

Keysight ZA0060A Custom IoT Device Functional Test Solution

Notices

Copyright Notice

© Keysight Technologies 2020

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 as governed by United States and international copyright laws.

Trademarks

Bluetooth® and the *Bluetooth®* logos are trademarks owned by *Bluetooth®* SIG, Inc., U.S.A. and licensed to Keysight Technologies, Inc.

Manual Part Number

ZA0060-90000

Edition

Edition 3, October 2020

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.

Declaration of Conformity

Declarations of Conformity for this product and for other Keysight products may be downloaded from the Web. Go to <http://www.keysight.com/go/conformity>. You can then search by product number to find the latest Declaration of Conformity.

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 <http://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.

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 FOR 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

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 are fully understood and met.

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.

Safety Symbols

The following symbols on the instrument and in the documentation indicate precautions which must be taken to maintain safe operation of the instrument.

| | | | |
|---|--|---|--|
|  | Standby supply. Unit is not completely connected from AC mains when switched off |  | Alternating current (AC) |
|  | Protective earth (ground) terminal |  | Caution, risk of danger (refer to this manual for specific Warning or Caution information) |
|  | Frame or chassis (ground) terminal | | |

Safety Considerations

Read the information below before using this instrument.

The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards for design, manufacture, and intended use of the instrument. Keysight Technologies assumes no liability for the customer's failure to comply with these requirements.

General

Do not use this product in any manner not specified by the manufacturer. The protective features of this product may be impaired if it is used in a manner not specified in the operation instructions.

Before Applying Power

Verify that all safety precautions are taken. Make all connections to the unit before applying power and select the appropriate power line voltage on the fuse module.

Ground the Instrument

This product is provided with protective earth terminals. To minimize shock hazard, the instrument must be connected to the ac power mains through a grounded power cable, with the ground wire firmly connected to an electrical ground (safety ground) at the power outlet. Any interruption of the protective (grounding) conductor or disconnection of the protective earth terminal will cause a potential shock hazard that could result in personal injury.

Do Not Operate in an Explosive Atmosphere

Do not operate the instrument in the presence of flammable gases or fumes.

Do Not Remove the Instrument Cover

Only qualified, service-trained personal who are aware of the hazards involved should remove instrument covers. Always disconnect the power cable and any external circuits before removing the instrument cover.

Do Not Modify the Instrument

Do not install substitute parts or perform any unauthorized modification to the product. Return the product to a Keysight Sales and Service Office for service and repair to ensure that safety features are maintained.

In Case of Damage

Instruments that appear damaged or defective should be made inoperative and secured against unintended operation until they can be repaired by qualified service personnel.

Environmental Conditions

The ZA0060A is designed for indoor use and in an area with low condensation. The table below shows the general environmental requirements for this instrument.

| Environmental condition | Requirement |
|-------------------------|--|
| Temperature | Operating condition 0 to 40 °C |
| | Storage condition –40 to 70 °C |
| Humidity | Operating condition – Up to 80% RH at 40°C (non-condensing) |
| | Storage condition – Up to 95% RH at 40°C (non-condensing) |
| Altitude | Up to 2000 m |
| Pollution degree | 2 |

Safety and Regulatory Information

The ZA0060A complies with the following safety and Electromagnetic Compatibility (EMC) regulations:






Safety compliance

- IEC 61010-1/EN 61010-1; IEC 61010-2-030/EN61010-2-030
- Canada: CAN/CSA-C22.2 No.61010-1-12; CAN/CSA-C22.2 No. 61010-2-030-12
- USA: ANSI/UL Std. No. 61010-1; ANSI/UL Std No.61010-2-030

EMC regulation

- IEC 61326-1/EN 61326-1
- Canada: ICES/NMB-001
- Australia/New Zealand: AS/NZS CISPR 11

Regulatory Markings

|  | The CE mark is a registered trademark of the European Community. This CE mark shows that the product complies with all the relevant European Legal Directives. | | |
|---|---|-------------|---|
|  | The RCM mark is a registered trademark of the Spectrum Management Agency of Australia. This signifies compliance with the Australia EMC Framework regulations under the terms of the Radio Communication Act of 1992. | | |
| ICES/NMB-001 | ICES/NMB-001 indicates that this ISM device complies with the Canadian ICES-001. Cet appareil ISM est conforme a la norme NMB-001 du Canada. | | |
|  | This symbol indicates the time period during which no hazardous or toxic substance elements are expected to leak or deteriorate during normal use. Forty years is the expected useful life of the product. | | |
|  | This instrument complies with the WEEE Directive (2002/96/EC) marking requirement. This affixed product label indicates that you must not discard this electrical or electronic product in domestic household waste. | | |
|  | This symbol is a South Korean Class A EMC Declaration, with product identification code R-R-Kst-GM20714. | | |
| | This equipment is suitable for professional use and is for use in electromagnetic environment outside of the home. | | |
| | South Korean Class A EMC Declaration | | |
| | A 급 기기 (업무용 방송통신기자재) | | |
| | Information to the user: This equipment has been conformity assessed for use in business environments. In a residential environment this equipment may cause radio interference. | | |
| | <table><tr><th>사 용 자 안 내 문</th></tr><tr><td>이 기기는 업무용 환경에서 사용할 목적으로 적합성평가를 받은 기기로서 가정용 환경에서 사용하는 경우 전파간섭의 우려가 있습니다.</td></tr></table> | 사 용 자 안 내 문 | 이 기기는 업무용 환경에서 사용할 목적으로 적합성평가를 받은 기기로서 가정용 환경에서 사용하는 경우 전파간섭의 우려가 있습니다. |
| 사 용 자 안 내 문 | | | |
| 이 기기는 업무용 환경에서 사용할 목적으로 적합성평가를 받은 기기로서 가정용 환경에서 사용하는 경우 전파간섭의 우려가 있습니다. | | | |

Waste Electrical and Electronic Equipment (WEEE) Directive 2002/96/EC

This instrument complies with the WEEE Directive (2002/96/EC) marking requirement. This affixed product label indicates that you must not discard this electrical or electronic product in domestic household waste.

Product category

With reference to the equipment types in the WEEE directive Annex 1, this instrument is classified as a “Monitoring and Control Instrument” product.

The affixed product label is as shown below.



Do not dispose in domestic household waste.

To return this unwanted instrument, contact your nearest Keysight Service Center, or visit <http://about.keysight.com/en/companyinfo/environment/takeback.shtml> for more information.

Sales and Technical Support

To contact Keysight for sales and technical support, refer to the support links on the following Keysight websites:

- www.keysight.com/find/X8711A
(product-specific information and support, software and documentation updates)
- www.keysight.com/find/assist
(worldwide contact information for repair and service)

Table of Contents

| | |
|--|----|
| Safety Symbols | 3 |
| Safety Considerations | 4 |
| Environmental Conditions | 6 |
| Safety and Regulatory Information | 7 |
| Safety compliance | 7 |
| EMC regulation | 7 |
| Regulatory Markings | 8 |
| Waste Electrical and Electronic Equipment (WEEE) Directive | |
| 2002/96/EC | 9 |
| Product category | 9 |
| Sales and Technical Support | 10 |
| Introduction | 13 |
| To Prepare Instruments for Use | 14 |
| Equipment requirements | 14 |
| Software requirements | 14 |
| Hardware Configuration | 15 |
| Software Installation | 17 |
| TAP and Measurement Suite License Redemption | 19 |
| TAP and Measurement Suite License Installation | 22 |
| Node-Locked License | 22 |
| USB Portable License | 23 |
| Getting Started: Zigbee Signaling Test Plan | 29 |
| Getting Started: <i>Bluetooth</i> [®] 5 Signaling Test Plan | 35 |
| <i>Bluetooth</i> [®] 5 Signaling PER Sensitivity Search Test Plan | 43 |
| <i>Bluetooth</i> [®] 5 UUID Read Write Tests | 46 |
| Getting Started: WLAN Signaling Test Plan | 48 |
| WLAN Signaling PER Sensitivity Search Test Plan | 53 |
| WLAN Access Point Device Discovery | 53 |
| Troubleshooting Procedure and Error Messages | 54 |

| | |
|--|----|
| Unit is Inoperative | 54 |
| No Valid Radio Options License Found | 54 |
| COM Port Error | 55 |
| COM Port Not Listed | 55 |
| Keysight 34999B Not Detected in Device Manager | 56 |
| Keysight 34972A Not Detected in Keysight IO Library | 56 |
| Incorrect Slot for 34999B | 56 |
| 34972A Connectivity Error | 57 |
| Test Plan Execution Error Messages | 58 |
| Could Not Create '<Test Step>': License Required: KS8330XA | 58 |
| 34972A Front Panel Annunciator Turn On | 58 |
| Fail Self Test Status | 58 |

Keysight ZA0060A

Custom IoT Device Functional Test Solution Quick Start Guide

Introduction

The Keysight ZA0060A is a custom solution based on the X8711A IoT device functional test solution. It is an over-the-air signaling tester that enables you to test your IoT device's transmitter and receiver easily and effectively. It is as simple as placing your device into a shield box and running the software test plans to get the transmitter and receiver test results in seconds!

With ZA0060A, you can now extend your test coverage for *Bluetooth*® 5 and Zigbee® 3.0, on top of the existing *Bluetooth*® Low Energy 4.2 and WLAN 802.11b/g/n.

This Quick Start Guide is designed to guide you through the hardware and software setup for the ZA0060A solution before introducing the features and capabilities of the Zigbee 3.0 and *Bluetooth*® 5 measurement suites. You can create and customize your test plan according to your test requirement.



To Prepare Instruments for Use

Equipment requirements

- Keysight 34972A LXI Data Acquisition / Switch Unit
- Keysight 34999B RF Module
- Power cord
- 34999-60009 USB cables Type A/B
- 34999-60011 USB cables Type A/Micro B
- RF cable*
- Shield box*
- Device under test (DUT)*

NOTE

* These accessories are not included in the ZA0060A Custom IoT device functional test solution.

Software requirements

- Keysight License Manager version 5.2 or above

NOTE

For those who are using USB portable license, download and install Keysight License Manager 6 at www.keysight.com/find/KLM6.

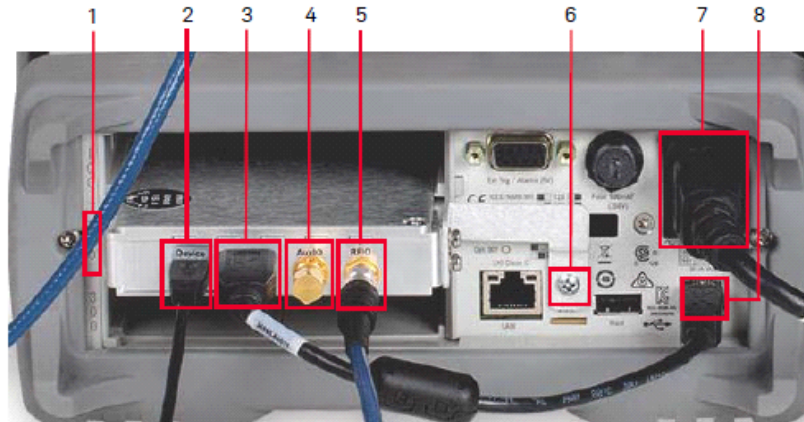
- Keysight IO Libraries Suite version 18.0 or above
- Keysight Test Automation Platform (TAP) Software version 8.7
 - KS8400A TAP Developer's System or KS8000A TAP Deployment System
- Keysight 34999 Utility software version 2.1 or above

NOTE

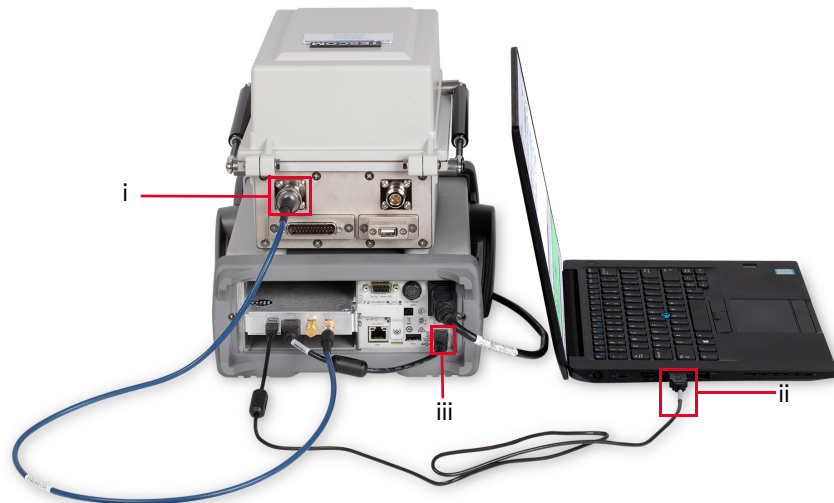
The KS8400A TAP Developer's System will install Keysight License Manager if not already installed.

Hardware Configuration

- 1 Attach the L locking bracket to the 34999B module and insert them into **1 (slot 200)**. Ensure that you have tightened the L locking bracket with a screw on **6 (Chassis Ground Screw)**.



- 2 Connect the following cables with reference to the image below.



- i **RF cable** from the **5 (RFIO Port)** of 34999B module to the back of the shield box. Do not remove the terminator at **4 (AuxIO Port)**.

- ii **34999-60009** USB cable from **2 (Micro-USB Port)** of 34999B to PC.
- iii **34999-60011** USB cable from **3 (USB Port)** to **8 (USB Interface Connector)** of the 34999B RF module.

NOTE

The input power measurement range of the ZA0060A low power WLAN option is from -4 to -44 dBm at the RFIO port. WLAN devices can transmit at higher power up to +36 dBm. Even after considering the path loss of cable/shield box, the input power to the tester RFIO port may still be above the tester power range. An external attenuator may be required to connect to the RFIO port to reduce input power to within the tester power range

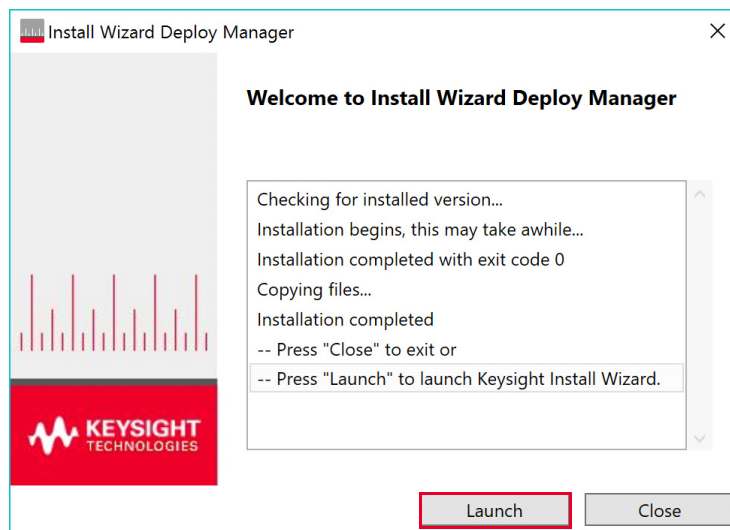
Keysight offers a variety of fixed attenuators (such as the 8493A/B/C) to choose based on the output power of your device.

- 3** Refer to **ZA0060-90001** for instructions to set up the multi-up configuration.
- 4** Plug in the power cord to **7 (Power Line Fuse Holder Assembly)** and then to the source of electricity.
- 5** Download and install the software listed in the next section, then power on the 34972A. Allow 15 seconds after powering on the 34972A for your PC to detect the instrument and its VISA address.

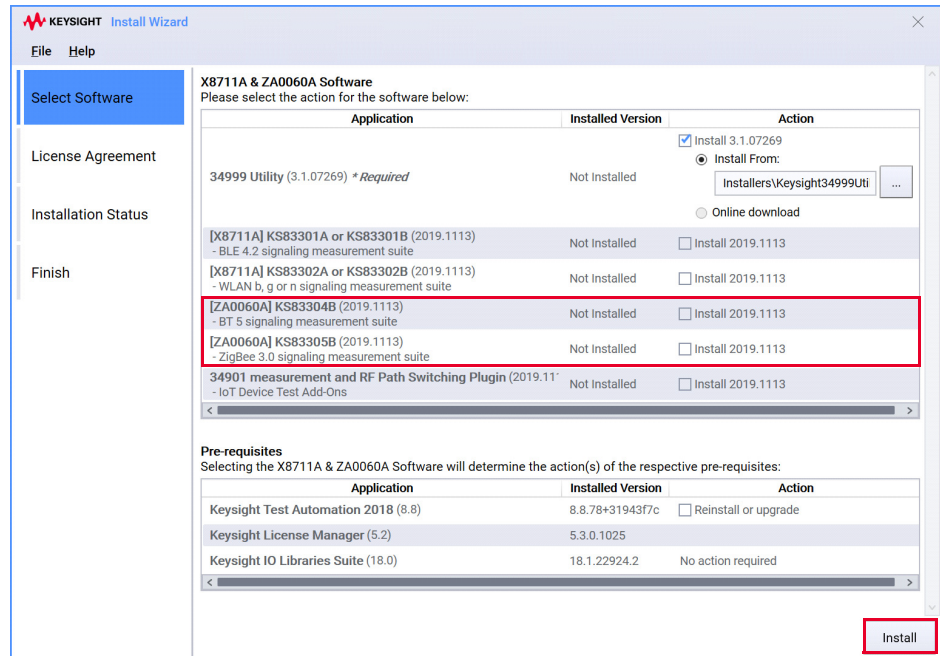
Software Installation

The Install wizard is a centralized application that contains necessary installers and software packages for the ZA0060A solution. Download the latest Install wizard to access the new releases of the software packages.

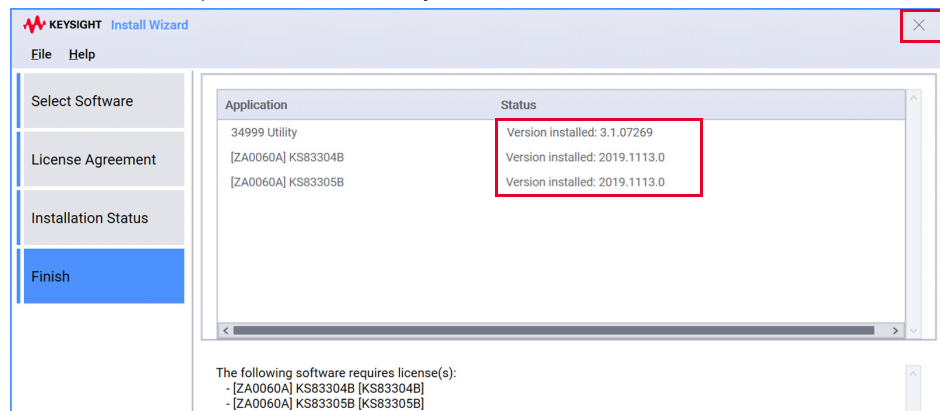
- 1 Download and install the X8711A & ZA0060A Install wizard from www.keysight.com/find/ZA0060A-installwizard.
- 2 Follow the on-screen instructions and click **Finish** to complete installation.
- 3 Click **Launch** when you see the pop-up below.



- 4 Select the **Install 2019.1113** check boxes to install the desired measurement suites and software prerequisites in the 'Action' column as shown below. The 34999 Utility application is a compulsory software and will be selected by default when it is not installed in your PC.



- 5 When the status reflects the latest version installed, you may close the Install wizard. Next, proceed to redeem your licenses.

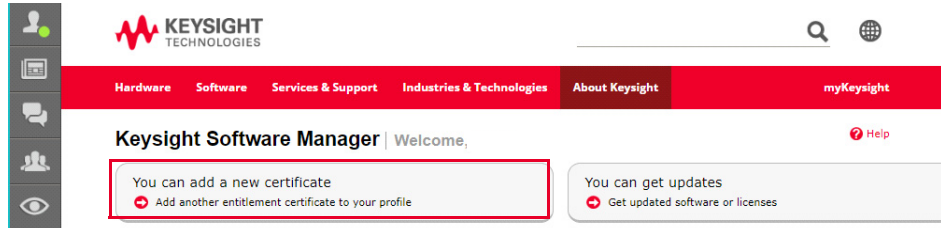


TAP and Measurement Suite License Redemption

NOTE

Go to **TAP and Measurement Suite License Installation** section if you have redeemed your licenses based on the instructions in the following certificates.

- 1 Refer to the email or printed **Keysight License Entitlement Certificate** for instructions on how to redeem your license.
- 2 Log in to Keysight Software Manager (KSM) using your myKeysight account at www.keysight.com/find/softwaremanager. First time users need to create a new account and add the Keysight Software Manager capability.
- 3 Click **You can add a new certificate**.



- 4 Enter the **Order Number** and **Certificate Number** from your Keysight License Entitlement Certificate. Click **Continue**.

Enter your certificate information

| Order Number | <input type="text"/> | ? | Certificates already in your profile: | | | | |
|--------------------|----------------------|---|---|--------------|--------------------|--|--|
| Certificate Number | <input type="text"/> | ? | <table border="1"> <thead> <tr> <th>Order Number</th> <th>Certificate Number</th> </tr> </thead> <tbody> <tr> <td> </td> <td> </td> </tr> </tbody> </table> | Order Number | Certificate Number | | |
| Order Number | Certificate Number | | | | | | |
| | | | | | | | |

- 5 Review the summary of the licenses on your certificate and click **Add Certificate**. You should see a confirmation message indicating that you have successfully added the certificate.
- 6 When you see the selection below, click **Yes** followed by **OK** to redeem your licenses.

Do you want to get your licenses now?

- ☒ Yes
☐ No, I will get them later.

OK

- 7 Select a host to assign your licenses. Depending on the type of license(s) purchased, you are required to provide any one of the following information.

Assign licenses to hosts, then click **Continue** to proceed.

Select the host to assign licenses to

Add a new host...

Enter new host information: [How do I find my Host ID?](#)

Keysight License Manager Host ID :

Copy/Paste the Host ID from the Keysight License Manager (e.g. PCSERNO,1J65329737 or E5080A,1J65329737)

- a For node-locked licenses, click **Add a new host** and enter the Host ID from the Keysight License Manager.
 - b For floating licenses, click **Add a new MAC Address host** and enter the MAC address of your server.
 - c For USB portable licenses, click **Add a new USB Portable FlexNet ID host** and enter the Flexnet ID printed on the USB dongle.
- 8 Select the license to assign to the specific Host ID and click **Assign Licenses**. Review the details and click **Continue**.

Select the host to assign licenses to

Keysight License Manager Host ID: PCSERNO,AF67678628

| | | | |
|-------------------------------------|---|---|---|
| <input checked="" type="checkbox"/> | KS83304B-1FP R-X5Q-001-A Bluetooth 5 and BLE 4.2 Signaling Measurement Suite, node-locked perpetual license | 3 | 1 |
|-------------------------------------|---|---|---|

Assign Licenses

Assigned licenses:

- 9 You should see a page below. Click **Yes** to assign more license(s) to other hosts. Otherwise, click **No** and followed by **Continue**.

The screenshot shows a software window titled "Assigned Licenses:". Inside, there is a table with one row containing the text "Keysight License Manager Host ID: PCSEBNO, AF67678628 KS83304B-1FP R-X5Q-001-A Bluetooth 5 and BLE 4.2 Signaling Mea..." and "(Quantity 1)". Below the table, it says "(You still have licenses available.)". Then, it asks "Do you want to assign more licenses to hosts now?" with two radio buttons: "Yes" (unselected) and "No, I will assign these later." (selected). At the bottom, there are three buttons: "< Back" (disabled), "Cancel" (disabled), and "Continue >" (highlighted with a red border).

- 10 Enter your email address and click **Submit**. You should receive an email shortly.

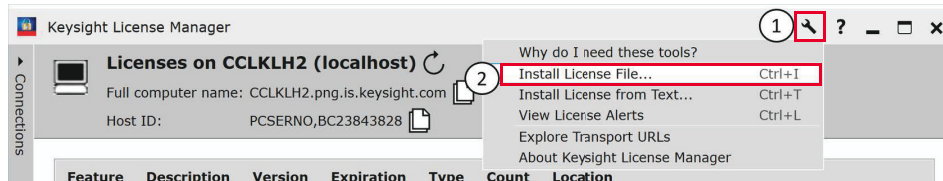
NOTE

For more information, view the [Keysight Software Manager Help File](#).

TAP and Measurement Suite License Installation

Node-Locked License

- 1 You will receive an email for the license file(s). Copy the attachment with the .lic extension to your PC.
- 2 Launch Keysight License Manager.
- 3 Perform the following steps with reference to the image below.
 - a Click the tools icon (1) followed by **Install License File (2)**.



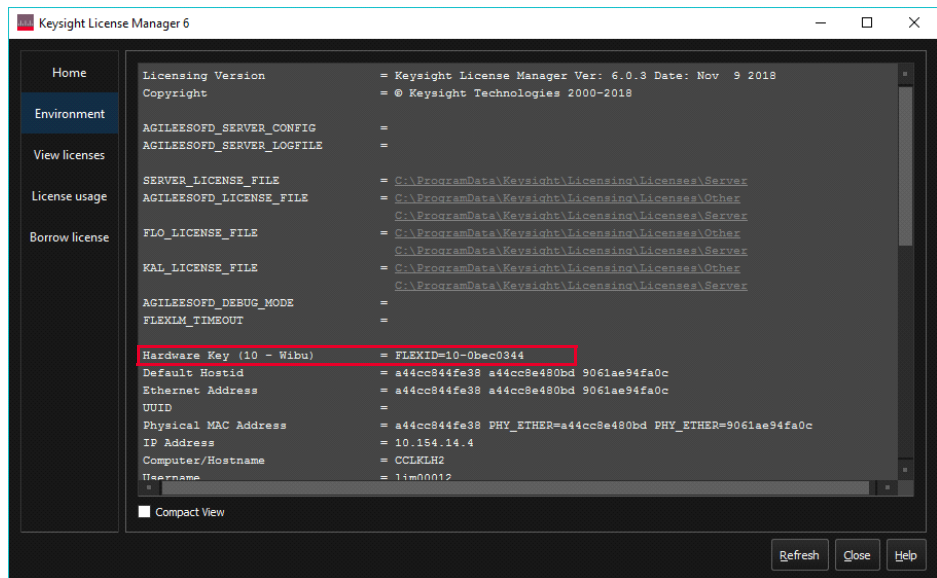
- b Locate the local copy of the License file (.lic) and click **Open**.
- c Successful license installation will be listed as below.

| Feature | Description | Version | Expiration | Type | Count | Location |
|----------|--------------------------|---------|------------|-------|-----------|----------|
| KS83301A | KS83301A | 1.000 | 2018/02/06 | Fixed | Unlimited | Local |
| KS83302A | KS83302A | 1.000 | 2018/02/06 | Fixed | Unlimited | Local |
| KS8400A | Test Automation Platform | 2.200 | 2018/01/06 | Fixed | Unlimited | Local |

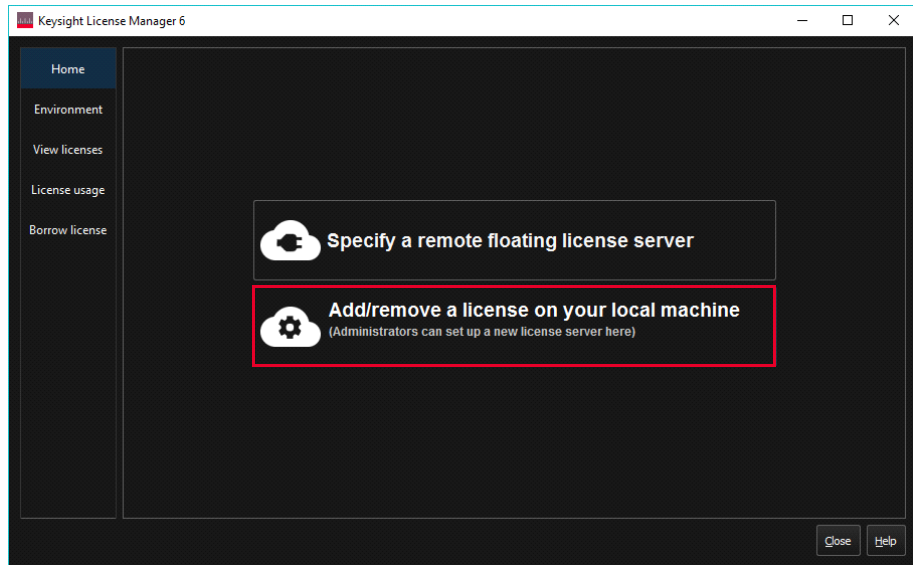
- 4 Repeat steps 1 through 3 to install more than one licenses.

USB Portable License

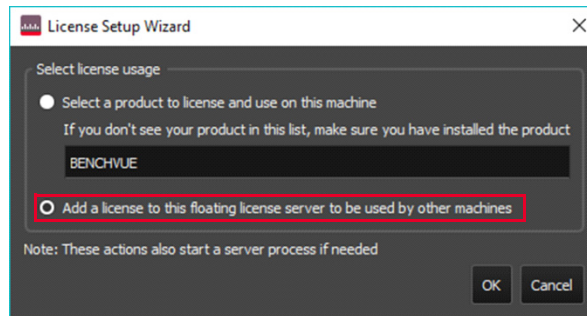
- 1 You will receive an email for the license file(s). Copy the attachment with the .lic extension to your PC.
- 2 Download and install Keysight License Manager 6 at www.keysight.com/find/KLM6. Double-click the installer and follow the instructions to complete installation.
- 3 Download and install the FLEXID10 USB Dongle Driver package at www.keysight.com/find/licensingusbdriver.
 - a Extract the files to a convenient location.
 - b Execute the Setup64.exe (on 64-bit Windows) or Setup32.exe (on 32-bit Windows). Follow the instructions, accepting the default values.
- 4 Connect the dongle to a USB port. The Flexnet ID is printed on the USB dongle. With the USB dongle connected to your PC, you can also retrieve the FlexNet ID in the Environment tab of KLM 6 as shown below.



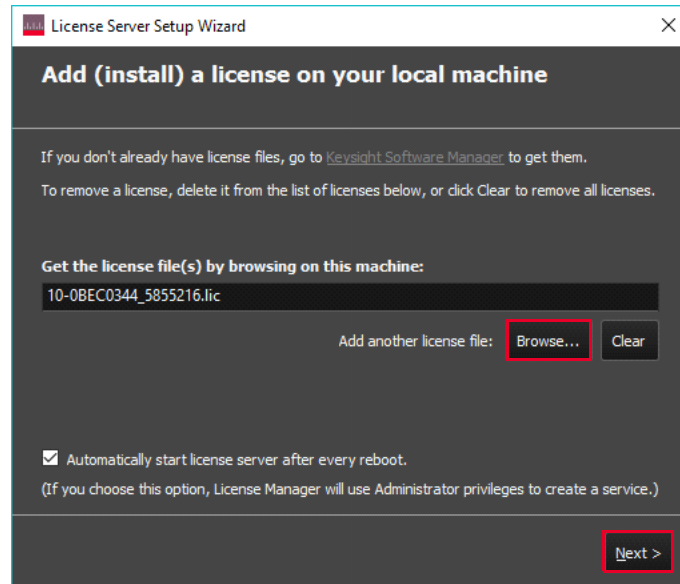
- 5 Launch Keysight License Manager 6 from your computer's Start menu. Click the **Add/remove a license to your local machine**.



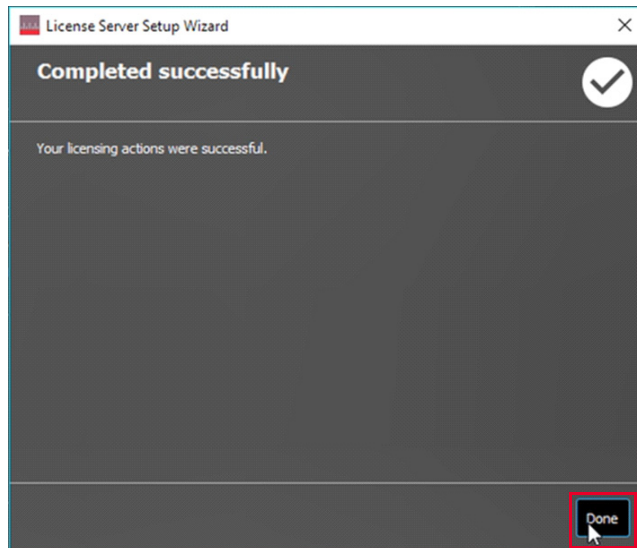
- 6 Click the **Add a license to this floating license server to be used by other machines** option.



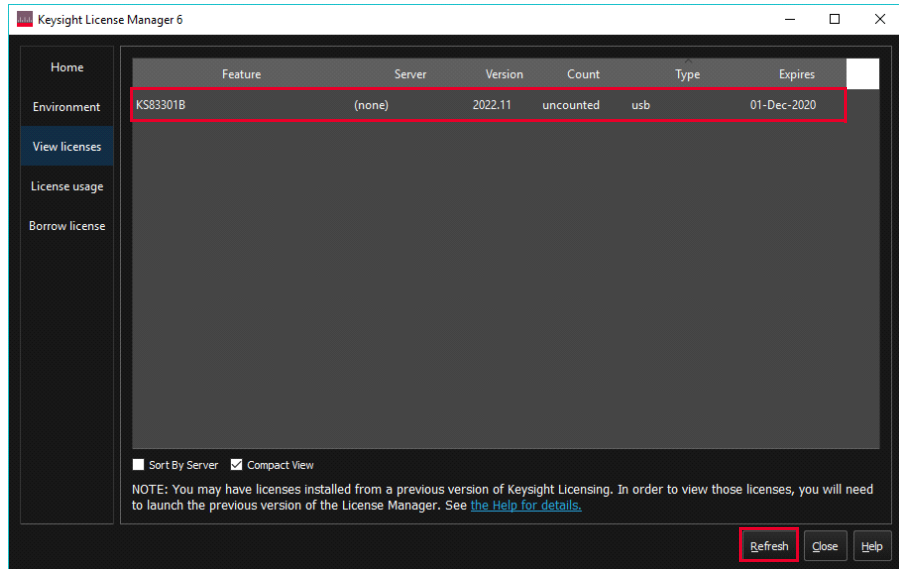
- 7 Click **Browse** and browse to the location of the license File. Click **Next**. When you are prompted to run a service in a pop-up window, click **Yes**.



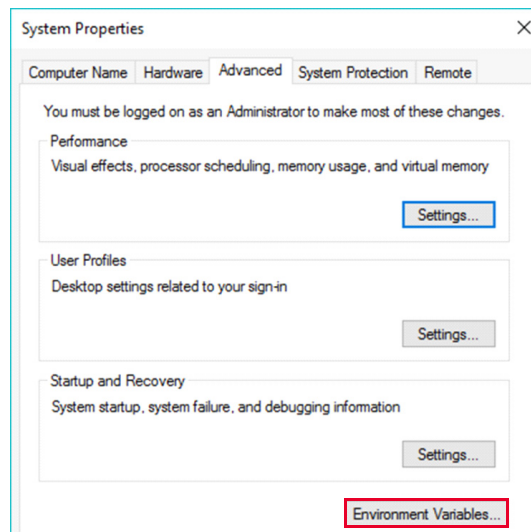
- 8 You should see the image below the licensing actions were completed successfully. Click **Done**.



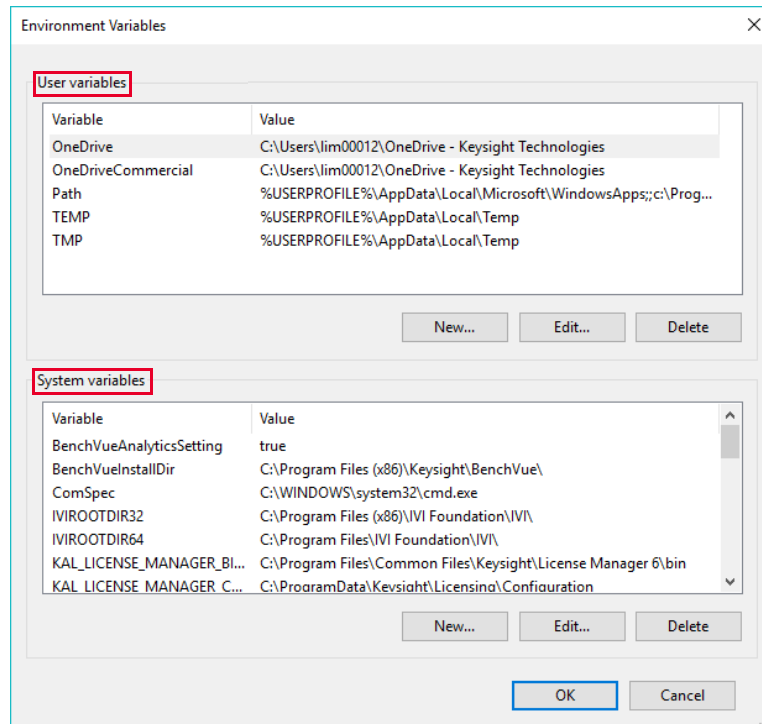
- 9 Select the View Licenses tab to view the license and the details of the license. You may need to click **Refresh** if it is not listed. In this example, KS83301B is successfully installed in the KLM 6.



- 10 Go to the Windows menu, search for 'Edit the system environment variables' and press **Enter** to view the window below. Click **Environment variables**.



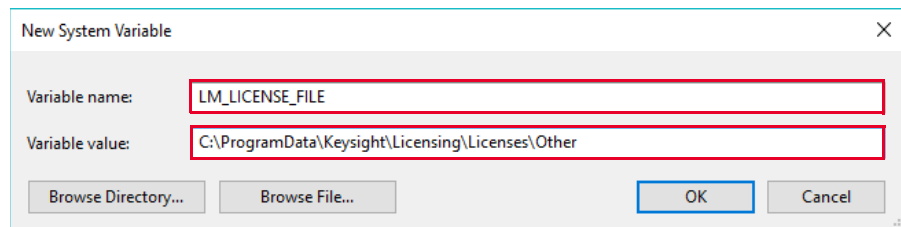
- 11 Search for the **LM_LICENSE_FILE** in the User and System variables. You will need to create one if it is not listed in either User or System variables.



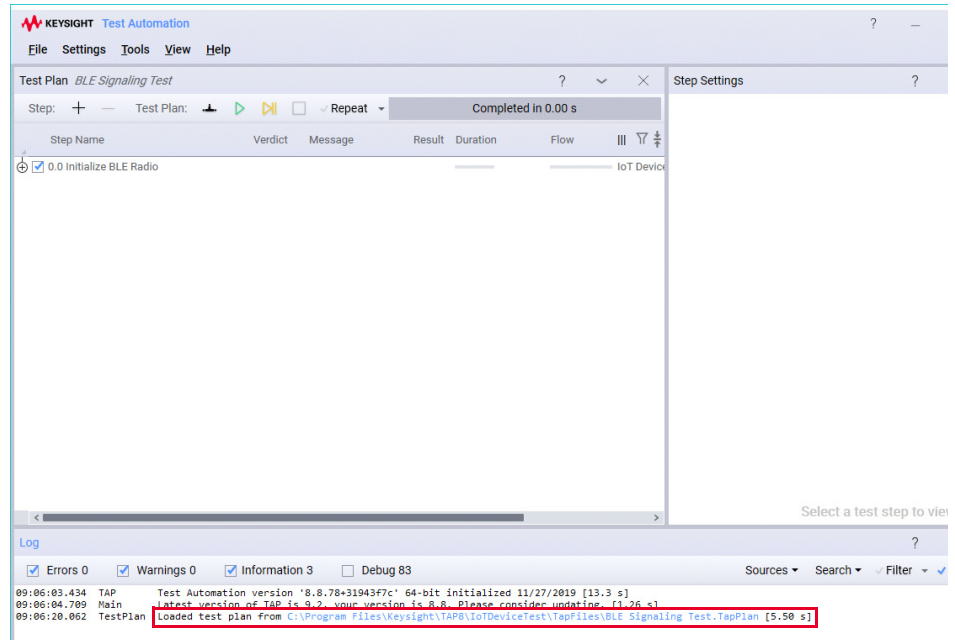
NOTE

Ensure that only one of **LM_LICENSE_FILE** variable is created in either User or System variables.

- 12 Click **New** to create the **LM_LICENSE_FILE** variable and enter the information as shown below. Click **OK** and you may close all the windows related to environmental variables.



- 13** Launch TAP and verify if you can load any of the test plans from the installed measurement suite. Based on the example below, you can now load the test plans from the BLE measurement suite in TAP with the KS83301B license installed.



- 14** Repeat these steps on each machine on which you plan to use the USB portable license.

NOTE

View the [Keysight Licensing Administrator's Guide](#) for more information.

Getting Started: Zigbee Signaling Test Plan

NOTE

This measurement suite requires KS83305B license. Contact your local Keysight representative to purchase your license.

- 1 Launch Keysight TAP and open the Zigbee Signaling test plan located at <C:\Program Files\Keysight\TAP8\IoTDeviceTest\TapFiles>.
- 2 Right-click any of the test steps and click **Expand All** to list the pre-configured test steps. Click a test step at any one time to view their Step Settings located at the left panel.
- 3 Click a test step at any one time to view their Step Settings located at the left panel. See the table below for the description and settings of each test step.
- 4 Set up the Results Listener plug-ins to record and export your data as Text Log and CSV files. If not already configured, follow the instructions below.

DUTs Add New Instruments 34999 ● Results Log ● Simple CSV ●

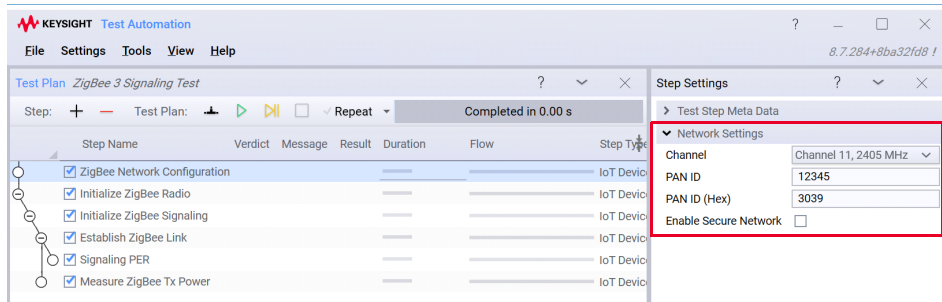
- a Click **Simple CSV** listed at the bottom of the Log panel.
- b Select the check boxes corresponding to the desired Result Listener plug-ins on the left tab. Click **+** to view more options other than Log and Simple CSV.
- c For Log, configure the File Path settings and set the Filter Options according to your preference.
- d For Simple CSV Listener, select the preferred option to generate your reports. When you are done, click **OK** to return to your test plan.
 - i Saving ResultSaveMode is set to Single Report, the report is saved as: [<CustomPrefix>_YYYYMMDD_HHmmss_<TestPlan>_<Verdict>.csv
 - ii Saving ResultSaveMode is set to Individual Reports, the reports are saved as one CSV file per report name into a folder with the name [<CustomPrefix>_YYYYMMDD_HHmmss_<TestPlan>_<Verdict>.
- 5 Once you have created the test plan that suits your testing requirement, turn on your DUT and place it in the shield box. Click **Run** to start the test plan.
- 6 Observe the Log panel as it will display a 'Passed' or 'Failed' message when the test completes.

- 7 Once the test is complete, you can view the results at the Step Settings tab for each test step. For those who have set up the 'Simple CSV Listener' plug-ins, find your results at **C:\Program Files\Keysight\Tap8\Results** and open it in Microsoft Excel.

Test Steps and Description

Zigbee Network Configuration

This test step functions to configure network protocol according to the step settings below.



Step Settings

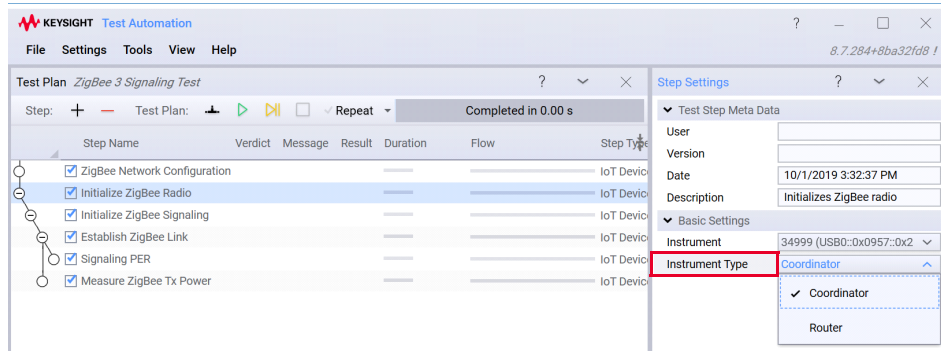
- Channel: Select the Zigbee channel for Packet Error Rate (PER) test from Channel 11 to 26, subject to the channel set by the DUT for transmission (MHz).
- PAN ID (Hex/Decimal): Enter the unique PAN ID of the Zigbee network to allow communication between the coordinator and router. You can use the PAN ID created by the coordinator or the known PAN ID embedded.
- Enable Secure Network: Select this check box for DUT with link key code enabled (security feature of Zigbee device). You will need to enter the link key code, otherwise the tester will not be able to establish connection with the DUT.
- Link Key: Choose 'Enable Secure Network' to display this key. You will need to enter the specific link key of the DUT to establish a connection.

The PAN ID of the system needs to match the PAN ID of the DUT, or the PAN ID of the DUT needs to match the PAN ID of the test system

Test Steps and Description

Initialize Zigbee Radio

This test step initializes the Zigbee radio. The radio is closed after the completion of the step (and its child steps).

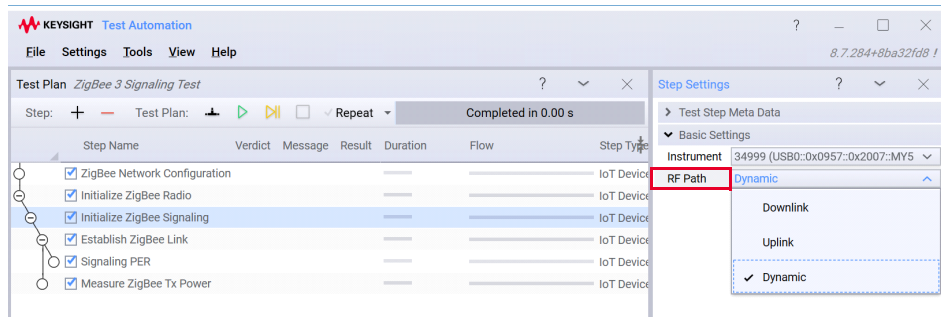


- Instrument: The VISA address of the instrument will auto populate when the 34999 profile is selected. Click Settings > Bench > Instruments to select the 34999 profile from the drop-down list.
- Device Type: Select to set the 34999B module as a Zigbee coordinator or router. The selection here will load the appropriate firmware file in the RF module.

Initialize Zigbee Signaling

This test step must be a child step of **Initialize Zigbee Radio**. This test step initializes the Zigbee signaling mode.

- RF Path: Set the path of signaling operations to be either Downlink, Uplink or Dynamic (default).
 - Downlink: Set the signal path from the DUT to the 34999B module.
 - Uplink: Set the signal path from the 34999B module to the DUT.
 - Dynamic: Set this path to enable the 34999B module to switch between uplink and downlink dynamically based on the incoming or outgoing signal direction.



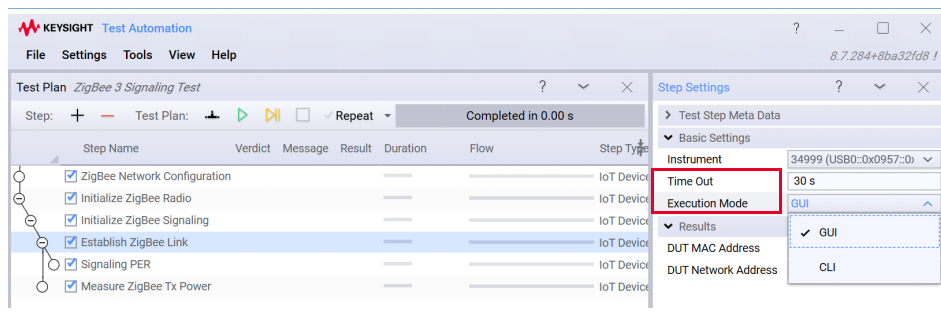
Test Steps and Description

Establish Zigbee Link

This test step must be a child step of **Initialize Zigbee Radio**. This test step establishes network with router or end device depending on the role of 34999B module as coordinator or router.

Step Settings

- Timeout: Set the time (seconds) to wait for the link to be established between 34999B and DUT.
- Execution Mode: Select either GUI or CLI mode. Choosing GUI will prompt a pop-up window to show that the link is being established. You will not see any pop-up window using CLI mode.



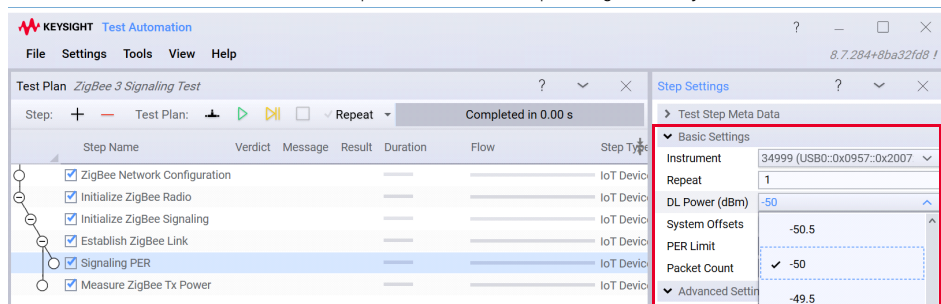
Test Steps and Description

Signaling PER

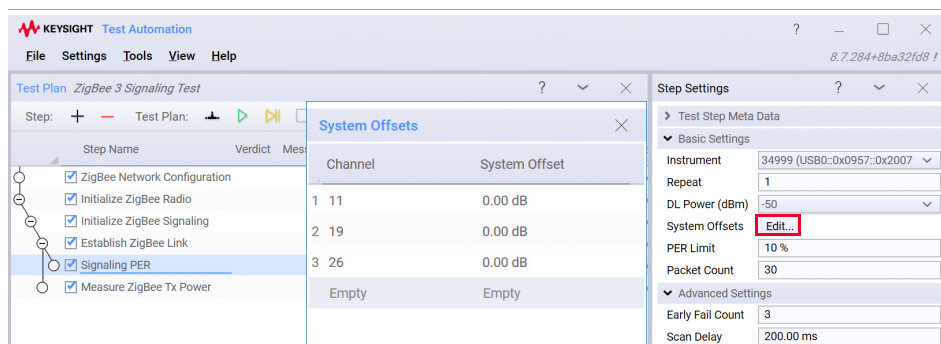
This test step must be a child step of **Establish Zigbee Link**. This test step performs signaling PER measurement.

Step Settings

- Repeat: Set the number of PER readings to be acquired within the test.
- Downlink (DL) Power: Select the DL power calculated depending on the Systems Offset.



- System Offsets: Set system offset for Zigbee channels. If the selected channel is not listed in the System Offsets, the software will interpolate the offsets using the two nearest channels. This setting is exclusive to Signaling PER. For example, the software will interpolate the offsets of the selected channel 8 using the values from channel 6 and 11.

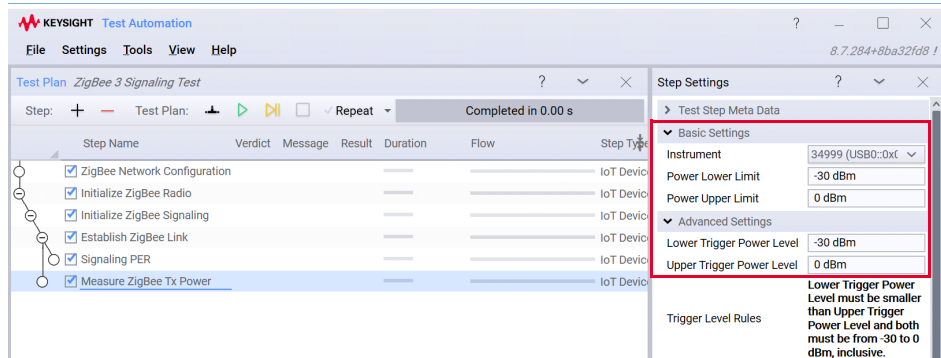


- PER limit: Set the upper limit of PER. Results that exceed this PER limit will be reported as Fail.
- Packet Count: Set number of packets sent to the DUT from 34999B module to calculate PER.
- Early Fail Count: Set the maximum number of consecutive failed received packets before the engine reports a 'Pass' or 'Fail' verdict. For example, setting Early Fail Count at three would only report 'Fail' when the test measured three consecutive failed received packets. The count will restart to zero whenever there is a 'Pass' packet measured.
- Scan Delay: Set the time delay (milliseconds) between each packet request. This is dependent on the response time of the DUT. The value set should be slightly longer than the beaconing period of DUT.

Test Steps and Description

Measure Zigbee Tx Power

This test step measures the transmit power of the Zigbee DUT.



Step Settings

- Power Lower and Upper Limits: The power limit set must be within the range set in 'Lower and Upper Trigger Power Level' or 10 to -30 dBm (whichever comes first) for the step to report a 'Pass'. Each Tx power reading will be evaluated as 'Pass' or 'Fail' before it is used to calculate the Average, Maximum and Minimum in Power Statistics.
- Lower and Upper Trigger Power Levels: Set the power level as the trigger point for the 34999B module to begin measuring power. The transmit (Tx) power of the DUT must be within 10 to -30 dBm for this test step to show 'Pass' results.
- Meas. Window Time: Set the maximum Window Time for signal acquisition. Range from 1500 to 150,000 milliseconds. For example, setting the Window Time at 50 seconds would mean that you will need to reset the DUT within 50 seconds to disconnect the DUT from any network and resume beaconing before the 34999B module performs power measurement to the DUT.
- Channel: This setting will use the same Zigbee channel selected at [Zigbee Network Configuration](#).
- System Offsets: See the description of System Offsets in [Signaling PER](#). This setting is exclusive to Measure Zigbee Tx Power.
- Reading Count: Set the number of readings to be acquired.
- Gate Above and Below: Set the boundary (in percentage) of the results to be taken into calculation. For example, setting the reading count at 10 with Gate above as 10% and below as 90% will only consider the second reading till the ninth to compute the average, maximum and minimum Tx power below.
- Power Statistic: List the computed average, maximum, and minimum Tx power based on data points recorded within 'Lower and Upper Trigger Power Level' set, according to the reading count set.

Getting Started: *Bluetooth*[®] 5 Signaling Test Plan

NOTE

This measurement suite requires KS83304B license. Contact your local Keysight representative to purchase your license.

- 1 Launch Keysight TAP and open the *Bluetooth*[®] 5 Signaling test plan located at <C:\Program Files\Keysight\TAP8\IoTDeviceTest\TapFiles>.
- 2 Right-click any of the test steps and click **Expand All** to list the pre-configured test steps.
- 3 Click a test step at any one time to view their Step Settings located at the left panel. See the table below for the description and settings of each test step.
- 4 To set up the Results Listener plug-ins, view step 4 on [page 29](#).
- 5 Once you have created a test plan that suits your testing requirement, turn on your DUT and place it in the shield box. Click **Run** to start the test plan.
- 6 Observe the Log panel as it will display a 'Passed' or 'Failed' message when the test completes.
- 7 Once the test is complete, you can view the results at the Step Settings tab for each test step. For those who have set up the 'Simple CSV Listener' plug-ins, find your results at <C:\Program Files\Keysight\Tap8\Results> and open it in Microsoft Excel.

Test Steps and Description

Initialize *Bluetooth*[®] 5 Radio

This test step is the root test step for *Bluetooth*[®] 5 signaling test to initialize the *Bluetooth*[®] 5 radio.

The screenshot displays the Keysight Test Automation software interface. The main window shows a test plan titled 'Test Plan BT5 Signaling Test'. The 'Step Settings' panel on the right is expanded, showing the 'Basic Settings' tab. The 'Instrument' is set to '34999 (USB0:0x0957:0x2)'. The 'Test Steps' table on the left lists the following steps:

| Step Name | Verdict | Message | Result | Duration | Flow |
|---|---------|-------------|--------|----------|------|
| 0.0 Initialize Bluetooth 5 Radio | | | | | |
| 1.0 Bluetooth 5 Device Discovery | | 00:00:00... | No PER | | |
| 1.1 Parallel Measure Advertising Interval and Power | | | | | |
| 1.1a Measure Advertising Interval | | | | | |
| 1.1b Advertising Channel Power Measurement | | | | | |
| 1.2 Set Bluetooth 5 DL Power | | | | | |
| 1.2.1 Active Scan | | | | | |
| 1.2.2 Connect Request | | | | | |

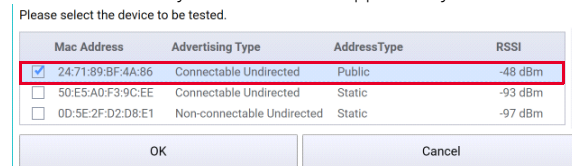
Test Steps and Description

Bluetooth® 5 Device Discovery

This step must be a child step of **Initialize Bluetooth® 5 Radio**. This test step publishes a list of discovered devices and the supported PER modes (Active Scan, Connect Request, Active Scan and Connect Request, and NoPER) after scanning for devices using either System Scan or User Entry mode. Place your DUT in a shield box to prevent interference.

Basic and Advanced Settings:

- RSSI Filter: Set the threshold value of Received Signal Strength Indicator (RSSI). Using the default value of -999 dB, this test step will only display devices with RSSI values higher than -999 dB. The DUT should have the highest RSSI when placed in the shield box.
- Mode: Select System Scan or User Entry.
 - System Scan: The radio scans and returns a list of devices in a pop-up window. Select your device and click OK for the radio to verify the PER modes supported by the DUT.



- User Entry: The radio scans for the device based the MAC address entered. This step will report 'Pass' only when the device is selected and discovered.
- UL RSSI Matching: Set the uplink RSSI target for BLE in dBm. Default is set at -55 dBm. This setting will activate the uplink RSSI matching mechanism to match the set UplinkRssiTarget.
- Active Scan time: Set delay time between each active scan from 100 milliseconds to 10 seconds. Typically, the delay is set longer than the advertising interval.
- Device Discovery Scan Time: Set the duration from 100 milliseconds to 10 seconds.
- User Defined PER Mode: Select this check box to individually select Active Scan or Connect Request or both. Clear this check box to allow the radio to verify the PER mode.
- Show and save discovered devices: Select the check box to save the list of devices detected.

☒ 1.0 Bluetooth 5 Device Discovery ● Pass 00:81:F9:49:FF:2B Active Scan
☒ 1.0 Bluetooth 5 Device Discovery ● Fail 00:00:00:00:00:00 No PER

Based on the above examples of 'Pass' and 'Fail' verdicts, it will report the following information:

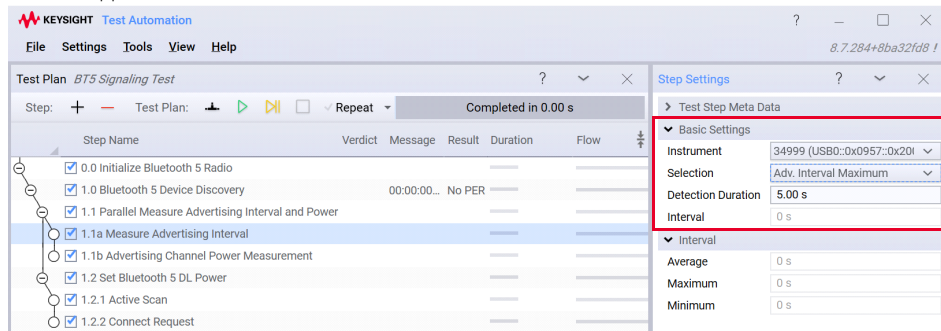
- The 'Pass' verdict indicates that a device is selected and discovered and it will display the MAC address of the DUT along with the supported PER mode. It will also include a list of devices with a higher RSSI value than the value set in RSSI Filter settings within the scan time set.
- The 'Fail' verdict indicates that no device was selected or discovered. It will display a MAC address of 00:00:00:00:00:00 and the No PER mode to show that the DUT does not support Active Scan or Connect Request.

When this test step reports a 'Pass' verdict, it will perform the Active Scan and/or Connect Request steps depending on the PER mode the DUT supports.

Test Steps and Description

Measure Advertising Interval

This step must be a child step of **Bluetooth® 5 Device Discovery**. This step is only executed when the device supports Active Scan.



Selection: Select one of the four types of advertising interval:

- Adv. Interval Maximum: Scan for the maximum advertising interval.
- Adv. Interval Minimum: Scan for the minimum advertising interval.
- Adv. Interval Average: Calculate the average advertising interval based on the advertising interval recorded within detection duration set (ranges from 1 to 15 seconds).
- User Entry: Enter the known advertising interval of your device.
- Interval (enabled in User Entry): Set the delay between scans from 10 milliseconds to 10 seconds.

Start with 'Adv. Interval Maximum' to determine the advertising interval. Use 'User Entry' mode when there is a known range of advertising interval. This step only measures the advertising interval of the DUT without assessing it as 'Pass' or 'Fail'.

The four types of advertising interval mentioned above will only affect the **Active Scan** test step. This test step will display the average, maximum, and minimum advertising intervals upon completion.

NOTE

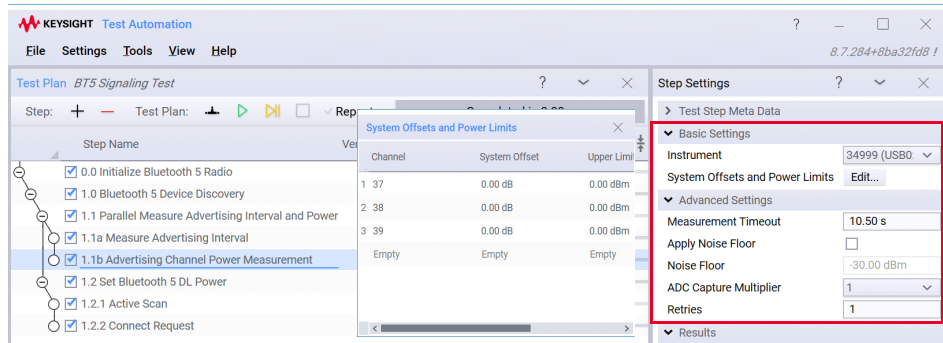
The ZA0060A systems uses the DUT's advertising interval when performing the Active Scan Packet Error Rate measurement (PER). To optimize the PER results for accuracy, it is recommended to set the Advertising Interval (via User Entry) to twice the maximum advertising interval.

If optimizing for speed, it is recommend to set the Advertising Interval to the maximum of the advertising interval (accuracy trade-off is ~ 2%). The Advertising Interval setting is linked to the Scan Delay setting under the advanced settings of the Active Scan PER test step by default.

Test Steps and Description

Bluetooth® 5 Advertising Channel Power Measurement

This step must be a child step of **Bluetooth® 5 Device Discovery**. This step measures the transmit (Tx) power of each advertising channel based on the System Offset and Power Limits set.



Step Settings

- System Offsets: Set path loss between RF I/O to DUT.
- Power Limits: Set the limit on power measurement to determine the 'Pass' or 'Fail' results of the DUT. For example, setting the limit from -30 to 0 dBm would allow a DUT of -20 dBm to report a 'Pass' result.
- Measurement Timeout: Set the timeout for this test step to exit measurement. Default to 10,500 milliseconds and the range is from 100 to 300,000 milliseconds.
- ADC Noise Floor: Set the ADC noise floor for advertising channel Tx power detection and measurement. Any RF events that occur above the set noise floor will trigger power measurement. Defaults to -31 dBm. This is an advanced parameter that should only be adjusted if directed by Keysight.
- ADC Capture Multiplier: Set the multiplier that increases the ADC capture points during advertising channel Tx power detection and measurement. This is typically used when the advertising packets RF bursts are long or when the timing between each advertising channel (Channel 37, 38, and 39) is long during an advertising event.
- Retries: Set the number of attempts to obtain power measurement.

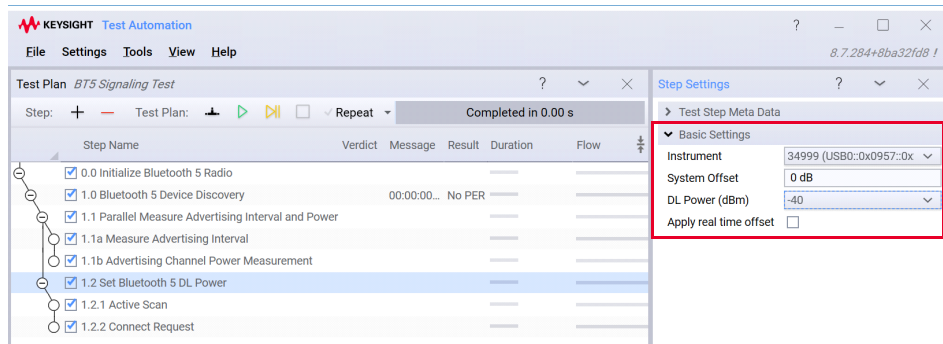
NOTE

If Retries are set >1 then the system will attempt additional measurements if the results are outside of the specification limits (USL and LSL). As such correctly setting the specification limits is important.

Test Steps and Description

Set Bluetooth® 5 DL Power

This step must be a child step of **Bluetooth® 5 Device Discovery**. This step initializes the output power for the *Bluetooth® 5* Signaling PER test according to the System Offset set. It will only be executed when a device is selected in this step.



Step Settings:

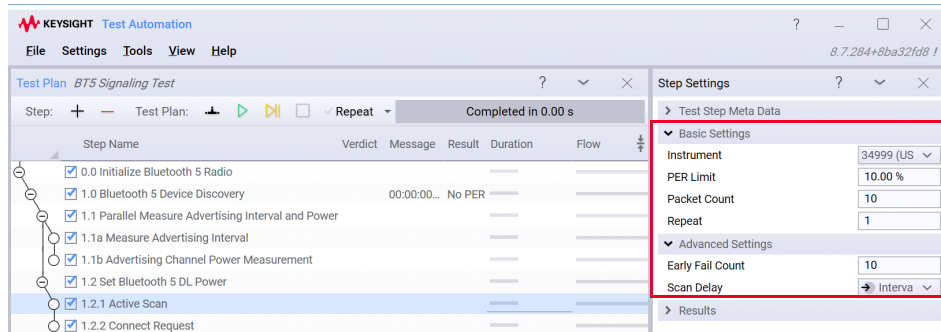
- System Offset: Set path loss to DUT.
- DL Power (dBm): Select the value from the drop-down list. The software will calculate the output power based on this value and System Offset. The output power range varies according to the module:
 - Standard module is from -100 to -40 dBm.
 - Low power module is from -95 to -20 dBm.

This test step will report a 'Pass' only when the Active Scan and Connect Request for *Bluetooth® 5* test steps report a 'Pass' (subject to the PER mode supported).

Test Steps and Description

Active Scan

This step must be a child step of **Set Bluetooth® 5 DL Power**. This step acquires the *Bluetooth® 5* Signaling PER of the device according to the settings below.



Basic and Advanced Settings:

- Packet Count: Set number of packets sent to the DUT from 34999B module to calculate PER.
- PER Limit: Set the upper limit of PER. Results that exceed this PER limit will be reported as Fail.
- Repeat: Set the number of PER readings to be acquired within the test.
- Early Fail Count: Set the maximum number of consecutive failed packet allowed before reporting error.
- Scan Delay from Measure Advertising Interval Step: There are two options for this setting.
 - Select the check box to use the Interval settings in **Measure Advertising Interval** test step.

Advanced Settings

Early Fail Count

Use Scan Delay from Measure Advertising Interval Step ☒

Scan Delay from Measure Advertising Interval

Use Scan Delay from Measure Advertising Interval Step ☐

Custom Scan Delay

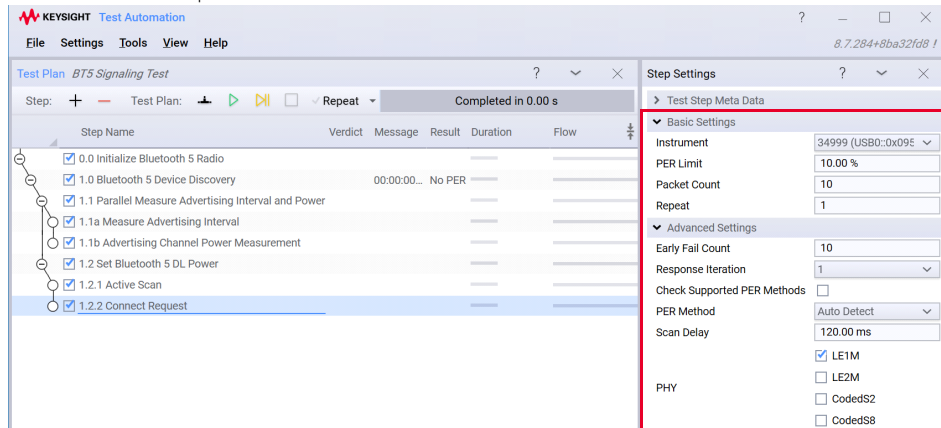
When a PER reading exceeds the limit, the test step to report 'Fail' verdict regardless of the number of repeats. This test step will also report the Scan Response Bytes and Scan Data Bytes described below.

- Scan Response Bytes: Total bytes of device's scan data.
- Scan Data Bytes: Content of device's scan data.

Test Steps and Description

Connect Request for *Bluetooth*® 5

This step must be a child step of **Set *Bluetooth*® 5 DL Power**. This step acquires *Bluetooth*® 5 Signaling PER of a connect request device.



Basic and Advanced Settings:

- View the descriptions for PER Limit, Packet Count, Repeat, and Early Fail Count in **Active Scan**.
- Response Iteration: Set the number of responses (1 to 10) to check for each connected PER method.
- Reconnect Retries: Set the number of times to reestablish connection to the DUT.
- Reconnect Power: Display the output power to reestablish connection.
- PER Method: Select one method out of the 19 options listed in the drop-down list. The default settings are set as the Auto Detect method and three response iterations. When the default settings are used, the radio will scan the devices based on the first connection method listed (UUID handle) until it finds a method that reports 'Pass' consecutively for three response iterations.
- Check Supported PER Methods: Select the check box to allow the 34999B module to determine the PER methods your DUT supports or manually select the Active Scan or Connect Request options.
- PHY: Choose one or more variants of Physical Layer (PHY) such as LE1M, LE2M, CodedS2 and CodedS8. Generally, *Bluetooth*® 4.2 devices only support LE1M while certain *Bluetooth*® 5 devices can support all four options. For the BLE 4.2 Signaling measurement suite, only the LE1M PHY is available.

When a PER reading exceeds the limit, the test step to report 'Fail' verdict regardless of the number of repeats. This test step will also report the Scan Response Bytes and Scan Data Bytes described below.

- Scan Response Bytes: Total bytes of device's scan data.
- Scan Data Bytes: Content of device's scan data.

NOTE

- During the BLE Device Discovery test step, the tester will try to establish a connection with the DUT to verify if it supports connections. Some of the BLE devices (connectable peripheral) will stop advertising for a period of time after it is disconnected from the tester, or do not allow subsequent connections made continuously mainly for security purpose (avoid device hacking).
 - If the BLE Active Scan PER measurement results (in %) are not repeatable, try to increase the Packet Count and/or Scan Delay. The default 10 packets may be insufficient for accurate PER measurements. You can adjust Packet Count in the Active Scan test step.
-

Bluetooth® 5 Signaling PER Sensitivity Search Test Plan

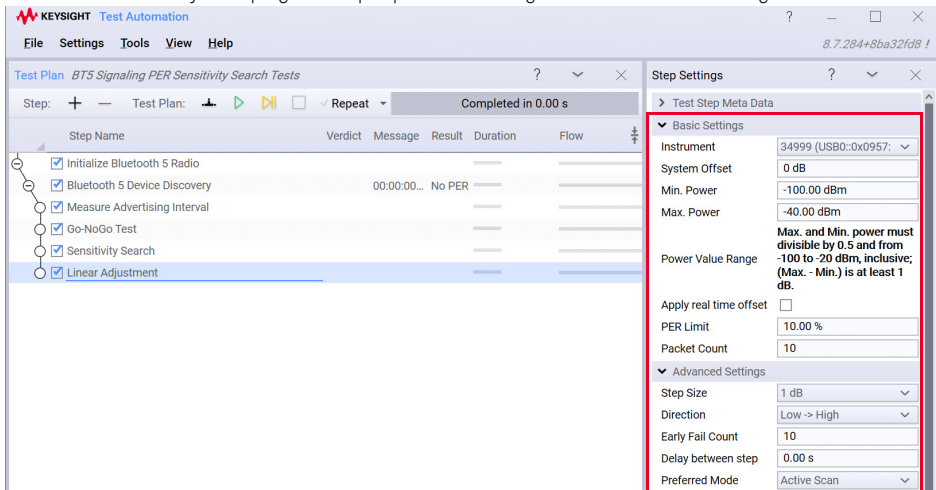
To validate the sensitivity of your DUTs, add one of the test steps below in your test plan. As the arrangement of these steps is important, some of the test steps are disabled at different positions to avoid the creation of invalid test plans.

The power values set must be divisible by 0.5 and be between -100 to -40 dBm.

Test Steps and Description

Linear Adjustment

Performs PER test by sweeping the output powers from high to low or from low to high.



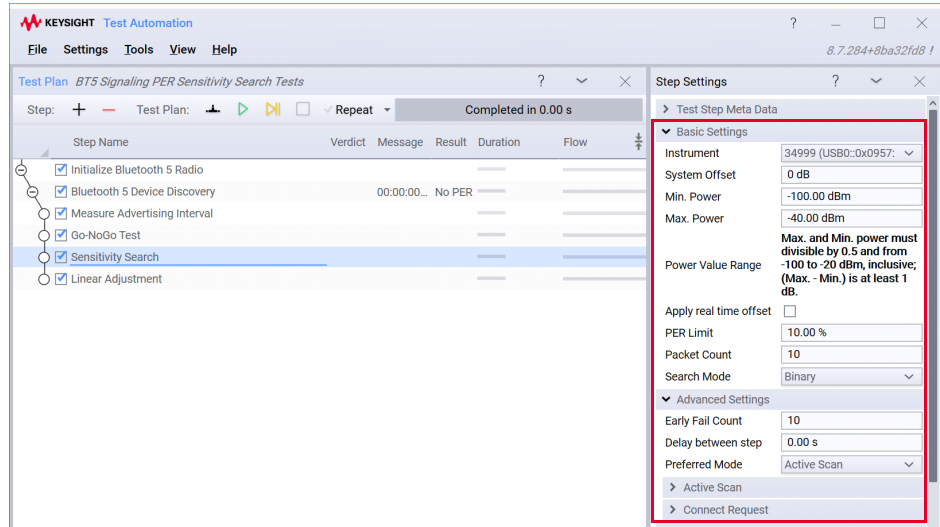
Advanced Settings:

- The PHY, PER Method, Response Iteration, Early Fail Count, and Reconnect Power parameters are as described under **Connect Request for Bluetooth® 5** test step.
- Step size: Select a sweep step size of 1 or 0.5 dB.
- Direction: A high to low direction will sweep the power levels from maximum to minimum. The opposite applies when selecting a low to high direction.
- Delay between step: Set the delay time (in seconds) between steps.
- Preferred Mode: Select Active Scan or Connect Request. Selecting Connect Request will require additional selection of PHY, PER Method, and Response Iteration in the Connect Request tab.
- Reconnect Retries: Sets the number of times to reestablish connection to the DUT.
- Scan Delay from Measure Advertising Interval Step: Select the check box to use the Interval settings from **Measure Advertising Interval** test step or clear the check box to enter the desired value in the Custom Scan Delay option (default value is set at 170 milliseconds).

Test Steps and Description

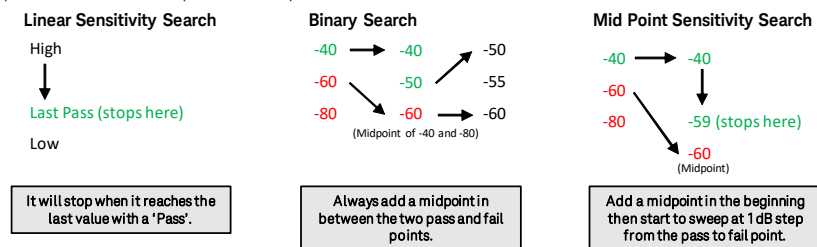
Sensitivity Search

Performs PER test using the one of the three search modes below to sweep through the power values set. Use this step to determine the lowest output power the DUT can support to meet the PER limit.



Step Settings

- Search Mode: Select one of the three options available.
 - Binary Sensitivity (Fastest): Perform binary searches for the PER sensitivity level.
 - Linear Sensitivity (Slowest): Search for the PER sensitivity level by sweeping from maximum to minimum power. This search will stop when it discovers the 'Last Pass', the last PER value that produces a 'Pass' verdict.
 - Mid-point Bi-directional: Search for the PER sensitivity level using a combination of binary and linear sensitivity searches. From the first break point of the binary search, it will sweep in a linear pattern for the 'Fail' point and report the 'Last Pass' value.

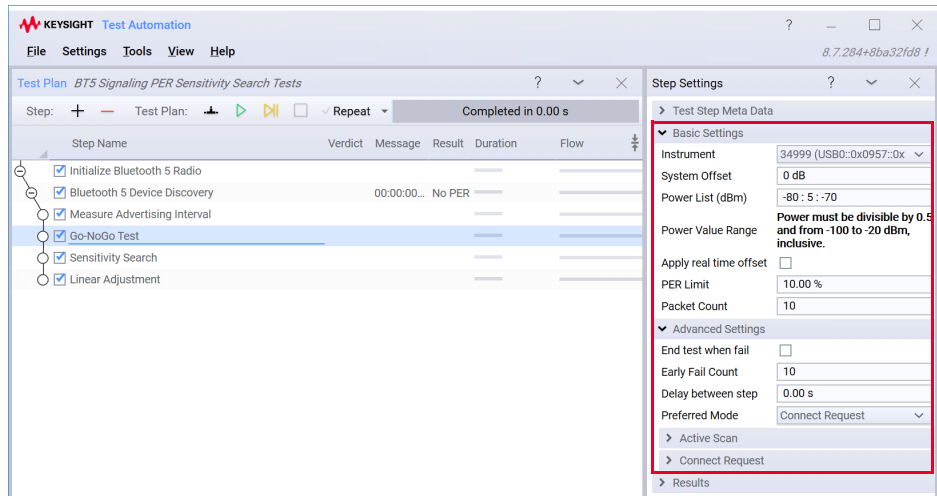


The Early Fail Count, Delay between Step, Reconnect Retries, and Preferred Mode parameters are as described under **Linear Adjustment** test step.

Test Steps and Description

Go-NoGo Test

Performs the PER test by sweeping through the specified values of output power and step size according to the values set in Power List. Use this step to determine the power levels where the DUT fails or passes.



Advanced Settings:

- Power List (dBm): Enter the values in this order; minimum output power : step size : maximum output power. For example, when the step size is set as 5, the test step will cycle in 5 dBm increment from -100 to -95 dBm, then to -90 dBm and so on up until the minimum or maximum output power set.
- End test when fail: Check this box to end the test plan when this test step reports a Fail.

The Early Fail Count, Delay between Step, Reconnect Retries, and Preferred Mode parameters are as described under [Linear Adjustment](#) test step.

Bluetooth® 5 UUID Read Write Tests

This test plan has similar test steps with *Bluetooth®* LE Signaling test plan and is only applicable for DUT that supports Connect Request PER. See the table below for description of the additional test steps.

Test Step and Description

The 'Initialize BLE Radio' and 'BLE Device Discovery' test steps and settings are as described in [Getting Started: Bluetooth® 5 Signaling Test Plan](#).

Establish Connection

Sets the DL power and establishes connection with a DUT that supports Connect Request. See the settings for DL Power in [Set Bluetooth® 5 DL Power](#) and the description of System Offset in [Bluetooth® 5 Advertising Channel Power Measurement](#).

Read UUID by handle

Reads the UUID handle (decimal or hexadecimal) of the characteristic set of your DUT. Select the 'Custom' option in the drop-down list to enter a custom handle value. Ensure that the VISA address of the 34999B RF module is selected.

Write UUID

This test step writes the UUID of the characteristic set in [Establish Connection](#) into the DUT.

The Data Byte list can accept a list of bytes in decimal or hexadecimal formats. Each byte should be separated by a comma. Examples, Decimal list: 1,2,3 and Hex list: 0x01,0x02, 0x03 would both result in the same data being written. Note that the data should match the structure of the specific characteristic that is being written. This will be very DUT dependent and the user will need to understand the operation of the DUT.

Read UUID by characteristic values

Select the desired characteristic values for the test step to read the UUID of the supported characteristics as shown below.

| | |
|-----------------|---|
| Characteristics | <input checked="" type="checkbox"/> UUID - Device Name |
| | <input checked="" type="checkbox"/> UUID - Appearance |
| | <input checked="" type="checkbox"/> UUID - System ID |
| | <input checked="" type="checkbox"/> UUID - Model Number |
| | <input checked="" type="checkbox"/> UUID - Serial Number |
| | <input checked="" type="checkbox"/> UUID - Firmware Revision |
| | <input checked="" type="checkbox"/> UUID - Hardware Revision |
| | <input checked="" type="checkbox"/> UUID - Software Revision |
| | <input checked="" type="checkbox"/> UUID - Manufacturer Name |
| | <input checked="" type="checkbox"/> UUID - IEEE Reg. Cert Data List |

Getting Started: WLAN Signaling Test Plan

NOTE

This measurement suite requires KS83302B license. Contact your local Keysight representative to purchase your license.

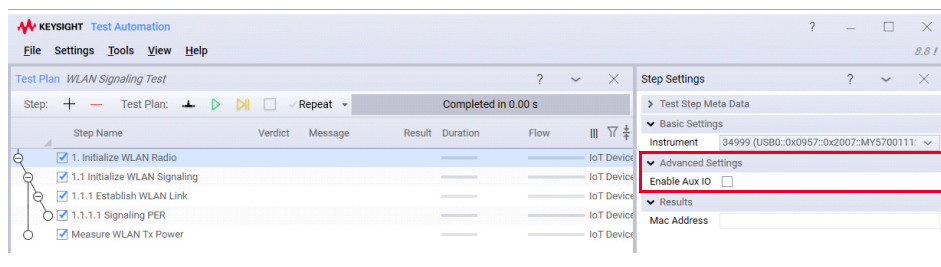
- 1 Launch Keysight TAP and open the WLAN Signaling test plan located at <C:\Program Files\Keysight\TAP8\IoTDeviceTest\TapFiles>.
- 2 Right-click any of the test steps and click **Expand All** to list the pre-configured test steps.
- 3 Click a test step at any one time to view their Step Settings located at the left panel. See the table below for the description and settings of each test step.
- 4 To set up the Results Listener plug-ins, view step 4 on [page 29](#).
- 5 Once you have created a test plan that suits your testing requirement, turn on your DUT and place it in the shield box. Click **Run** to start the test plan.
- 6 Observe the Log panel as it will display a 'Passed' or 'Failed' message when the test completes.
- 7 Once the test is complete, you can view the results at the Step Settings tab for each test step. For those who have set up the 'Simple CSV Listener' plug-ins, find your results at <C:\Program Files\Keysight\Tap8\Results> and open it in Microsoft Excel.

Test Steps and Description

Initialize WLAN Radio

This test step is the root test step for WLAN signaling test plan to initialize WLAN radio.

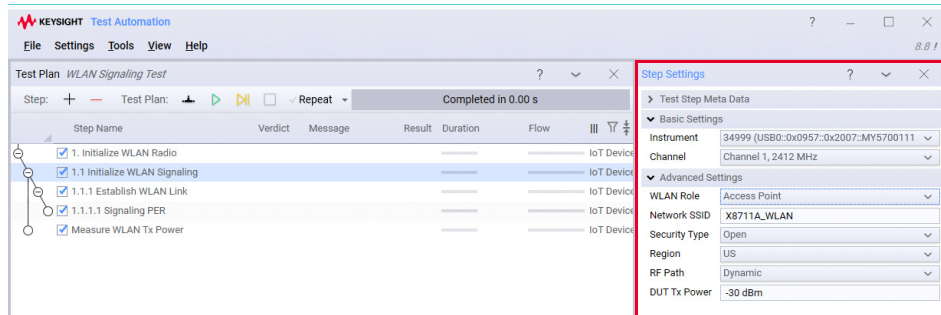
- Select the Enable Aux IO check box to enable signal routing to the AuxIO port and it will not use the onboard power detector. The Enable Aux IO check box is disabled by default.



Test Steps and Description

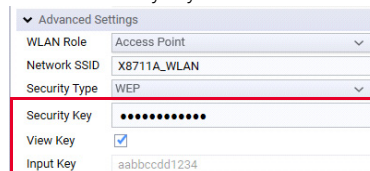
Initialize WLAN Signaling

This step must be a child step of **Initialize WLAN Radio**. This test step initializes WLAN profile for Signaling PER test based on the following settings.



Basic and Advanced Settings:

- Channel: The number of channels available in the drop-down list is subject to the region selected.
 - US: Channel 1 to 11
 - Japan: Channel 1 to 14
 - Europe: Channel 1 to 13
- WLAN role: Set the role of the 34999B as an Access Point or Station.
- Network SSID: Set the SSID for WLAN connection with a maximum length of 32 characters
- Security Type: Select Open, WEP, or WPA2 option. For the WEP and WPA2 option, you will need to enter the security key. You can also choose to view the security key in readable form as shown below.

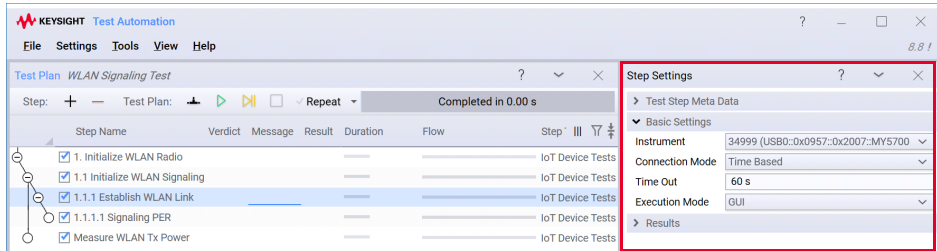


- Region: Select US, Japan or Europe.
- RF Path: Select one of the three options to set the RF path of the signaling operations.
 - Dynamic: Set the signal path to enable the 34999B module to switch between uplink and downlink dynamically based on the direction of the incoming or outgoing signal. For this option, you can set the DUT Tx Power to track the incoming DUT transmission signal.
 - Downlink: Set the signal path from the DUT to the 34999B module.
 - Uplink: Set the signal path from the 34999B to the DUT.

Test Steps and Description

Establish WLAN link

This step must be a child step of **Initialize WLAN Signaling**. This step establishes the link between the 34999A module with the DUT.



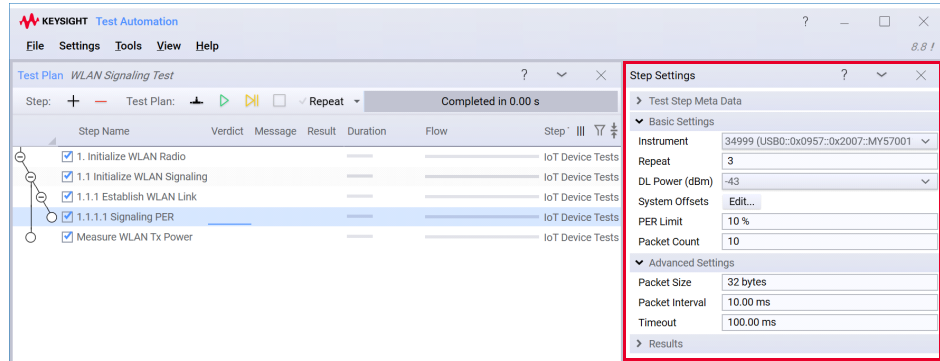
Basic Settings

- Connection Mode: Select time based or manual option. The time based option will introduce a Time Out setting where you will need to enter the time in seconds.
- Execution Mode: Select the CLI or GUI mode.
 - In GUI mode, you will see the pop-up window below instructing you to connect your WLAN device to the network SSID. You will need to connect your device within the Time Out period set or the test plan will report this step as Fail.
 - The CLI mode will run this test step using TAP's CLI.

Test Steps and Description

Signaling PER

This step must be a child step of **Establish WLAN link**. This test step acquires the WLAN signaling PER after the WLAN link is established.



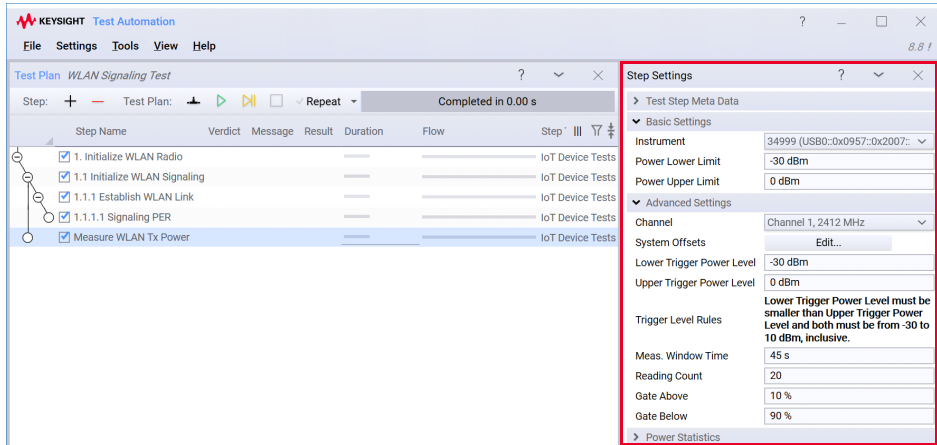
Step Settings

- Repeat: Set the number of PER readings to be acquired within the test.
- Downlink (DL) Power: Select the DL power calculated depending on the Systems Offset.
- System Offsets: Set system offset for channels. If the selected channel is not listed in the System Offsets, the software will interpolate the offsets using the two nearest channels. For example, the software will interpolate the offsets of the selected channel 8 using the values from channel 6 and 11.
- PER limit: Set the upper limit of PER. Results that exceed this PER limit will be reported as Fail.
- Packet Count: Set number of packets sent to the DUT from 34999B module to calculate PER.
- Packet Size: Set the size of the transmitted data packet size from 24 to 1400 bytes.
- Packet Interval: Set the interval time (in milliseconds) between data packets.
- Timeout: Set the timeout to receive each packet response during the PER test. Range from 100 to 2000 milliseconds.

Test Steps and Description

Measure WLAN Tx Power

This step must be a child step of **Initialize WLAN Radio**. This step measures the WLAN transmit power of the DUT according to the lower and upper limits of power set.



Basic and Advanced Settings

- Power Lower and Upper Limits: Set the limits of power measurement
- Channel: Selection of WLAN channel.
- View the description for System Offset in the **Signaling PER** test step.
- Lower and Upper Trigger Power Level: Set the upper and lower trigger such that the DUT Tx Power will fall within the range.
- Meas. Window Time: Set the time for signal acquisition (in milliseconds)
- Reading Count: Set the number of reading to acquire.
- Gate Above and Below: Set the boundary of results (in percentage) to be taken into calculation. For example, setting a reading count of 10 with Gate Above and Below at 10% and 90% respectively will only consider the second reading to ninth to compute the Tx power.

WLAN Signaling PER Sensitivity Search Test Plan

The functions of the test steps listed below are as described in [Bluetooth® 5 Signaling PER Sensitivity Search Test Plan](#).

- Linear Adjustment
- Receiver Sensitivity Search (comprises of Binary Sensitivity Search, Linear Sensitivity Search, and Mid-point Sensitivity Search)
- Go-NoGo Test

WLAN Access Point Device Discovery

This test plan functions to scan and discover WLAN Access Points within the area after initializing the radio. Upon the completion of the test plan, you should see a list of WLAN devices listed in the Step Settings panel, under the Results tab.

Troubleshooting Procedure and Error Messages

Unit is Inoperative

- Verify that the AC power cord is connected to the instrument.
- Verify that the front-panel On/Standby switch has been pushed.
- Verify that the power-line fuse is installed and not open. The instrument is shipped from the factory with a 500 mA, 250 V fuse.
- Remove all plug-in modules to verify that the plug-in module is not causing the failure.

No Valid Radio Options License Found

Hardware option error will appear when the respective radio options are not enabled, and you will need to purchase certain licenses according to your test requirements. Examples are:

BLE Option License Not Found

```
Discover BLE Devices started.
Discover BLE Devices failed, moving on. The error was 'No valid BLE option license found. For license request please contact Keysight Technol
Discover BLE Devices completed with verdict 'Error'. [39.5 ms]
TAP is currently configured to abort run on step error. This can be changed in Engine Settings.
TestPlan aborted. (Verdict of 'Discover BLE Devices' was 'Error'.)
```

WLAN Option License Not found

```
1. Initialize WLAN Radio started.
1. Initialize WLAN Radio failed, moving on. The error was 'No valid WLAN option license found. For license request please contact Keysight T
1. Initialize WLAN Radio completed with verdict 'Error'. [19 ms]
TAP is currently configured to abort run on step error. This can be changed in Engine Settings.
TestPlan aborted. (Verdict of '1. Initialize WLAN Radio' was 'Error'.)
```

Zigbee Option License Not found

```
ZigBee Network Configuration started.
ZigBee Network Configuration completed. [10.5 ms]
Initialize ZigBee Radio started.
Keysight.Tap.Plugins.kt34999A.ZigBee Version: 2019.0311.0.0
Initialize ZigBee Radio failed, moving on. The error was 'No valid ZigBee option license found. For license request please contact Keysight Technolog
Initialize ZigBee Radio completed with verdict 'Error'. [17.3 ms]
TAP is currently configured to abort run on verdict Error. This can be changed in Engine Settings.
Test plan abort requested...
TestPlan aborted. (Verdict of 'Initialize ZigBee Radio' was 'Error'.)
Summary of run created: 04/20/2019 15:37:47
```

Here are a few tips that you can try

- Use Keysight 34999 Utility software to verify the license(s). You can refer to the Help File in the software for more information.
- To obtain licenses, contact your local Keysight representative to purchase the license(s) for your test requirement.

Once you have purchased the license(s), you will receive an entitlement certificate via email. Follow the instructions in the email to redeem the license. If you do not receive the licenses, check your e-mail system's junk e-mail and spam filters.

COM Port Error

Incorrect port number will stop the initializing step abruptly as unable to initialize the TAP test plan. There are two possible error messages when you entered the incorrect port number. Examples are:

Timeout on BLE Radio COM port data read

Discover BLE Devices failed, moving on. The error was 'Timeout on BLE radio COM port data read.'. Discover BLE Devices completed with verdict 'Error'. [6.75 s]
TAP is currently configured to abort run on step error. This can be changed in Engine Settings.

The Port '<COM Port number>' does not exist

Discover BLE Devices failed, moving on. The error was 'The port 'COM28' does not exist.'. Discover BLE Devices completed with verdict 'Error'. [4 s]
TAP is currently configured to abort run on step error. This can be changed in Engine Settings.

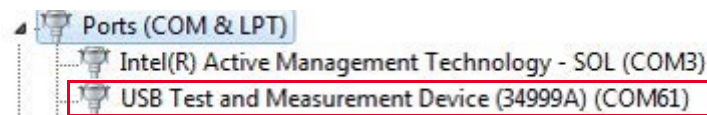
Here are a few tips that you can try:

- Verify the correct COM port setting of the 34999B instrument. Follow the steps in **COM Port Not Listed** section to identify the COM port number of your 34999B.
- When the USB Test and Measurement Device is still not listed in Device Manager, refer to **Keysight 34999B Not Detected in Device Manager**.

COM Port Not Listed

Follow the steps below to identify the COM port number of the 34999B.

- 1 From the Start menu, search for **Device Manager** and look for **Ports (COM & LPT)** section.
- 2 Expand **Ports** and look for **USB Test and Measurement Device (34999B)(COM#)**. Based on the example below, the COM Port number (#) is 61.



Keysight 34999B Not Detected in Device Manager

When the Device Manager does not show “USB Test and Measurement Device (34999B)” under Ports (COM & LPT) section, this could happen due to a faulty or issues related to COM Port and cable. This could also happen when you do not install the Keysight 34999 Utility software.

Here are a few tips that you can try:

- Verify that the 34999B module is inserted into 34972A.
- Verify that the USB cable from 34999B module is connected to PC.
- Ensure that you installed the Keysight 34999 Utility software.
- Connect and disconnect the cables and observe if the “USB Test and Measurement Device (34999B)” is listed in Ports (COM & LPT).
- Reboot your PC when it is still unable to detect the 34999B.

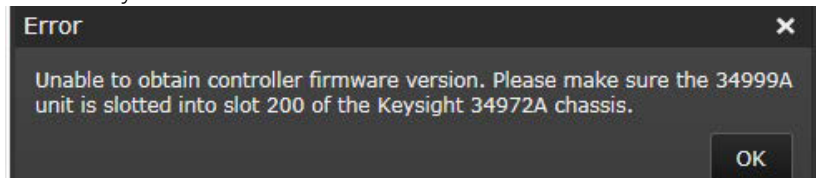
Keysight 34972A Not Detected in Keysight IO Library

Here are a few tips that you can try:

- Power on 34972A instrument.
- Verify that the power cable is connected properly.
- Verify that the USB cables connected from 34972A to PC.

Incorrect Slot for 34999B

Placing the 34999B in slots other than **slot 200** will display the pop-up below in the 34999 Utility software.



On TAP, you will see a message “Failed to open source (Unable to obtain controller firmware version...)”

- Ensure 34999B in slot 200 as shown in [To Prepare Instruments for Use](#) section.

34972A Connectivity Error

Connectivity errors often occur when the software (TAP) fails to communicate and establish a connection (wired or wireless) with the hardware (34972A). Possible root causes include using a faulty cable to connect the hardware, entering inconsistent VISA address, or using offline instruments.

Such connectivity errors will stop the ongoing test plan abruptly as TAP is unable to establish a connection with 34972A, producing insignificant results.

Here are the two possible error messages when the connection of the Keysight 34999B to the 34972A is inactive.

Inner Exception: Could Not Connect to Keysight 34999B with Resource Name: <VISA Address of 34972A>

```
Connecting to USB0::0x0957::0x2007::MY57004297::0::INSTR...first time usage will take approximately 2.5 ~ 3 minutes to load the cali
Caught error while opening resources! See error message for details.
Resource "34999A" closed. [30.7 us]
Exception: One or more errors occurred.
    Inner exception: Could not connect to Keysight 34999A with Resource Name: USB0::0x0957::0x2007::MY57004297::0::INSTR
```

Inner Exception: 34999B can only be used with Keysight 34972A. Please check that the correct instrument is being used.

```
Connecting to TCP/IP0::10.116.9.60...first time usage will take approximately 2.5 ~ 3 minutes to load the calibration data.
Caught error while opening resources! See error message for details.
Resource "34999A" closed. [1.77 ms]
Exception: One or more errors occurred.
    Inner exception: 34999A can only be used with Keysight 34972A. Please check that the correct instrument is being used.
```

Here are a few tips that you can try:

- Verify the VISA address of the 34972A in Keysight Connection Expert and ensure that the connection status is green. Try to send some commands using Interactive IO to test the existing connection between Connection Expert and 34972A.
- If the Connection Expert can communicate with the instrument but unable to do so using TAP, exit and restart TAP. Observe if the same problem persists.

Test Plan Execution Error Messages

Could Not Create '<Test Step>': License Required: KS8330XA

You will see the following message when you do not have the measurement suite plug-ins license.

```
Unable to create instance of Keysight.Tap.Plugins.Kt34999A.ZigBee.TestSteps.ZigBeeNetworkConfigStep.  
Exception: Could not create an instance of 'ZigBee Network Configuration': License required: KS83303B  
Unable to create instance of Keysight.Tap.Plugins.Kt34999A.ZigBee.TestSteps.InitializeZigBee.  
Exception: Could not create an instance of 'Initialize ZigBee Radio': License required: KS83303B  
Loaded test plan from C:\Program Files\Keysight\TAP8\IoTDeviceTest\TapFiles\ZigBee signaling test.TapPlan
```

You will need to purchase the following license that are offered in the ZA0060A:

- KS83304B: *Bluetooth*® 5 and *Bluetooth*® Low Energy 4.2 Signaling.
- KS83305B: Zigbee 3.0 and Zigbee Pro Signaling.

Once you have purchased the license(s), you will receive an entitlement certificate via email. Follow the instructions in the email to redeem the license.

34972A Front Panel Annunciator Turn On

Refer to Chapter 5: Error Messages in [34972A User Guide](#).

Fail Self Test Status

The example below is the interface you would expect where your 34999B radio module reported a **FAIL** Self Test Status on the Keysight 34999 Utility software.

| Temperature: 26.18 °C | | Serial Number: LP11001977 | | Host ID: PCSER1 |
|-----------------------|-------------------|---------------------------|----------|-----------------|
| Radio | MAC Address | Self Test Status | License | |
| BLE | CC:78:AB:8A:9C:03 | FAIL | Licensed | |
| WLAN | F4:5E:AB:9F:DB:E6 | FAIL | Licensed | |

The following are a list of possible reasons:

- No written manufacturing calibration data.
- Flash memory could be corrupted.

If the self-test fails, troubleshoot or replace the 34999B module.

This information is subject to change without notice. Always refer to the English version at the Keysight website for the latest revision.

© Keysight Technologies 2020
Edition 3, October 2020

Printed in Malaysia



ZA0060-90000

www.keysight.com