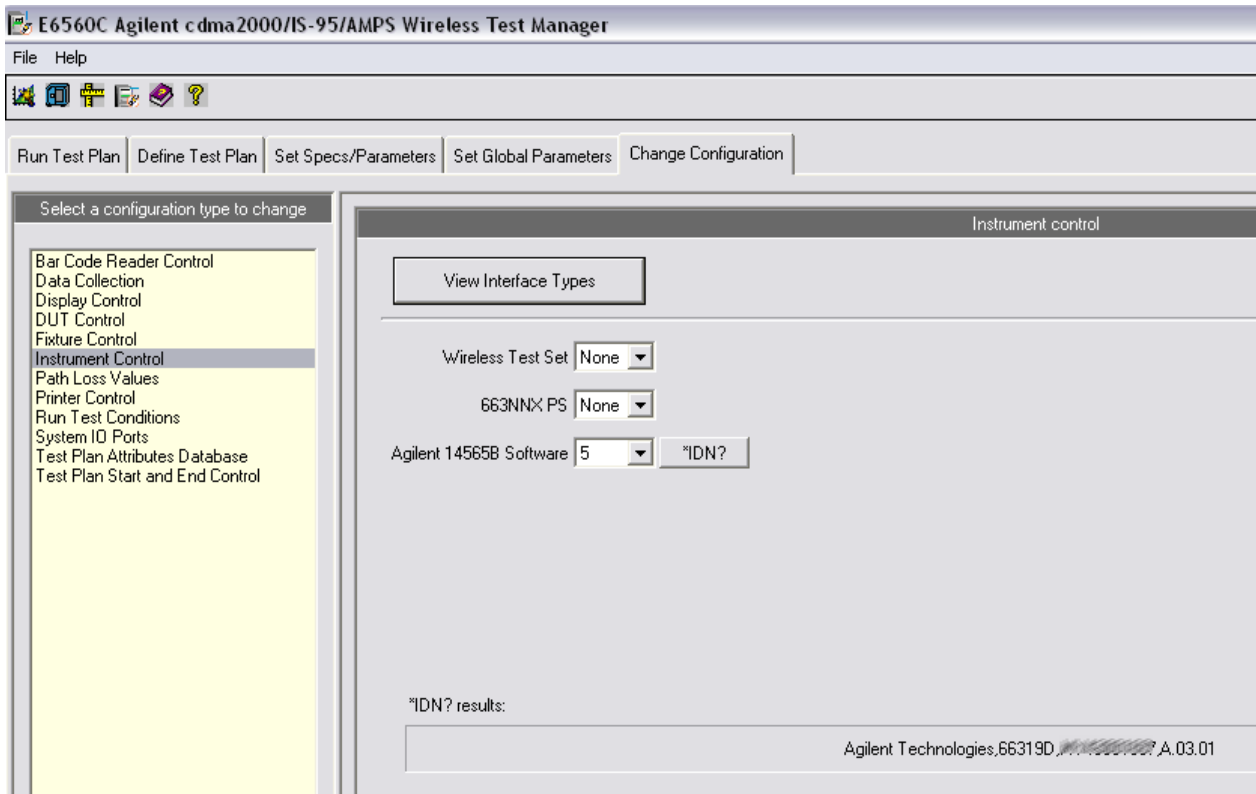


Click OK, then click Finish when the original wizard window reappears.

4. Now build and run the WTM project. Both of these tasks can be done by clicking the Start Button found on the toolbar.



After a successful compilation, the modified WTM software will execute. After WTM loads click the Change Configuration tab. Then click on Instrument Control in the list on the left. You should see the Keysight 14565B as one of the instruments. When you click the Define Test Plan tab, you should see the new 14565B test steps.

**NOTE**

If you search for all instances of the string “ag14565B” in the project files you will see how WTM initializes the instrument and how the test plans have access to the instrument. In most cases it is recommended that the WTM wizards found in the toolbar of Visual Studio be used for common WTM tasks.

NOTE

Wireless Test Manager comes with a power supply driver named 663NNX PS in the software and PowerSupply in the source code. Some of the Test Steps that come with WTM use this power supply driver. It is recommended that you check if a Test Step you are using has calls to PowerSupply and that you do not add that Test Step in between ag14565BxBegin and ag14565BxEnd Test Steps that may be Data Logging or doing a CCDF histogram.

3

Using Test Steps

Using the Provided Keysight 14565B Test Steps	17
Test Step Examples	27
Test Step Example Using the Keysight Wireless Test Manager...	30

The programming examples in this chapter describe how to program the Keysight 14565B Device Characterization Software from within the Keysight Wireless Test Manager. Test step examples are explained in detail. Source code for a sample WTM test step is included at the end of the chapter.

Using the Provided Keysight 14565B Test Steps

The provided test steps found in *My Documents\Keysight\14565B\Development\14565B Examples.zip\WTM Test Steps\Agilent14565BMeasSteps.vb* allow for the use of the four acquisition modes found in the Keysight 14565B: Current Waveform, Voltage Waveform, CCDF, and Data Logging. The Test Steps included are:

1. ag14565B CCDF Begin
2. ag14565B CCDF End
3. ag14565B CCDF Get Measurements
4. ag14565B Data Logging Begin
5. ag14565B Data Logging End
6. ag14565B Data Logging Get Measurements
7. ag14565B Data Logging Insert Event Tag
8. ag14565B Setup Power Supply
9. ag14565B Waveform Capture
10. ag14565B Waveform Get Measurements

The Test Steps are described in detail in the following tables.

ag14565B CCDF Begin

This step is used to setup and start a CCDF acquisition in 14565B.

Properties	Description
ag14565B Acquisition Hours CCDF	Acquisition Period Hours
ag14565B Acquisition Minutes	Acquisition Period Minutes
ag14565B Acquisition Seconds	Acquisition Period Seconds
ag14565B CCDF Sense Type	Acquisition Sense Type <u>Enumerated Values:</u> ag14565B CCDF Sense Type Voltage (0) ag14565B CCDF Sense Type Current (1) ag14565B CCDF Sense Type DVM (2)

ag14565B CCDF End

This step is used to wait for the CCDF acquisition to finish after a call to CCDF Begin. When the test plan gets to this test step it can halt and display the time remaining in the acquisition at the bottom of the screen or it can stop right away. This step can also save the acquired CCDF graph to a file.

Properties	Description
ag14565B Save Directory	The directory where the file will be saved. This is relative to the 14565B Working Folder set under Preferences in the Keysight 14565B software. You can also specify an absolute path.
ag14565B Save Filename	The filename without the file extension of the waveform to be saved.
ag14565B Save Filename Include Timestamp	Adds a %t to the filename string signifying to the 14565B to insert the start date-time stamp in that place. <u>Enumerated Values:</u> ag14565B No (0) ag14565B Yes (1)
ag14565B Save To A File	Whether or not to save the acquisition to a file. <u>Enumerated Values:</u> ag14565B No (0) ag14565B Yes (1)
ag14565B Wait for Acquisition to Finish	Whether to wait for the acquisition to finish or stop the acquisition when it gets to this stop test step. <u>Enumerated Values:</u> ag14565B No (0) ag14565B Yes (1)

ag14565B CCDF Get Measurements

This step is used to retrieve the measurements from 14565B after a CCDF acquisition.

Properties	Description
ag14565B 0point1th Percentile Value	Value of the CCDF Graph at 0.1th Percentile
ag14565B 10th Percentile Value	Value of the CCDF Graph at 10th Percentile
ag14565B 1st Percentile Value	Value of the CCDF Graph at 1st Percentile
ag14565B Average Percentile	Percentile of the Average on the CCDF Graph
ag14565B Average Value	Value of the Average Value on CCDF Graph
ag14565B Maximum Value	Maximum Value on the CCDF Graph

Properties	Description
ag14565B Results Label	Acquisition Text Label that will be placed next to each result returned by this test step in the WTM Results table. This allows for easier parsing of the results table

ag14565B Data Logging Begin

This step is used to setup and start a Data Logging acquisition in 14565B.

Properties	Description
ag14565B Acquisition Hours Dlog	Acquisition Period Hours
ag14565B Acquisition Minutes	Acquisition Period Minutes
ag14565B Acquisition Seconds	Acquisition Period Seconds
ag14565B Dlog Integration Time	Data Logging Integration Time. See the 14565B Help File – under <i>Long-Term Data Logging</i> for more information.
ag14565B Dlog Sense Type	Acquisition Sense Type <u>Enumerated Values:</u> ag14565B Dlog Sense Type Current (0) ag14565B Dlog Sense Type Current and Voltage (1) ag14565B Dlog Sense Type Current and DVM (2)

ag14565B Data Logging End

This step is used to wait for the Data Logging acquisition to finish after a call to Data Logging Begin. When the test plan gets to this test step it can halt and display the time remaining in the acquisition at the bottom of the screen or it can stop right away. This step can also save the acquired Data Logging waveform to a file.

Properties	Description
ag14565B Save Directory	The directory where the file will be saved. This is relative to the 14565B Working Folder set under Preferences in the Keysight 14565B software. You can also specify an absolute path.
ag14565B Save Filename	The filename without the file extension of the data log to be saved.
ag14565B Save Filename Include Timestamp	Adds a %t to the filename string signifying to 14565B to insert the start date-time stamp in that place. <u>Enumerated Values:</u> ag14565B No (0) ag14565B Yes (1)
ag14565B Save To A File	Whether or not to save the acquisition to a file. <u>Enumerated Values:</u> ag14565B No (0) ag14565B Yes (1)
ag14565B Wait for Acquisition to Finish	Whether to wait for the acquisition to finish or stop the acquisition when it gets to this stop test step. <u>Enumerated Values:</u> ag14565B No (0) ag14565B Yes (1)

ag14565B Data Logging Get Measurements

This step is used to retrieve the measurements from 14565B after a Data Logging acquisition.

Properties	Description
ag14565B Average Value	Average Measurement of the Data Log waveform
ag14565B Maximum Value	Maximum Measurement of the Data Log waveform
ag14565B Minimum Value	Minimum Measurement of the Data Log waveform

Properties	Description
ag14565B Dlog Get Meas Type	The measurement type to retrieve from the Data Log waveform. Note: If the <i>ag14565B Dlog Sense Type</i> property in ag14565B Data Logging Begin is set to ag14565B Dlog Sense Type Current, you can only retrieve Current in this property. <u>Enumerated Values:</u> ag14565B Get Meas Type Current (0), ag14565B Get Meas Type Voltage (1), ag14565B Get Meas Type Power (2)
ag14565B Results Label	Text Label that will be placed next to each result returned by this test step in the WTM Results table. This allows for easier parsing of the results table.

ag14565B Data Logging Insert Event Tag

This step is used to insert an event tag into a running data log waveform. Use this to label parts of your waveform in real-time with meaningful descriptions while executing the Test Plan.

Properties	Description
ag14565B Dlog Event Tag Label	A text label for the event tag.

ag14565B Setup Power Supply

This test step sets up the 663xx power supply connected to 14565B. Call this test step before making a call to *ag14565B Data Logging Begin*, *ag14565B CCDF Begin*, or *ag14565B Waveform Capture* test steps to setup the power supply and turn on the Device Under Testing. Note that you must call this function every time you switch to a different 14565B Acquisition mode. See the property *ag14565B Acquisition Mode* below.

Properties	Description
ag14565B Acquisition Mode	Set this to the 14565B acquisition mode you plan using in the subsequent Begin/Capture test step. For example, you have to set this property to <i>ag14565B CCDF Acquisition</i> if you want to set up the power supply before calling <i>ag14565B CCDF Begin</i> test step. Similarly, you set this property to <i>ag14565B Data Logging Acquisition</i> before making a call to <i>ag14565B Data Logging Begin</i> . This is necessary because the different acquisition modes have parameters like Current Type and Current Range passed in differently. <u>Enumerated Values:</u> ag14565B Current Waveform (0) ag14565B Voltage Waveform (1) ag14565B CCDF Acquisition (2) ag14565B Data Logging Acquisition (3)
ag14565B Reset 14565B and Power Supply	Reset the power supply and the 14565B software state.
ag14565B IO Timeout	Instrument IO Timeout
ag14565B Output 1 Enabled	Set the output state of the channel. <u>Enumerated Values:</u> ag14565B No (0) ag14565B Yes (1)
ag14565B Output 1 Setup	Whether or not the output state of the channel will be changed. <u>Enumerated Values:</u> ag14565B No (0) ag14565B Yes (1)
ag14565B Output 2 Enabled	Set the output state of the channel. <u>Enumerated Values:</u> ag14565B No (0) ag14565B Yes (1)

Properties	Description
ag14565B Output 2 Setup	Whether or not the output state of the channel will be changed. <u>Enumerated Values:</u> ag14565B No (0) ag14565B Yes (1)
ag14565B Output Channel 1 Relay Mode	Set the mode of the relay of the channel. Note: The power supply has to have the

	<p>Relay option installed to set a value other than <i>ag14565B Output Relay Mode Not Available</i>.</p> <p><u>Enumerated Values:</u> ag14565B Output Relay Mode DD (0) ag14565B Output Relay Mode HD (1) ag14565B Output Relay Mode DH (2) ag14565B Output Relay Mode HH (3) ag14565B Output Relay Mode Not Available (4)</p>
ag14565B Output Channel 2 Relay Mode	<p>Set the mode of the relay of the channel. Note: The power supply has to have the Relay option installed to set a value other than <i>ag14565B Output Relay Mode Not Available</i>.</p> <p><u>Enumerated Values:</u> ag14565B Output Relay Mode DD (0) ag14565B Output Relay Mode HD (1) ag14565B Output Relay Mode DH (2) ag14565B Output Relay Mode HH (3) ag14565B Output Relay Mode Not Available (4)</p>
ag14565B Output Compensation Mode	<p>Set the compensation mode of the power supply. For more information, see the power supply manual.</p> <p><u>Enumerated Values:</u> ag14565B Output Compensation Mode LLOCAL (0) ag14565B Output Compensation Mode HLOCAL (1) ag14565B Output Compensation Mode LREMOTE (2) ag14565B Output Compensation Mode HREMOTE (3)</p>
ag14565B Output Coupling	<p>Set the output coupling on or off.</p> <p><u>Enumerated Values:</u> ag14565B No (0) ag14565B Yes (1)</p>
Properties	Description
ag14565B Prompt Output On and Turn On DUT	<p>Whether or not to show the prompts displaying the power supply settings right before Output ON and to turn on the Device Under Testing.</p> <p><u>Enumerated Values:</u> ag14565B No (0) ag14565B Yes (1)</p>
ag14565B Sense Current Range	<p>Set the sense current range.</p> <p><u>Enumerated Values:</u> ag14565B Sense Current Range High (0) ag14565B Sense Current Range Medium (1) ag14565B Sense Current Range Low (2)</p>
ag14565B Sense Current Type	<p>Set the sense current range.</p> <p><u>Enumerated Values:</u></p>

	ag14565B Sense Current Type ACDC (0) ag14565B Sense Current Type DC (1)
ag14565B Sense Protection Enabled	Enable/Disable the sense protection. <u>Enumerated Values:</u> ag14565B No (0) ag14565B Yes (1)
ag14565B Sense Window	Set the sense window. <u>Enumerated Values:</u> ag14565B No (0) ag14565B Yes (1)
ag14565B Source Channel 1 Current Limit	Channel 1 Current Limit.
ag14565B Source Channel 1 OVP Limit	Channel 1 OVP Limit.
ag14565B Source Channel 1 Resistance Value	Channel 1 Resistance Level. Set this property to <i>ag14565B</i> Yes if this channel has resistance capability.
ag14565B Source Channel 1 Resistance Capability	Whether or not this channel has resistance capability. <u>Enumerated Values:</u> ag14565B No (0) ag14565B Yes (1)
ag14565B Source Channel 1 Voltage Level	Channel 1 Voltage Level.
ag14565B Source Channel 2 Current Limit	Channel 2 Current Limit.
ag14565B Source Channel 2 Voltage Level	Channel 2 Voltage Level.

ag14565B Waveform Capture

This step sets up and starts a Current or Voltage Waveform in 14565B. You may set an instantaneous or a triggered waveform.

Properties	Description
ag14565B Waveform Mode	Voltage or Current Waveform capture mode in 14565B. <u>Enumerated Values:</u> ag14565B Current Waveform (0) ag14565B Voltage Waveform (1)
ag14565B Capture Length	The time of the captured waveform. This value determines the rate and number of points. The max rate is 64kHz and the max points are 4096. <u>Enumerated Values:</u> ag14565B Capture Length 600 us (0) ag14565B Capture Length 1200 us (1) ag14565B Capture Length 3000 us (2) ag14565B Capture Length 6 ms (3) ag14565B Capture Length 12 ms (4) ag14565B Capture Length 30 ms (5)

	ag14565B Capture Length 60 ms (6) ag14565B Capture Length 120 ms (7) ag14565B Capture Length 300 ms (8) ag14565B Capture Length 600 ms (9) ag14565B Capture Length 1200 ms (10) ag14565B Capture Length 3000 ms (11) ag14565B Capture Length 6 s (12) ag14565B Capture Length 12 s (13) ag14565B Capture Length 24 s (14)
ag14565B Trigger Delay	Set the position of the pre-trigger based on the total capture length. The delay is the percentage of the capture length. For example, if the ag14565B Capture Length was set to 30 ms and ag14565B Trigger Delay was set to 10, the pre-trigger would be set at 3ms before t = 0 (30ms * 10%).
ag14565B Trigger Hysteresis	The hysteresis value of the level trigger.
ag14565B Trigger Level	The level of the trigger.
ag14565B Trigger Mode	The trigger mode. <u>Enumerated Values:</u> ag14565B Auto Trig (0) ag14565B Positive Slope (1) ag14565B Negative Slope (2) ag14565B Either Slope (3) ag14565B External (4)

ag14565B Waveform Get Measurements

Retrieve the measurements from 14565B after a Waveform Capture.

Properties	Description
ag14565B Average Value	Average Measurement of the waveform.
ag14565B High Value	High Measurement of the waveform.
ag14565B Low Value	Low Measurement of the waveform.
ag14565B Maximum Value	Maximum Measurement of the waveform.
ag14565B Minimum Value	Minimum Measurement of the waveform.

Properties	Description
ag14565B Results Label	Text Label that will be placed next to each result returned by this test step in the WTM Results table. This is to allow for easier parsing of the results table.
ag14565B Save Directory	The directory where the file will be saved. This is relative to the 14565B Working Folder set under Preferences in the Keysight 14565B software. You can also specify an absolute path.
ag14565B Save Filename	The filename without the file extension of the waveform to be saved.
ag14565B Save Filename Include Timestamp	Adds a %t to the filename string signifying to 14565B to insert the start date-time stamp in


6 Maintenance

	that place. <u>Enumerated Values:</u> ag14565B No (0) ag14565B Yes (1)
ag14565B Save To A File	Whether or not to save the acquisition to a file. <u>Enumerated Values:</u> ag14565B No (0) ag14565B Yes (1)

Test Step Examples

Example #1

Set the power supply to 3.6V, set the cell phone to some state, and measure current for 45 seconds. Get the average current. Save the entire 5 minute waveform for later analysis.



Current test plan steps:	
ag14565B Setup Power Supply	
GPRS 	
ag14565B Data Logging Begin	
ag14565B Data Logging End	
ag14565B Data Logging Get Measurements	

Properties

The properties of the test steps are as follows. Note that the default test step properties are not shown.

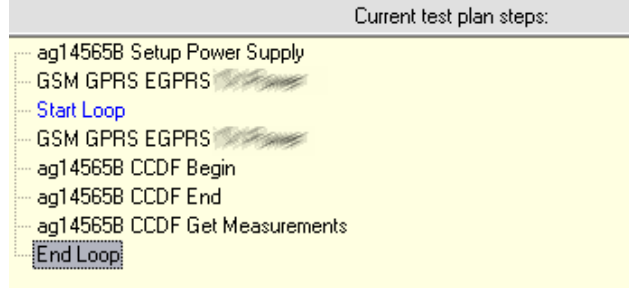
Properties	Description
ag14565B Setup Power Supply	Acquisition Mode: Data Logging Reset: Yes Output 1 Enabled: Yes Output 1 Setup: Yes Output 1 Voltage Lev.: 3.6 V
GPRS (or other cell phone state command)	Turn on the phone and set it to some state.
ag14565B Data Logging Begin	Acquisition Seconds: 45 seconds Integration Time: 5 ms Sense Type: Current
ag14565B Data Logging End	Wait for Acquisition to finish: Yes Save to a file: Yes
ag14565B Data Logging Get Measurements	Dlog Get Meas Type: Current

Results

Test Title	Measured Value
[Setting up 663xx Power Supply Connected to 14565B for a Data Logging Acquisition.]	
Power Supply Settings: Output 1 Enabled (3.6V, Max Current Limit).	
✓ GPRS 	
[Current Data Logging Acquisition Started. Acquisition Length: 00:00:45 Start Local Time: 1:49:02 PM.]	
[Waiting for Data Logging to finish: 00:00:45. Wait start Local Time: 1:49:02 PM.]	
Finished Waiting Local Time: 1:49:49 PM.	
Saved Data Logging to directory: [Saved Data] file: [My Data %t].	
[Current Data Logging Acquisition Measurements. Local Time: 1:49:49 PM.]	
✓ Current Data Logging Minimum	-0.0002
✓ Current Data Logging Average	0.0844
✓ Current Data Logging Maximum	0.3142

Example #2

Set the power supply to 3.6V and set the cell phone to some state. Start a loop that will iterate 10 times over some parameter in a cell phone. Measure current for 35 seconds during each loop iteration and get the average current.



Properties

The properties of the test steps are as follows. Note that the default test step properties are not shown.

Properties	Description
ag14565B Setup Power Supply	Acquisition Mode: CCDF Reset: Yes Output 1 Enabled: Yes Output 1 Setup: Yes Output 1 Voltage Lev.: 3.6 V
GPRS (or other cell phone state command)	Turn on the phone and set it to some state
Start Loop	Loop 10 times, possibly change a cell phone state
GPRS (or other cell phone state command)	Change some cell phone state
ag14565B CCDF Begin	Acquisition seconds: 35 seconds Sense type: Current
ag14565B CCDF End	Wait for Acquisition to finish: Yes Save to a file: No
ag14565B CCDF Get Measurements	Display the current measurements
End Loop	

Results

Test Title	Measured Value	Lower Limit	Upper Limit
[Setting up 663xx Power Supply Connected to 14565B for a Data Logging Acquisition.]			
Power Supply Settings: Output 1 Enabled (3.6V, Max Current Limit).			
✓ GPRS			
Repeat = 0			
✓ GPRS			
[Current CCDF Acquisition Started. Acquisition Length: 00:00:35 Start Local Time: 2:03:32 PM.]			
[Waiting for CCDF Acquisition to finish: 00:00:35. Wait start Local Time: 2:03:32 PM.]			
Finished Waiting Local Time: 2:04:10 PM.			
[CCDF Acquisition Measurements. Local Time: 2:04:10 PM.]			
✓ CCDF Average	0.0877	None	None
✓ CCDF Maximum	0.3142	None	None
✓ CCDF Average Percentile	40.1 Percent	None	None
✓ CCDF Value of 10th Percentile	0.2467	None	None
✓ CCDF Value of 1st Percentile	0.2849	None	None
✓ CCDF Value of 0.1th Percentile	0.3059	None	None
Repeat = 1			
✓ GPRS			
[Current CCDF Acquisition Started. Acquisition Length: 00:00:35 Start Local Time: 2:04:11 PM.]			
[Waiting for CCDF Acquisition to finish: 00:00:35. Wait start Local Time: 2:04:11 PM.]			
Finished Waiting Local Time: 2:04:49 PM.			
[CCDF Acquisition Measurements. Local Time: 2:04:49 PM.]			
✓ CCDF Average	0.1057	None	None
✓ CCDF Maximum	0.3652	None	None
✓ CCDF Average Percentile	50.0 Percent	None	None
✓ CCDF Value of 10th Percentile	0.2445	None	None
✓ CCDF Value of 1st Percentile	0.2770	None	None
✓ CCDF Value of 0.1th Percentile	0.2943	None	None
Repeat = 2			
✓ GPRS			
[Current CCDF Acquisition Started. Acquisition Length: 00:00:35 Start Local Time: 2:04:50 PM.]			
[Waiting for CCDF Acquisition to finish: 00:00:35. Wait start Local Time: 2:04:50 PM.]			
Finished Waiting Local Time: 2:05:28 PM.			
[CCDF Acquisition Measurements. Local Time: 2:05:28 PM.]			
✓ CCDF Average	0.0227	None	None
✓ CCDF Maximum	0.1522	None	None
✓ CCDF Average Percentile	19.0 Percent	None	None
✓ CCDF Value of 10th Percentile	0.0897	None	None
✓ CCDF Value of 1st Percentile	0.1232	None	None
✓ CCDF Value of 0.1th Percentile	0.1250	None	None

Example #3

Set the power supply to 3.6V and set the cell phone to some state. Change the cell phone state and capture a 600ms current waveform when the current level goes above exactly 200 mA.





Current test plan steps:
ag14565B Setup Power Supply
GSM GPRS EGPRS
ag14565B Waveform Capture
GSM GPRS EGPRS
ag14565B Waveform Get Measurements

Properties

The properties of the test steps are as follows. Note that the default test step properties are not shown.

Properties	Description
ag14565B Setup Power Supply	Acquisition Mode: CCDF Reset: Yes Output 1 Enabled: Yes Output 1 Setup: Yes Output 1 Voltage Lev.: 3.6 V
GPRS (or other cell phone state command)	Turn on the phone and set it to some state
ag14565B Waveform Capture	Waveform Mode: Current Waveform Capture Length: 600 ms Trigger Hysteresis: 0.01 A Trigger Level: 0.2 A Trigger Mode: Positive slope
GPRS (or other cell phone state command)	Change some cell phone state
ag14565B Waveform Get Measurements	Display the current measurements

Results

Test Title	Measured Value
[Setting up 663xx Power Supply Connected to 14565B for a Data Logging Acquisition.]	
Power Supply Settings: Output 1 Enabled (3.6V, Max Current Limit).	
✓ GPRS 	
[Starting Current Waveform Capture. Capture + I/O Transfer Timeout: 13138 ms Start Local Time: 2:...	
Trigger: Positive Slope. Trigger Delay (Percent of Capture Time): 0. Trigger Level: 0.2. Trigger Hyste...	
✓ GPRS 	
Waveform Capture Measurements:	
✓ Waveform Minimum	0.0004
✓ Waveform Low	0.1036
✓ Waveform Average	0.1101
✓ Waveform High	1.0453
✓ Waveform Maximum	1.0453

Test Step Example Using the Keysight Wireless Test Manager

This section is intended for users who plan to write new test steps for use with the Keysight 14565B.

To show an example of how the Keysight 14565B would be used in a test steps, we will create a new test class module using the Keysight Add Wireless Test wizard. Name the new test class module “Agilent14565BSteps” and the new test step “DataLoggingStart”. This will create the source file Agilent14565BSteps.vb and the function named DataLoggingStart. The source code for Agilent14565BSteps.vb is as follows:

Program Code

```
'© Copyright 2006 Keysight Technologies, Inc.
```

```
Option Strict On
Option Explicit On
```

```
Friend Class Agilent14565BSteps
```

```
' WIZARD GENERATED CLASS, DO NOT REMOVE THIS LINE
```

```
Private TestData As Agilent.WTM.Exec.IExecTestData
Private Message As Agilent.WTM.Exec.IExecTextMessage
Private FlowControl As Agilent.WTM.Exec.IExecFlowControl
Private DataLogging As Agilent.WTM.Exec.IExecDataLogging
Private ExecUtils As Agilent.WTM.Exec.IExecUtilities
Private DUTControl As Agilent.WTM.Exec.IExecDutControl
Private FixtureControl As Agilent.WTM.Exec.IExecFxtControl
Private LoopingControl As Agilent.WTM.Exec.IExecLooping
Private PathOffset As Agilent.WTM.Exec.IExecPathOffset
Private LocalApplication As Agilent.WTM.Exec.IExecLocalizeApp
Private ag14565B As Agilent.WTM.ag14565BMoM.ag14565BControl
```

```
Friend Sub Resource(ByRef VDataExec As Agilent.WTM.Exec.ExecControl, ByRef
VDataInstruments As SortedList)
```

```
.....
'
' Original Date: 8/8/2006 11:37:52 AM
' Revision Date:
'
' Author: Keysight
'
' Description:
' This method must be called by the application program.
' For example: cdmaCallProcessing.Resource Exec, Instruments
' For example: cdmaCallProcessing.Resource Exec, Instruments
'
.....
```

```
.....
TestData = VDataExec.WTMTestData
Message = VDataExec.WTMTextMessage
FlowControl = VDataExec.WTMFlowControl
DataLogging = VDataExec.WTMDataLogging
ExecUtils = VDataExec.WTMUtilities
DUTControl = VDataExec.WTMDUTControl
FixtureControl = VDataExec.WTMFixtureControl
LoopingControl = VDataExec.WTMLoopingControl
PathOffset = VDataExec.WTMPathOffset
LocalApplication = VDataExec.WTMLocalizeApplication
ag14565B = DirectCast(VDataInstruments.Item("ag14565B"),
Agilent.WTM.ag14565BMoM.ag14565BControl)
```

```
End Sub
```

```
Protected Overrides Sub Finalize()
```

```
MyBase.Finalize()
```

```
End Sub
```

```
Public Sub DataLoggingStart()
```

```
.....
```

```

'
' Original Date: 8/8/2006 11:37:52 AM
' Revision Date:
' Revision: 1.0
' Author: Keysight
'
' Test Description:
'     This step begins data logging.
'
' WIZARD GENERATED COMMENTS BELOW, DO NOT MODIFY
'
' Test Name: Data Logging Start
' Test Class Name: Agilent14565BSteps
' Test Group: Keysight 14565B
' Format Standard: All
'
' Parameters Used:
'     Name: Sense Type
'         Units:
'         DataType: OOM or Integer Enum
'         Default Value: Current
'         Range: Current (0), Current and Voltage (1), Current and DVM (2)
'     Name: Integration Time
'         Units:
'         DataType: Double
'         Default Value: .005
'         Range: .005 to 1
'     Name: Seconds
'         Units:
'         DataType: Integer
'         Default Value: 35
'         Range:
'     Name: Minutes
'         Units:
'         DataType: Integer
'         Default Value: 0
'         Range:
'     Name: Hours
'         Units:
'         DataType: Integer
'         Default Value: 0
'         Range:
'

```

```

.....

' Dimension parameters
Dim SenseType As Integer
Dim IntegrationTime As Double
Dim Seconds As Integer
Dim Minutes As Integer
Dim Hours As Integer

Try
    ' Find the parameter values from the data store
    With TestData
        SenseType = .FindParmEnum("Sense Type")
        IntegrationTime = cDbl(.FindParm("Integration Time"))
        Seconds = cInt(.FindParm("Seconds"))
        Minutes = cInt(.FindParm("Minutes"))
        Hours = cInt(.FindParm("Hours"))
    End With

```



```

If Not FlowControl.RepeatingTest Then

End If
'This section would probably be done in another step
'The code is here to provide more function call examples
'Reset, Set Channel 1 = 3.6V, Max Curr, Output On
ag14565B.Utility.Reset()

ag14565B.Source.SetVoltageLevel(Agilent.WTM.ag14565BMoM.ag14565BChannelEnum.ag145
65BChannell1, 3.6)

ag14565B.Source.SetCurrentLimit(Agilent.WTM.ag14565BMoM.ag14565BChannelEnum.ag145
65BChannell1, ag14565B.Utility.QueryCurrentLimitMax())

ag14565B.Output.SetEnabled(Agilent.WTM.ag14565BMoM.ag14565BChannelEnum.ag14565BCh
annell1, True)

' Pause and turn on dut

ag14565B.Measurement.Dlog.SetupDlogAcq(CType(SenseType,
Agilent.WTM.ag14565BMoM.ag14565BDlogSenseTypeEnum), Hours, Minutes, Seconds,
IntegrationTime)
ag14565B.Measurement.StartMeasurement()
TestData.PrintMessage("Data Logging Started")
' Initiate the measurement
' TODO: Add code to initiate the measurement here
'Fetch and Compare measurement results to the given specification

' ..
' TODO: Make Measurements here using the following objects:
'   TestData
'   Message
'   FlowControl
'   DataLogging
'   Utilities
'   DUTControl
'   FixtureControl
'   and the appropriate COM objects for Methods of Measurement or
PnP drivers
' ..

Catch ex As Exception
  TestData.LogErrorMessage(SAMUtils.ParseErrLN(ex))
  FlowControl.AbortTestPlan = True
End Try

End Sub
End Class

```

Analysis

The main thing to note here is how to convert test parameters picked from the WTM GUI to enumerated parameters used in the 14565B function calls. For example, one of the test parameters is Sense Type. In the Keysight Add Wireless Test wizard, this parameter was setup to be OOM with driver enum (which stands for One of Many, with a numerical meaning behind every choice). The choices look like this:

```
'      Name: Sense Type
'      Units:
'      DataType: OOM or Integer Enum
'      Default Value: Current
'      Range: Current (0), Current and Voltage (1),
Current and DVM (2)
```

In the beginning of the DataLoggingStart function you can see the Sense Type parameter being assigned to a local integer variable using the following code:

```
SenseType = .FindParmEnum("Sense Type")
```

A few lines down is the function call to set up data logging. The code is as follows:

```
ag14565B.Measurement.Dlog.SetupDlogAcq(CType(SenseType,
Agilent.WTM.ag14565BMoM.ag14565BDlogSenseTypeEnum), Hours,
Minutes, Seconds, IntegrationTime)
```

The first parameter of SetupDlogAcq() is an enum type named Agilent.WTM.ag14565BMoM.ag14565BDlogSenseTypeEnum. In order to pass SenseType as the first argument of the function call, you have to cast it to the enum type. This is done using the CType call:

```
CType(SenseType,
Agilent.WTM.ag14565BMoM.ag14565BDlogSenseTypeEnum)
```

For this to work properly, Sense Type has to be an integer-storing type (int, long, short) and have its values correspond to the enum type values. This means that when adding a OOM parameter to a Test Step, you should refer to the definition of the enum the parameter will represent. Look in the Automation Interface Help for the list of enumerations.

So in this case, when adding Sense Type OOM parameter, you look at ag14565BdlogSenseTypeEnum:

```
typedef enum { ag14565BDlogCurr = 0,
ag14565BDlogCurrVolt, ag14565BDlogCurrDVM }
ag14565BDlogSenseTypeEnum;
```

and have the Sense Type OOM parameter represent the same values as the enum (Current = 0, Current & Volt = 1, Current & DVM = 2).

Index

A		H	
Add instrument Control	13	history	3
ag14565B CCDF Begin	19		
ag14565B CCDF End	19	I	
ag14565B CCDF Get Measurements	20	insert event tag test.....	27
ag14565B Data Logging Begin	20	interface wrapper	5
ag14565B Data Logging End	21		
ag14565B Data Logging Get Measurements..	22	O	
ag14565B Data Logging Insert Event Tag	22	OOM.....	35
ag14565B Setup Power Supply.....	23		
ag14565B Waveform Capture	25	P	
ag14565B Waveform Get Measurements	26	print-date.....	3
automation interface	5		
		S	
		source code	32
		T	
		test parameters	35
		test steps	5, 11, 18
		V	
		Visual Studio 2003.....	7
		Visual Studio 2005.....	7
		W	
		web URL's.....	5
		wireless test manager	5

