CuSIM

Release 2.0

User Guide

KEYSIGHT

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Documentation conventions

The following documentation conventions are used in this guide:

Describing interactions with the UI

You can interact with products by using different input methods: keyboard, mouse, touch, and more. So in most parts of the user documentation, generic verbs have been used that work with any input method. In cases where input-neutral verbs do not work, mouse-specific verbs are used as the first choice, followed by touch-specific verbs as the second choice.

See the following table for examples on how you can interpret the different input methods.

Input-neutral	Mouse	Touch
Select **Modify**.	Click **Modify**.	Tap **Modify**.
Select **Accounts** > **Other accounts** > **Add an account**.	Click **Accounts** > **Other accounts** > **Add an account**.	Tap **Accounts** > **Other accounts** > **Add an account**.
To open the document in Outline view, select **View** > **Outline**.	To open the document in Outline view, click **View** > **Outline**.	To open the document in Outline view, tap **View** > **Outline**.
Select **Protocols**.	Click the **Protocols** tab.	Tap **Protocols**.
-NA-	Double-click the **Client** wizard.	Double-tap the **Client** wizard.
Open the **Packages** context menu.	Right-click **Packages** to open the shortcut menu.	Long tap **Packages** to open the shortcut menu.

Deprecated words

The following words have been replaced with new words, considering the audience profile, our modern approach to voice and style, and our emphasis to use input-neutral terms that support all input methods.

Old usage...	New usage...
shortcut menu, right-click menu	context menu
click, right-click	select
drag and drop	drag

Table of Contents

CHAPTER 1

CuSIM overview

In the 5G New Radio (NR) transport architecture, the original LTE BBU functions are split into three parts: Central Unit (CU), Distributed Unit (DU), and Radio Unit (RU). The 3GPP *Higher Layer Split* (HLS) refers to the CU/DU split (over the F1 interface) and the CU-UP/CU-CP split (over the E1 interface).

Keysight CuSIM is a cloud-native gNB Central Unit (CU) simulator that provides comprehensive support for testing the performance and functionality of your gNB Distributed Units (DUs) in a standalone (SA) network topology. It simulates user plane and control plane traffic flowing over the F1 interface from a simulated gNB CU to your gNB DU (the DUT), and it responds to traffic sent from your DUT to the simulated gNB CU.

CuSIM also includes basic 5G-Core functionality to handle NAS Layer procedures without a 5G Core simulation tool.

Chapter contents:

CuSIM feature summary

- Supports testing in 5G SA networks.
- Features a web-based user interface (UI) through which you manage all aspects of your CuSIM testing environment, including test creation, execution, and management; traffic agent deployment and management; statistical results and reporting; and user and license administrative control.
- Traffic agents generate traffic over the F1-U (user plane) and F1-C (control plane) interfaces. The agents are implemented as containers or virtual machines, depending upon the platform on which they are deployed. The supported platforms include:
  - private clouds: VMware ESXi 6.5 and ESXi 6.7 and KVM
- Supports multi-thread control plane process flows.
- Provides extensive control plane and user plan statistics coverage.
- Provides support for scripting-based impairments.

UI overview

The Keysight CuSIM web UI provides access to all of the tools, functions, and options that are needed to create, run, and manage tests; to view, analyze, and manage test results; to respond to

system events; and to administer your CuSIM instance.

The major elements of the UI are:

- Application framework elements below
- Dashboard page below
- Test overview page on the facing page
- Configuration properties pages on the facing page
- Statistics page on the facing page

Application framework elements

CuSIM uses a web-based UI that is common to a number of Keysight applications, including LoadCore and CyPerf. The web page framework includes the following elements:

Title bar

The title bar, which is located across the topic of the CuSIM window, is present on all pages, and provides key information and controls, including:

- Keysight logo: Click the Keysight logo from any point in the interface to return to the dashboard page.
- Session identifier: Shows the current session number and test config name. Clicking the session identifier returns you to the TEST OVERVIEW page.
- Events menu ( ): Provides access to notifications and test events.
- Links to the OVERVIEW and STATISTICS pages.
- User profile menu: The user profile menu provides access to the current user's Edit Account screen in which you can edit your profile preferences. (In the example shown below, the current user is *jabot2*.)
- Settings menu ( ): Provides access to a number of application and administrative functions and resources, including user Logout, License Manager, Agent Management, software update, diagnostics (test logs), product information, and more.

Tool bar

The tool bar is located directly under the title bar. It provides access to functions and content that are specific to your current application context. The **START TEST** and **STOP TEST** buttons are located on the tool bar.

Dashboard page

After you successfully log in, the **Dashboard** page opens. From this page, you can create new tests, access other test sessions (each test session tile displays the test name and status), browse among and manage previously run tests, and browse among and access test results from previously run tests. You can navigate to the other CuSIM pages to view and customize test setups, view real-time statistics, view and export test results, view events, logs, and other application and test-specific information.

Test overview page

When you create a test session based on any predefined, newly-created, or imported test configuration, CuSIM opens the **TEST OVERVIEW** page on which you can view a summary of the test configuration and a visual representation of the test topology. The Overview includes a test progress bar, timeline and objectives summary data, a link to the Global Settings, and the test topology section.

The test topology is an interactive graphical representation of the test network. From the topology, you access all of the configurable elements for the current test. These include the DUT (your gNB-CU), the DU (which is represented as a DU-CP node and a DU-UP node), and the user endpoints (UEs).

Configuration properties pages

You use a number of properties pages as you configure a test. They are presented as a series of cascading panels that reveal successively detailed settings for the elements in your test configuration.

Statistics page

Real-time statistics are immediately available while a test is running and can be accessed for tests that were previously run. The statistics page will contain multiple panels that display graphical or textual test run statistics. You can select from among the various tabs to view specific categories of statistics, including F1 setup, F1 UE Context setup, F1 UE Context release, RRC procedures, NAS procedures, HTTP requests, HTTP traffic throughput, among others.

Additional information and resources

All of the information in this User Guide is based on the assumption that CuSIM has already been successfully deployed in your network. The following resources provides information that is not covered in this guide:

Resource	Location
Software and documentation download page	Downloads & Updates
CuSIM Deployment Guide	A copy is available on the CuSIM online help *Welcome* page and well as the Software Downloads page cited above.
Release Notes	The Release Notes are available TBD.
CuSIM web page	TBD
Keycloak user documentation	https://www.keycloak.org/documentation

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CHAPTER 2

Initial administrator login

This chapter describes the actions that are required the first time you log in to CuSIM as the application administrator, following deployment.

Required information

- The IP address that you set for the CuSIM web interface during deployment.
- The IP address of the license server.
  The license server is shipped as a separate `.ova` file. After deploying the `.ova` file, you can access it using a web browser.
- Your CuSIM license activation codes (or entitlement codes).

Initial login and password change

CuSIM provides a default administrator account, and you will use that account on your initial login and for subsequent administrative tasks.

To log in as the administrator:

1. Enter the IP address of your deployed CuSIM instance in your browser's address field.
   CuSIM opens the Keysight login page.
2. Enter the default administrator login credentials:
   - user ID: **admin**
   - password: **admin**
3. Click **Login**.
   Because this is the initial login, CuSIM requires that you change the password for the admin account.
4. Review and accept the Keysight Software End User License Agreement.

5. Change the default **admin** user password:
   a. Click your account name (*admin*) in the CuSIM title bar.

   CuSIM opens the **Edit Account** page in a new browser tab.
   b. Click **Password** in the navigation pane.
   c. Enter the current password and your new password.
   d. Click **Save**.

Next steps:

- Activate licenses
- Configure your license server
- Create user accounts

Activate licenses using License Manager

Once you have completed the initial admin login, you need to activate the licenses for this CuSIM deployment.

To activate your licenses:

1. Select **Administration** from the setup menu ( ).
2. Select **License Manager** from the **Adminstration** menu. CuSIM opens the **License Manager** page.
3. To activate your licenses:
   a. Select **Activate licenses**.
   CuSIM opens the **Activate Licenses** dialog.
   b. Enter your license data in the dialog box.
   You can use either activation codes or entitlement codes (one or more).
   c. Select **Load Data**, indicate the number of licenses you want to activate, then click **Activate**.
   Your new licenses—which should now be listed in the **License Manager** page—are now available for running tests.

Configure the License Server

If you are using an external License server, then you need to select and configure your license provider:

1. Select **Applications Settings** from the setup menu ( ).
   CuSIM opens the **Application Settings** dialog.
2. Select your **License Provider** from the drop-down list.

3. Enter the **License Server IP** address (see Required information on page 5, above).
4. Click **Update**.

Create regular user accounts

Before you and other members of your organization start building and running tests, it is recommended that you—logged in as the administrator—create a *regular user account* for each individual (including yourself). A *regular user* can create, manage, and run tests, but cannot perform access control functions (such as creating and managing user accounts). Further, it is recommended that you use the admin account only for administrative activities.

Refer to Manage CuSIM users on page 67 for detailed information about user account management.

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CHAPTER 3

User login and logout

After the CuSIM application administrator has created user accounts for the individuals who will use CuSIM, those users can access the system and start to use its services.

Log in as a regular user

The user accounts that the CuSIM application administrator creates are known as regular user accounts. A *regular* user can create, manage, and run tests, but cannot perform access control functions (such as creating and managing user accounts).

1. Enter the CuSIM IP address in your browser's URL address field.
2. Press **Enter** to access the Keysight **Login** window.
3. Enter your CuSIM user name and password, then select **Login**.
4. If you are logging in for the first time, you may be required to change your password:
   a. Enter your **New Password**.
   b. Enter the password again in the **Confirm Password** field.
   c. Select **Submit**.

On successful log in, CuSIM opens the dashboard.

Log out

To log out of CuSIM, select **Log Out** from the Settings menu ( ).

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CHAPTER 4

Build and run a test

This chapter describes the sequence of actions needed to build and run a new CuSIM test.

Chapter contents:

Step 1: Create a new test config

The first step in building a new test is to create a new config:

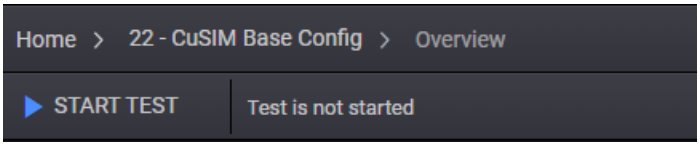
- Create a config based on a template below
- Create a new config based on an existing config on the next page

Create a config based on a template

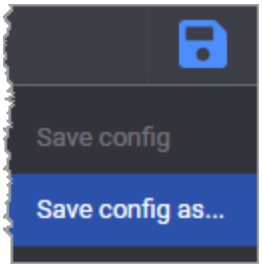
1. Log in to CuSIM.
2. In the Dashboard page, select the **Wireless CuSIM** template from the **Create New Test** panel.

   CuSIM opens the **Test Overview** page, which includes the graphical representation of the test topology.

   CuSIM assigns a session number and temporary name to the test, and displays that information in the title bar. For example:



3. Assign a name to your new test config:
   a. Select **Save config as...**



   CuSIM opens the **Save config as** dialog.
   b. Enter a name for the config, then select **Save As**.

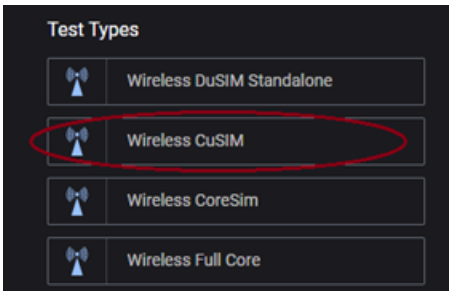
The new test config is immediately available.

NOTE

The terms test config and test session are not entirely synonymous. A 'config' refers to a configuration definition file (JSON format), whereas a 'session' is an instance of that file that is loaded in memory and is capable of being run. Refer to Manage and use test sessions on page 57 for detailed information about managing config files and sessions.

Create a new config based on an existing config

Rather than creating a new config based on one of the CuSIM templates, you can create a config based on an existing test config. The only difference is that (in step 2 in the procedure shown above) you will select a test config from the **Browse Configs** panel, and that will be the source for your new config.

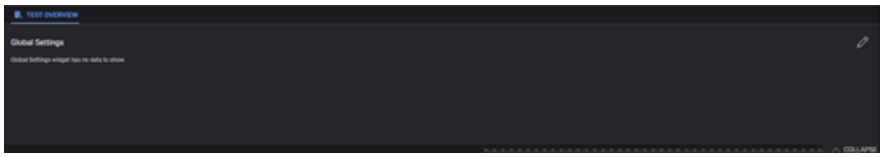


Step 2: Configure Global Settings

Global Settings provide access to configuration properties that are applicable at the test level (versus the node or UE level).

To configure the Global Settings:

1. Navigate to the **Test Overview** window.
2. Select **Expand** if the **Test Overview** section is collapsed.
3. Select the **Edit** button on the **Global Settings** section.



This opens the **Global Settings** panel.

4. Configure the settings that you will need in your test.
   Many of these settings are important for the proper execution of your tests and for establishing the parameters that control logging, captures, and statistics collection.

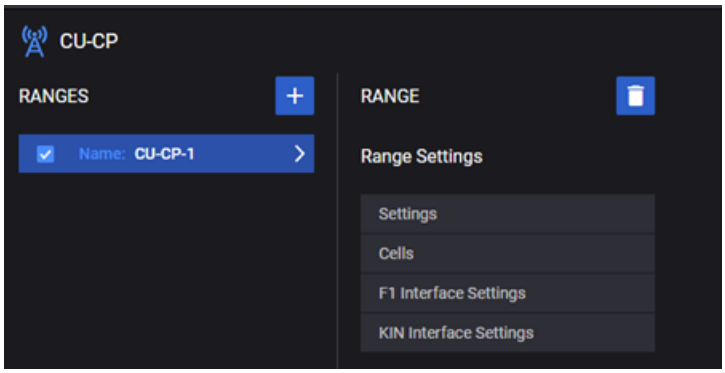
Refer to Global Settings on page 21 for a description of all of the settings.

Step 3: Configure CU-CP test nodes

The CuSIM test topology includes a representation of the simulated CU nodes in your test configuration. Each CU node is structured as two units: CU-CP and CU-UP.

To configure and manage CU-CP nodes for your test:

1. Select **CU-CP** from the topology window.
   CuSIM opens the CU-CP **RANGES** panel. A new test will have one CU-CP range; you can add additional ranges.
2. Select the name of a range (such as CU-1) to access the configuration settings. For example:



3. Configure each of the settings, which are described in CU-CP configuration settings.

Step 4: Configure CU-UP test nodes

The CuSIM test topology includes a representation of the simulated CU nodes in your test configuration. Each CU node is structured as two units: CU-CP and CU-UP.

About CU-UP ranges

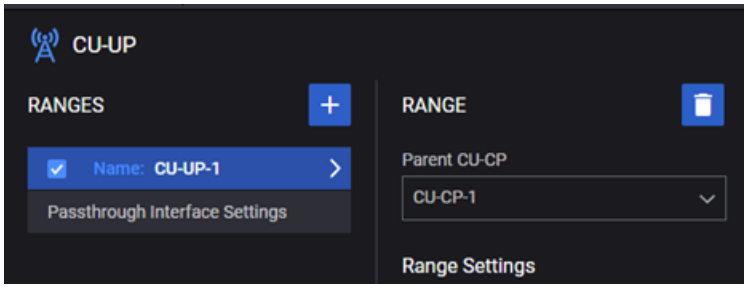
CuSIM manages DU-UP ranges as follows:

- CuSIM automatically creates one DU-UP range for each DU-CP range that you configure in the test.
- If you delete a DU-CP range, CuSIM automatically deletes the corresponding DU-UP range.
- Although you cannot directly delete a DU-UP range, you can deselect a range for the test session. When you deselect a DU-UP range, CuSIM does not deselect the corresponding DU-CP range.

How to configure CU-UP nodes

To configure and manage **CU-UP** nodes for your test:

1. Select **CU-UP** from the topology window.
   CuSIM opens the CU-UP **RANGES** panel.
2. Select the name of a range (such as CU-1) to access the configuration settings. For example:

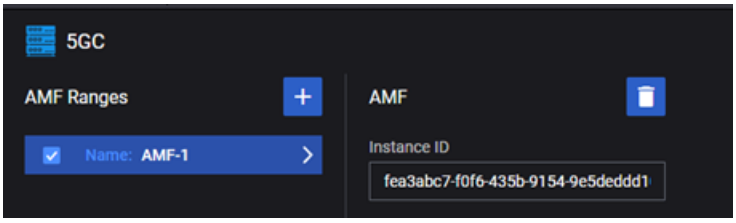


3. Configure each of the settings, which are described in CU-UP Range panel.
4. To select or deselect a range for the rest:
   a. Return to the CU-UP **RANGES** panel.
   b. Select the **Select** check box to toggle the range between *Selected* and *Deselected*, as required.

Configure 5G Core Settings

The CuSIM test topology includes a representation of the simulated 5G Core/AMF information in your test configuration.

1. Select AMF from the topology window. CuSIM opens the 5GC AMF RANGES panel.
2. Select the name of a range (such as AMF-1) to access the configuration settings. For example:



3. Configure each of the settings, which are described in AMF Range panel.

Assign agents to the CU test nodes

You cannot run a CuSIM test until you have assigned agents to all of the test nodes. To assign an agent to a node:

1. In the topology window, select the traffic agent icon on the top right corner of the node. The icon that represents the agent can be any of the following:

⚠	—	No agents are assigned to the node.

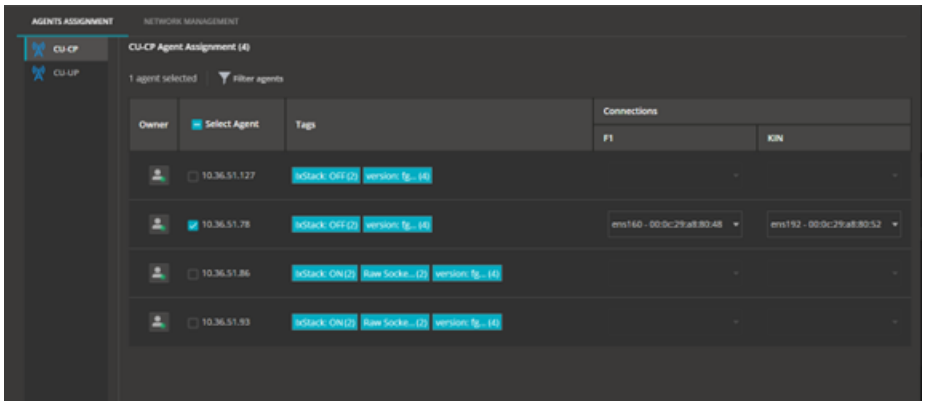
— One or more agents are assigned.

CuSIM opens the **Agents Assignment** window, which presents a list of agents. If the list has no filters set, then all agents are listed.

2. Assign specific agents or all available agents to the node:
   - To assign specific agents (one or more) to the node, select the check-box next to the agent's IP address.
   - To assign all available agents to the node, select the **Select Agent** check-box (located in the table header) Select Agent.

   NOTE You can display the agent ID by hovering over the IP address.

3. Select the F1, KIN **Connections**, IP passthrough interface if required.
4. Select **Update**.



Agent Assignments window

The following table describes the content of each column displayed on the **Agents Assignment** window.

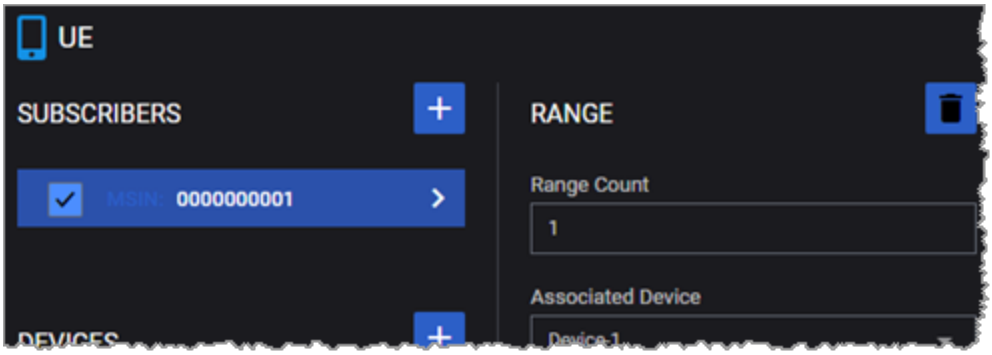
Column	Description
Owner	Hover over the **Owner** icon to see the current agent ownership and status, which will be one of the following: • The agent is owned by the user whose email address is listed. In this case, the agent is not available for assignment. • The agent is offline. In this case, the agent is not available for assignment. • The agent is available for assignment.
Select Agent	Use the check box next to the IP address to select that agent for assignment. You can also select all available agents by selecting the **Select Agent** check box (in the table header).
Tags	This column displays the tags associated with each agent. Each tag indicates the number of agents to which it is associated.

Column	Description
	Refer to About traffic agents for more information about tags.
Connections	The table displays the available interface and the MAC address for each wireless connection. The interface can be selected from the drop-down list. NOTE For the CuSIM nodes that have multiple interfaces, for each interface, you can change the interface type using the drill-down option.

NOTE From the **Agents Assignment** window you can select other nodes from the list and configure the agents for those nodes also. In this way, you can configure agents for all your test nodes at the same time.

Step 5: Configure UEs

In a CuSIM test, UEs refers to the test's simulated users who are attempting to access the test network and use its services.



To configure one or more ranges of mobile subscriber definitions for a test:

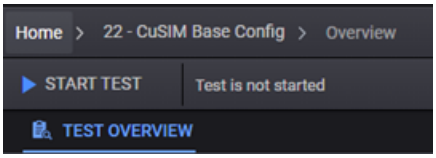
1. Select **UE** from the CuSIM topology window.
   CuSIM opens the top-level (leftmost) UE properties window.
2. From the UE panel, select a **UEs** range to open its properties panel. (Each range is identified by the MSIN assigned to the first subscriber in the range.)
   CuSIM opens the **RANGE** for the selected subscriber.
3. Configure the subscriber settings. The configuration tasks for each range include:
   a. Specify the number of subscribers to create for the range (the *Range Count* setting).
   b. b. Configure the detailed settings, which include Identity settings and Security Settings of the subscriber range. See UE SUBSCRIBER configuration settings for detailed descriptions.
   c. Configure **Objectives** for the range:
      i. In the **RANGE** panel, in the **Objectives** section, select **Control Plane**. Configure Test Duration per UE range. If there are multiple UE ranges, test is stopped according to the maximum specified duration value.
      ii. In the **RANGE** panel, in the **Objectives** section, select **User Plane**. CuSIM opens the **User Plane** panel.

iii. Add each **Application Traffic** type that you need for the subscriber range. See UE Test Objective settings for a description of the properties that you can configure for each of the traffic types.

4. To add and configure additional subscriber ranges:
   a. Return to the UE **RANGES** panel.
   b. Select the **Add Range** button.
   c. Configure the settings for the new range.

Step 6: Start the test

After you have configured all the properties needed for your test, select the **START TEST** button.



After you start a test, the CuSIM tool bar displays the test status throughout its execution progress. In addition, each test session tile (located on the CuSIM Dashboard) displays that test's name and current status. The test status will be one of the following:

- **Test is not started**: The test session is created, the test configuration is loaded, but the test has not yet been started.
- **Test is initializing**: After clicking the **START TEST** button on the test progress bar, the initializing state is displayed on the progress bar and the test session tile. During this phase the hardware resources are allocated and the test is prepared for starting.
- **Test is configuring**: During this stage, the configuration is applied to the test.
- **Test is running**: During this stage, the nodes are connected, test iterations start one-by-one based on the configured parameters, traffic flows are connected, and traffic generation begins.
- **Test is stopping**: During this stage, traffic stops, traffic flows disconnect, logs are collected, ports are released, and the hardware disconnects.
- **Test is stopped**: The test is no longer running.

CuSIM will display a message in the tool bar if it cannot successfully initialize the test.

After the test initialization and configuration phases have been successfully completed, CuSIM will:

- Start generating traffic (user plane and control plane).
- Display the **STOP TEST** button in the tool bar.
- Open the **STATISTICS** page.

The estimated total time it takes the test to complete and the current run time are also displayed on the progress bar.

If for any reason you want to stop the test before it completes, select the **STOP TEST** button on the progress bar.

Step 7: View real-time test results

When you successfully start a test, CuSIM immediately displays the **STATISTICS** page, where you can view real time statistics.

The specific groups of statistics that are collected depend upon several factors, including:

- The types of traffic that you have chosen in your **Objectives** settings.
- Whether or not you have selected **Enable User Plane Advanced Stats** in the **Global Settings** (one of the **Advanced Settings**).
- The procedural call flows that your DUT attempted to achieve.

Statistics page

The **Statistics** page has several panels, which can be dragged and dropped and rearranged on the dashboard. They can also duplicated or removed, and there are a wide variety of formatting options for each panel. Inspecting a panel allows you to view or download results as CSV, JSON, Query, or just as a list of Stats.

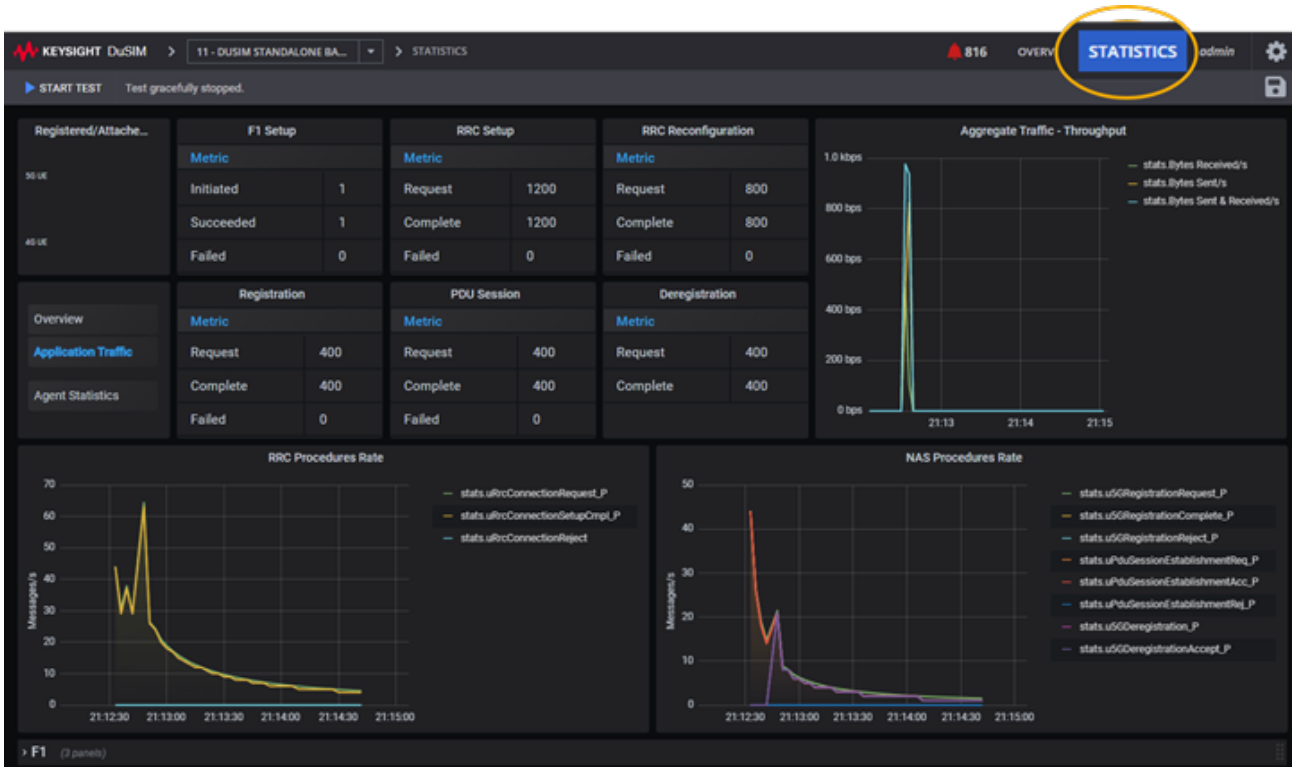
Statistics groupings

The statistics are organized into groups, which include Overview, Application Traffic, and Agent Statistics

Overview statistics include:

- F1 Setup: number of procedures initiated, succeeded, and failed.
- RRC Setup: number of procedures initiated, succeeded, and failed.
- RRC Reconfiguration: number of procedures initiated, succeeded, and failed.
- Registration: number of procedures initiated, succeeded, and failed.
- PDU Session: number of procedures initiated, succeeded, and failed.
- Deregistration: number of procedures initiated, succeeded, and failed.
- Aggregate Traffic Throughput: number of bytes sent and received per second.
- RRC Procedure Rate: number of RRC connections requested, completed, and rejected per second.
- NAS Procedure Rate: number of NAS registrations and deregistrations requested, completed, and rejected per second; number of PDU session establishment requests made, accepted, and rejected.

Statistics page example



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CHAPTER 5

Global Settings

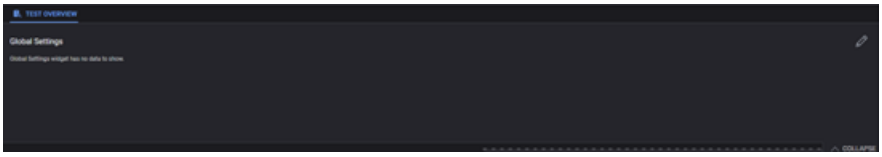
The Global Settings include parameters that either have overall applicability to the test or can be used (by reference) in the configurations of other nodes in the test topology.

Chapter contents:

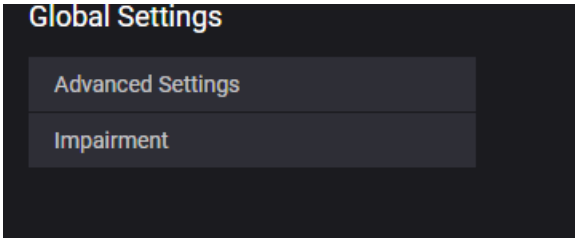
Access Global Settings

To access the **Global Settings** page, do the following:

1. Select the **Test Overview** tab.



2. Select **Expand** if the **Test Overview** section is collapsed.
3. Select the **Edit** button on the **Global Settings** section.
   This opens the **Global Settings** panel.



Advanced Settings

The following table describes the settings required to enable user plane and control plane advanced statistics:

Setting	Description
Overwrite Capture Size for IxStack	Enable this option to overwrite the capture size for IxStack.
Custom Capture Size for	Set the custom value of the capture size for IxStack.

Setting	Description
IxStack	
Enable Capture Circular Buffer for IxStack	Select this option to enable circular buffer capture for IxStack.
Enable Capture On Loopback Interface	Select this option to enable packet capture on the loopback interface.
Enable Control Plane Advanced Stats	Select this option to enable control plane latency statistics.
Enable User Plane Advanced Stats	Select an option from the drill-down list for the user plane advanced statistics: • **None** - no advanced statistics enabled. • **One Way Delay** - the time spent by the packet on the network from the moment it is sent until it is received. • **Delay Variation Jitter** - the per polling interval average delay variation jitter value calculated for all packets.
Automated Polling Interval	This option is enabled by default. The statistics are retrieved based on a predefined polling interval.
Custom Polling Interval (sec)	This option becomes available only when *Automated Polling Interval* option is disabled. It allows you to create a custom polling interval.

Logging Settings

The following tables describe log level and log components settings:

Agent

Setting	Description
Log level	Select one of the options: • **Info** - Designates informational messages that highlight the progress of the application at coarse-grained level. • **Debug** - Designates fine-grained informational events that are most useful for debugging the application.
Log Tags	Log Tags are used to collect specific information in the logs; they work with Debug and with Info log levels. Rather than allowing the logs to collect information about everything, you can use Log Tags to collect specific information—such as SCTP or HTTP messages—during the test. This limits the amount of information that is collected, making it easier for you to extract the data that you need. Select one or more tags from the drop-down list.

GTPU:

Setting	Description
Log level	Select one of the options: • **Critical** - Designates messages indicating that a major error has occurred that impacts system stability. • **Error** - Designates messages indicating that an error has occurred that impacts application stability. • **Warning** - Designates messages indicating that an error has occurred that potentially impacts application stability. • **Info** - Designates informational messages that highlight the progress of the application at coarse-grained level. • **Debug** - Designates fine-grained informational events that are most useful for debugging the application.
Log Components	These are different protocol pieces, or subcomponents, of the GPRS Tunnelling Protocol GTP overall functionality. This limits the amount of information that is collected, making it easier for you to extract the data that you need, as it does not log full packets that are received, but logs different events which helps in debugging on the selected component. Select one or more components from the drop-down list.
Log Frame Components	This option logs actual packets on the wire as the GPRS Tunnelling Protocol processes it, so here you can select which packet you want to log, like: Uplink packet, Downlink packet, ARP packet, and so on. Select one or more components from the drop-down list.

Control Plane PDCP:

Setting	Description
Log level	Select one of the options: • **Critical** - Designates messages indicating that a major error has occurred that impacts system stability. • **Error** - Designates messages indicating that an error has occurred that impacts application stability. • **Warning** - Designates messages indicating that an error has occurred that potentially impacts application stability. • **Info** - Designates informational messages that highlight the progress of the application at coarse-grained level. • **Debug** - Designates informational messages that highlight the progress of the application at coarse-grained level.
Log Components	These are different protocol pieces , or subcomponents of the Packet Data Convergence Protocol overall functionality. This limits the amount of information that is collected, making it easier for you to extract the data that you need, as it

Setting	Description
	does not log full packets that are received, but logs different events which helps in debugging on the selected component. Select one or more components from the drop-down list.

User Plane PDCP:

Setting	Description
Log level	Select one of the options: • **Critical** - Designates messages indicating that a major error has occurred that impacts system stability. • **Error** - Designates messages indicating that an error has occurred that impacts application stability. • **Warning** - Designates messages indicating that an error has occurred that potentially impacts application stability. • **Info** - Designates informational messages that highlight the progress of the application at coarse-grained level. • **Debug** - Designates fine-grained informational events that are most useful for debugging the application.
Log Components	These are different protocol pieces , or subcomponents of the Packet Data Convergence Protocol (PDCP) overall functionality. This limits the amount of information that is collected, making it easier for you to extract the data that you need, as it does not log full packets that are received, but logs different events.

CHAPTER 6

Assign and manage agents

A CuSIM *agent* is the virtual machine or docker container on which the application traffic and control plane procedure simulation is performed. Assigning and managing traffic agents is one of the essential and required aspects of creating and executing CU simulation tests.

Chapter contents:

About traffic agents

CuSIM tests require the use of *agents* to generate traffic for both DU-UP (user plane) and DU-CP (control plane). The containers and virtual machines that act as agents can be horizontally scaled to support a very high level of application traffic throughput and control plane procedure rates.

Agent implementation

Agents are implemented as containers or virtual machines, depending upon the platform on which they are deployed.

Platform	Supported platforms	Implementation
Public clouds	Amazon Web Services (AWS)	virtual machines
Private clouds	VMware ESXi 6.5 and ESXi 6.7	virtual machines
Servers	Kubernetes with OpenShift, Flannel, and Calico	Container

Assigning tags to agents

Tags provide a flexible and simple method of assigning metadata to agents. There are two types of tags:

Type	Color	Description
System tag	Blue	These tags are defined by CuSIM. You can hover over the system tag icon to display the tag information.
User-defined tags	Gray	You can add custom tags from the Agent Management window. These are tags that you create; they are free-form, which gives you the

Type	Color	Description
		ability to categorize or mark agents in any way that supports your test requirements. Refer to Agent management for instructions.

Assigning agents to nodes

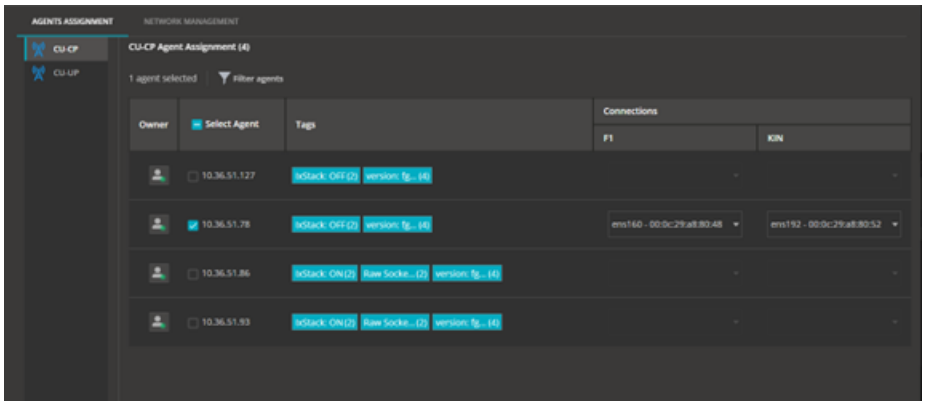
You cannot run a CuSIM test until you have assigned agents to all of the test nodes. To assign an agent to a node:

1. In the topology window, select the traffic agent icon on the top right corner of the node. The icon that represents the agent can be any of the following:

⚠	—	No agents are assigned to the node.
	—	One or more agents are assigned.

   CuSIM opens the **Agents Assignment** window, which presents a list of agents. If the list has no filters set, then all agents are listed.
2. Assign specific agents or all available agents to the node:
   - To assign specific agents (one or more) to the node, select the check-box next to the agent's IP address.
   - To assign all available agents to the node, select the **Select Agent** check-box (located in the table header) Select Agent.

   NOTE You can display the agent ID by hovering over the IP address.
3. Select the F1, KIN **Connections**, IP passthrough interface if required.
4. Select **Update**.



Agent Assignments window

The following table describes the content of each column displayed on the **Agents Assignment** window.

Column	Description
Owner	Hover over the **Owner** icon to see the current agent ownership and status, which will be one of the following: • The agent is owned by the user whose email address is listed. In this case, the agent is not available for assignment. • The agent is offline. In this case, the agent is not available for assignment. • The agent is available for assignment.
Select Agent	Use the check box next to the IP address to select that agent for assignment. You can also select all available agents by selecting the **Select Agent** check box (in the table header).
Tags	This column displays the tags associated with each agent. Each tag indicates the number of agents to which it is associated. Refer to About traffic agents for more information about tags.
Connections	The table displays the available interface and the MAC address for each wireless connection. The interface can be selected from the drop-down list. NOTE For the CuSIM nodes that have multiple interfaces, for each interface, you can change the interface type using the drill-down option.

NOTE From the **Agents Assignment** window you can select other nodes from the list and configure the agents for those nodes also. In this way, you can configure agents for all your test nodes at the same time.

Agent management

You manage your CuSIM agents from the **Agent Management** window, which is accessed from the Setting menu (⚙). This window displays detailed information for all or selected agents and provides all of the functionality needed to manage them.

- Agent Management window
- Selecting agents
- Search, select, and filter agent data
- Adding and removing tags
- Management actions

Agent Management window

The Agent Management window displays a table that shows the current status of your agents.

Column	Description
☐	The first column in the table contains a checkbox that you use when selecting individual agents for various operations. Note that you can use the *Agent IP* checkbox in the table header to select all agents.
Agent IP	Displays the IP address of the agent. To see the Agent ID, hover over the agent's IP IP address.
Owner	Indicates whether the agent is assigned, available, or offline.
Status	Indicates the current status of the agent.
Tags	This column displays the tags associated to each agent. There are two types of tags: • system tags (blue): these are defined by CuSIM. You can hover over a system tag to view more details. • user tags (gray): these are defined by cusim users. Refer to Adding and removing tags for more details. Each tag indicates the number of agents to which it was associated.
Test NICs	Displays the NICs for each agent and, on hover, it displays the MAC address.
Hostname	Displays the hostname.
Memory	Displays the amount of RAM memory allocated to the agent.
CPU info	Displays additional information about the CPU model, the frequency and the number of cores.
Last Run Data	Displays the nodes that were last run on the agent.
Last Run Timestamp	Displays the date and time of the last agent run.

Selecting agents

You can perform management actions on individually-selected agents (one or more) or on all agents:

- To select a specific agent, select the check-box associated with the agent's IP address. (When hovering over the IP address of an agent, the agent ID is displayed.)
- To select all agents currently listed in the table, select the *Agent IP* checkbox in the table header.

Search, select, and filter agent data

You can selectively locate and display agent data using the following functions:

Function	Description
Filter agents	Use this option to filter the available agents by tag names: 1. Select **Filter agents**. 2. Enter the name of the tag or select it from the available list. 3. Select **Close**. The content on the Agent Management window is updated with the filtering results. To remove the filtering results, select **Clear**.
Include offline agents	Set this option to either include or exclude offline agents from the list.
Search	Search by IP, Owner, hostname, or status.

Adding and removing tags

You can create and use tags to categorize agents in any way that suits your needs.

Add a custom tag:

1. Select one or more agents in the table.
2. Select **Tag as**.
3. Type the name of the tag in the **Search or add tag** field, then select **Add**.
4. Select **Update** to add the tag name.

Remove a tag:

1. Select one or more agents in the table.
2. Select **Tag as**.
3. Select **Remove tags**.
4. Use the search functionality to identify the tag name or select it from the list.
5. Select **Update** to remove the tag name.

Agent management actions

You can perform the following actions on the agents that are currently selected (selected via the selection checkbox in the first column of the table):

Function	Description
Clear ownership	Releases your ownership of the selected agents.
Hard reboot	Performs a hard reboot on the agent (the agent machine is power-cycled).
Delete	Removes the selected agent(s) from the Agent Management list.

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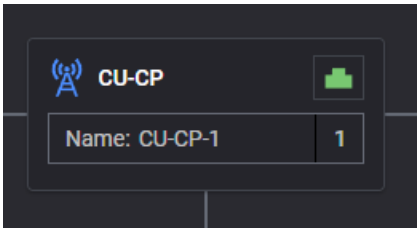
CHAPTER 7

GNB CU-CP configuration settings

The gNB Centralized Unit (gNB-CU) is a logical node hosting PDCP and SDAP layers of the gNB and waits gNB-DU's connects to it. One gNB-CU supports one or multiple cells, and it terminates the F1 interface connected with the gNB-DU.



In the CuSIM test topology, the gNB-CU is logically structured as two entities:

- CU-CP, which connects with the DU over the F1-C interface, which carries control plane traffic.
- CU-UP, which connects with the DU over the F1-U interface, which carries user plane traffic.

NOTE In this release, only one CU-CP range is supported.

The DU is the device under test (DUT) in a Keysight CuSIM test configuration.

Chapter contents:

CU-CP Node settings panel

Settings	Description
Requests cells activation at F1 Setup	If this checkbox is enabled, CU-CP requests the gNB-DU-CP to activate cells via F1 Setup Response message, then gNB-DU-CP will initiate gnB-DU Configuration Update procedure for cell activation. If this checkbox is not enabled, gNB-CU initiates gNB-CU Configuration Update procedure for cell activation after F1 Setup procedure.
Name	The name uniquely identifies the CU-CP. You can accept the value provided by

Settings	Description
	CUSIM or overwrite it with your own value.
CU ID	Enter the gNB-CU Identifier for this CU-CP range. It can be configured to use between 22 bits and 32 bits. The valid value range is 0 - 4,29,49,67,295.
CU ID Length	The number of bits (from NRCGI) to use for gNB-CU Identifier. (The number of bits to use for CU ID is a vendor decision.)
F1 Setup Wait Time	This parameter defines the value of the “Time to Wait” IE set by the gNB-CU in the F1 Setup Failure message.

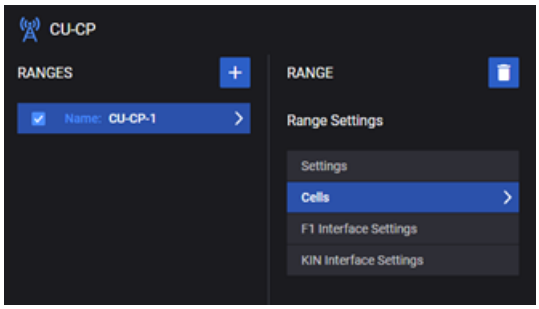
CU-CP Range settings

Each CU-CP Range is identified by a unique name. The following table describes the Range Settings that you configure for each CU-CP range.

Settings	Description
Settings	Each CU-CP range requires the configuration of an associated of Node Settings which are described in section CU-CP Node settings.
Cells	Each CU-CP range requires the configuration of an associated Cells which are described in section Cell settings.
F1 Interface Settings	Each CU-CP range requires the configuration of F1 interface settings, through which CU-CP instance interacts with gNB-DU-CP Node. These settings are described in section F1 Interface Settings.
KIN Interface Settings	Each CU-CP range requires the configuration of KIN interface settings, through which CU-CP node and CU-UP nodes communicates. This interface is an internal interface (not exposed to DUT) and suggested to be configured through an internal network within CUSIM. These settings are described in section KIN Interface Settings.

Cells settings

Each CU-CP range requires configuration of a group of Range Settings, which include the range's Cells settings.



These settings are organized in the following groups:

- Cells
- NSSAI
- SIB

Cells

Each CU-CP range requires configuration of a group of **Cells** settings, which are the cells that this gNB-DU supports:

Settings	Description
Cell ID	Cell Identifier for this range. The NR Cell Identifier (NCI) is calculated using CU ID, and CU ID length from section Error! Reference source not found.. NCI NCI (36 bits) = gNB-CU Identity (CU ID Length) + Cell ID (36- CU ID Length)
Cell ID Increment	Enter the value by which CuSIM will increment each Cell ID if the Cell Count is greater than 1.
Cell Count	If you want to create multiple cells for this cell range, enter the desired number in this field.
ARFCN	Enter the desired downlink New Radio Absolute Radio Frequency Channel Number
SSB Frequency	The Frequency referring to the position of resource element RE=#0 (subcarrier #0) of resource block RB#10 of the SS block. Used for Handover decision.
Subcarrier Spacing	Select the subcarrier spacing value for the served cell. In 5G networks, the subcarrier spacing scales by 2μ x 15 kHz to cover different services: QoS, latency requirements, and frequency ranges. 15, 30, and 60 kHz subcarrier spacing are used for the lower frequency bands, and 60, 120, and 240 kHz subcarrier spacing are used for the higher frequency bands.
TAC	The unique identifier of the Tracking Area Code (TAC) to which this cell belongs in the 5G system.
PLMN Identity	The Public Land Mobile Network (PLMN) in which this cell is located. The PLMN is a globally unique identifier that comprises the MCC and MNC: • PLMN MCC: The PLMN's mobile country code (MCC). • PLMN MNC: The PLMN's mobile network code (MNC).
NSSAI	See NSSAI.
SIB	See SIB.

NSSAI

Each CU-CP range requires configuration of a group of NSSAI settings, which are described in the following table:

Setting	Description
	The following actions are available: • Select the **Add NSSAI** button to add a new NSSAI to your test configuration. • Select UE NSSAI from the list to access the configuration settings.
NSSAI panel:	
	Select the **Delete NSSAI** button to delete this NSSAI from your test configuration.
SST	The value that identifies the SST (Slice/Service Type) for this NSSAI. SST comprises octet 3 in the S-NSSAI information element. The standardized SST values are: **1** (eMBB) **2** (URLCC) **3** (MIoT)
SD	The Slice Differentiator (SD) value for this NSSAI. SD is an optional information that differentiates amongst multiple Network Slices of the same Slice/Service type. The SD field comprises octets 4 through 6 in the S-NSSAI.
Mapped SST	The Mapped configured Slice/Service Type (SST) value for this NSSAI.
Mapped SD	The Mapped configured Slice Differentiator (SD) value for this NSSAI.

SIB

If you would like CU-CP to send optional gNB-CU System Information with F1 Setup Response message, you can configure them from:

Setting	Description
SIB Type	Enter the System Information Block Type, e.g. 2 means sibType2, 3 for sibType3, etc.
SIB Message	Enter the hex string bytes - RRC SIB Message Container. (OCTET STRING)

F1-CP Interface Settings

Each **CU-CP** range requires configuration of a group of **Range Settings**, which include the range's **F1-CP Interface Settings**.

These settings enable communication between the simulated DUs and your DUT. They are grouped into **F1 Interface Settings** and **Connectivity Settings**.

F1 Settings

The F1 interface settings specify the F1 port number and the interface setup wait time.

Setting	Description
F1 Port	The port to use for the F1 connection. The default port number is 38472, which is an unassigned IANA port number. You can set this to a different value, if appropriate for your test requirements.

Connectivity Settings

The connectivity settings comprise the interface's IP address and, optionally, outer and inner VLAN identifiers.

Setting	Description
IP settings:	
IP Address	Enter the IP address that the first CuSIM CU-CP node defined in this range will use to communicate with gNB-DU (DUT)
IP Prefix Length	The subnet prefix length associated with this CU-CP IP interface. It specifies the number of leftmost bits in the address, which indicates the network portion of the address.
Gateway Address	This CU-CP node’s gateway address.
VLAN settings:	
Outer VLAN	Enable this setting if you need VLAN IDs for your test, and then specify the **VLAN ID**.
Inner VLAN	When *Outer VLAN* is enabled, CuSIM exposes the optional *Inner VLAN* setting. Enable this setting if you need inner VLAN IDs for your test, and then specify the inner **VLAN ID**.

KIN Interface settings

The traffic agents of the CuSIM test nodes (CU-CP and CU-UP) communicate through an internal network called the Keysight Internal Network. The following table describes the settings for the KIN interface:

Settings	Description
IP Address	Enter the IP address of the KIN for this CU-CP node defined in this range will use to communicate with CU-UP node.

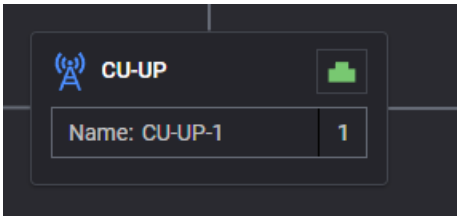
Settings	Description
IP Prefix Length	The subnet prefix length associated with this KIN IP interface. It specifies the number of leftmost bits in the address, which indicates the network portion of the address.
Gateway Address	KIN Interface’s gateway address.

CHAPTER 8

GNB CU-UP configuration settings

In the CuSIM test topology, the gNB-CU is logically structured as two entities:

- CU-CP, which connects with the CU over the F1-C interface, which carries control plane traffic.
- CU-UP, which connects with the CU over the F1-U interface, which carries user plane traffic.



The chapter describes the **CU-UP** settings.

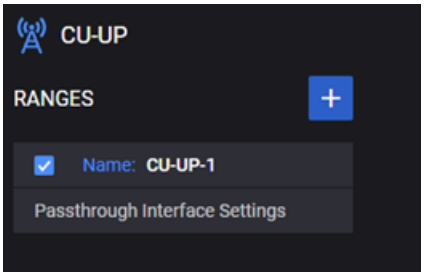
Chapter contents:

CU-UP RANGES panel

The **CU-UP RANGES** panel opens when you select the CU-UP node from the network topology window. You can perform the following tasks from this panel:

- Open a CU-UP range configuration for editing or viewing.
- Turn on or turn off a range for the test configuration.

For example:



CU-UP Range panel

When you select a DU-UP range from the **DU-UP Ranges** panel, CuSIM opens the **Range** panel, from which you configure the F1-UP interface settings and connectivity settings.

Parent CU-CP: Select the CU-CP range, this CU-UP range is connected to.

F1 Interface Settings

The F1 interface settings specify the F1 port number and the MTU value for this interface.

Setting	Description
F1 Port	The port to use for the F1 connection. The CuSIM default port number is 2152, which is the registered GTP-U protocol port. You can set this to a different value, if appropriate for your test requirements.
MTU	The desired Maximum Transmission Unit (MTU) for the F1 interface. The MTU specifies the largest packet that an Ethernet frame can carry.

Connectivity Settings

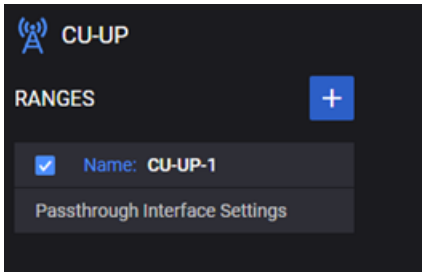
The connectivity settings include the IP address values plus the layer 2 values for the user plane traffic.

Setting	Description
IP settings:	
IP	Enter the IP address for the first DU-UP node in this range. This is the user plane IP address for the simulated DUs. It can be on its own subnet, as it has no relationship with any other IP addresses in the test config.
IP Address Increment	The value (expressed in IP address notation) by which the IP addresses of all the DU-UP nodes that are defined in this range will be incremented. The number of IP addresses that will be created is determined by the *Range Count* value configured for the *Parent DU-CP*.
IP Prefix Length	The subnet prefix length associated with this DU-UP IP interface. It specifies the number of leftmost bits in the address, which indicates the network portion of the address.
Gateway Address	This DU-UP node's gateway address.
MAC settings:	
MAC	Specify the first media access control (MAC) address that will be assigned to the DU-UP node defined in this range. The default value is an auto-generated address that you can change, if desired.

Setting	Description
MAC Increment	Specify the value (expressed as a 12-character alphanumeric MAC address value) by which the MAC addresses of all the DU-UP nodes that are defined in this range will be incremented.
VLAN settings:	
Outer VLAN	Enable this setting if you need VLAN IDs for your application traffic, and then specify the **VLAN ID**.
Inner VLAN	When *Outer VLAN* is enabled, CuSIM exposes the optional *Inner VLAN* setting. Enable this setting if you need inner VLAN IDs, and then specify the inner **VLAN ID**.

Passthrough interface settings

To configure the passthrough interface settings, select **Passthrough Interface Settings** from the RAN panel.



The configuration of the passthrough interface is required when passthrough is enabled in the UE settings. This interface will wait for an external traffic source.

The following settings are required for the passthrough interface configuration.

Setting	Description
IP settings:	
IP	Select the IP address to open the IP configuration panel for editing.
IP Address	The IP address assigned as the gateway address for the external traffic source.
IP Prefix Length	The IP address prefix assigned to this range. It specifies the number of leftmost bits in the address, which indicates the network portion of the address.
Gateway Address	The IP address assigned as gateway address.
Gateway Increment	The value to use when incrementing the Gateway address (starting with the Gateway Address).
MTU	The Maximum Transmission Unit (MTU) for this range. MTU specifies the largest packet that an Ethernet frame can carry.

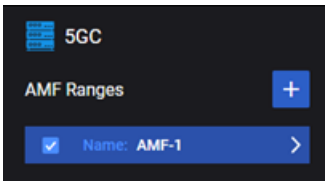
Setting	Description
MSS	The Maximum Segment Size (MSS) for this range. MSS specifies the largest TCP segment that the IP device can transmit as a single, unfragmented unit.
MAC settings:	
MAC	Select the MAC address to open the MAC configuration panel for editing.
MAC Address	Hardware MAC address.
MAC Increment	The value to use when incrementing the MAC address (starting with the MAC Address). The default value is 000000000001.
VLAN settings:	
Outer VLAN	Select the check-box to make this option available, and, then, select the Outer VLAN to open the configuration panel for editing.
VLAN ID	VLAN identifier
VLAN identifier	VLAN tag protocol ID.
Inner VLAN	This option is visible only when the Outer VLAN check-box is selected. Select the check-box to make this option available, and, then, select the Inner VLAN to open the configuration panel for editing.
VLAN ID	VLAN identifier.

CHAPTER 9

5g-Core and AMF configuration settings

CUSIM simulates 5G Core functionality and to configure 5G Core related information, you use AMF Ranges to configure the required information.

The AMF Ranges panel opens when you select the AMF node from the network topology window. Currently only one AMF range is supported and configured gNB-CU range uses this AMF range.



AMF Range panel

You use AMF Range Panel to configure AMF and 5G Core information.

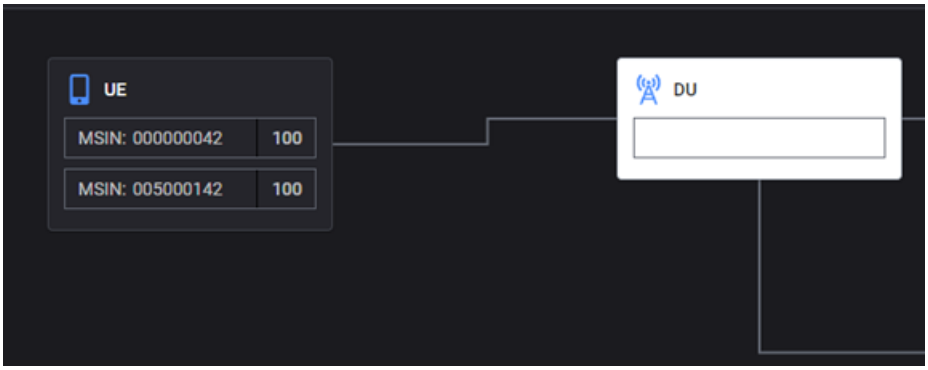
Parameter	Description
Instance Id	Each AMF instance is uniquely identified by an Instance ID. You can accept the value provided by CUSIM overwrite it with your own value.
Name	The name uniquely identifies each AMF instance. You can accept the value provided by CUSIM or overwrite it with your own value.
PLMN MCC	The PLMN MCC for this AMF range
PLMN MNC	The PLMN MNC for this AMF range.
Region ID	An AMF Region consists of one or multiple AMF Sets. The AMF Region ID to use for this simulated AMF node. This ID identifies the region in which the node resides. The AMF Region ID addresses the case that there are more AMFs in the network than the number of AMFs that can be supported by AMF Set ID and AMF Pointer. It allows operators to re-use the same AMF Set IDs and AMF Pointers in different regions.
Set ID	An AMF Set consists of some AMFs that serve a given area and Network Slice. Multiple AMF Sets may be defined per AMF Region and Network Slice(s). The AMF Set ID to use for this simulated AMF node. The Set ID uniquely identifies the AMF Set within the AMF Region.
Pointer	The AMF Pointer to use for this simulated AMF node. The AMF Pointer identifies

	one or more AMFs within the AMF Set.
Home Network Private Key	The home network public key that will be used for concealing the SUPI
Ciphering Algorithm	Allows to select the supported 5G ciphering algorithm: • NEA0 - Null ciphering algorithm • NEA1 - 128-bit SNOW 3G based algorithm • NEA2 - 128-bit AES based algorithm
Integrity Algorithm	Allows to select the supported 5G integrity protection algorithm: • NIA0 - Null Integrity Protection algorithm • NIA1 - 128-bit SNOW 3G based algorithm • NIA2 - 128-bit AES based algorithm

CHAPTER 10

UE configuration settings

When you select the **UE** object from the topology window, CuSIM opens the top-level (leftmost) UE properties window. The UE properties include all of the settings required to simulate large and varied groups of subscribers who are attempting to access the test network, establish connections to data networks, transmit (and receive) data of various types, and travel amongst the cells contained within your test network.

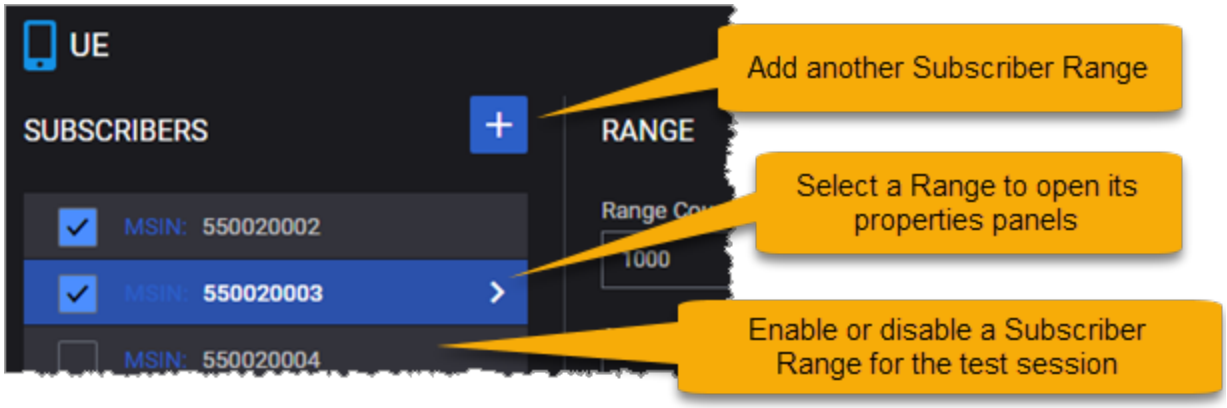


Chapter contents:

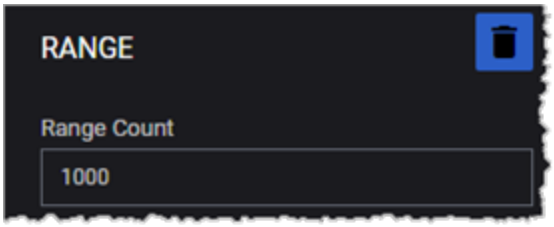
UE RANGES panel

The **UE** panel opens when you select the UE node from the network topology window. It provides access to properties panels with which you configure all of the settings needed to simulate one or more ranges of simulated subscribers.

You can perform the following **SUBSCRIBERS** tasks from the UE panel:



UE RANGE settings



The Subscribers **RANGE** panel provides access to all of the properties that define a Subscriber range.

Except for *Range Count*, all of the other properties are configured on additional panels.

Setting	Description
	Select the **Delete Range** icon to delete this range from your test configuration.
Range Count	Specify the number of subscribers to configure for this range.

UE Identification settings

The Identification properties are assigned to each individual subscriber in a Subscriber range. Each subscriber will have a unique MSIN, MSISDN, and IMEI Serial Number value. The MCC and MNC values are shared by all the subscribers in a range.

Setting	Description
PLMN MCC	The Mobile Country Code (MCC) for this range of UEs.
PLMN MNC	The Mobile Network Code (MNC) for this range of UEs.
MSIN	The Mobile Subscriber Identification Number (MSIN) to assign to the first subscriber in the range. This value is incremented for each additional subscriber to ensure that each individual subscriber has a unique MSIN.

Setting	Description
MSIN Increment	The increment value to create a unique MSIN for each subscriber in a range. The increment value to use for the second and all subsequent subscribers in the range, to ensure that each subscriber has a unique MSIN.
MSISDN	The first Mobile Station ISDN (MSISDN) value in this range.
MSISDN Increment	The increment value to use for the second and all subsequent subscribers in the range, to ensure that each subscriber has a unique MSISDN.
IMEI SV	The Serial Number to use in the construction of the IMEI that will be assigned to the subscribers in the range. The SNR is a string of six decimal digits.
IMEI SV Increment	The increment value to use for the second and all subsequent subscribers in the range, to ensure that each subscriber has a unique IMEI Serial Number.

UE Security settings

Each UE range requires security settings for subscriber authentication and subscriber privacy. In the 5G system, the Subscription Permanent Identifier (SUPI) is a globally unique identifier allocated to each subscriber. The serving network must authenticate the SUPI in the process of authentication and key agreement between UE and network. The serving network authorizes the UE through the subscription profile obtained from the home network; this UE authorization is based on the authenticated SUPI.

The SUPI is never transferred in clear text over the 5G-RAN; instead, the SUCI is used. The SUbscription Concealed Identifier (SUCI) is a privacy-preserving identifier containing the concealed SUPI. In the 5G core network, only the UDM has authority to reveal the SUCI.

For detailed information, refer to 3GPP TS 33.501 (Security architecture and procedures for 5G System). The following table describes the UE Security Settings.

Setting	Description
K	The K (Subscriber Authentication Key) value used for authentication of the UEs in this range. The key is a string with a maximum length of 34 characters. You can accept the value generated by CuSIM or enter of a K value of your own choosing.
Configure OP or OPc	Select the operator-specific authentication value.
OP	The Auth OP value specifies the operator-specific authentication value to use for the UEs in this range. It is a string with a maximum length of 34 characters. It remains fix for all Subscriber/SIM of an operator. You can accept the value generated by CuSIM or enter of an OP value of your own choosing
OPC	The OPc value is derived from the subscriber key K and the operator dependent value OP. You can accept the value generated by CuSIM or enter of an OP value of your own choosing.

Setting	Description
RAND	A hexadecimal number that represents the 128-bit random challenge. You can accept the value generated by CuSIM or enter of a RAND value of your own choosing.
AUTN	The AUthentication TokeN (AUTN) to use when authenticating the UEs in this range.

UE Settings

Each UE range has a set of Settings that configure subscription data and PDU session data for the range.

Setting	Description
AMF Force Identification During Registration	This option will force the AMF to always trigger the "Identification Procedure" to get the identity of the UE. When the NG-RAN node receives this request, it responds with the IMEISV or the SUCI.
IP Address Increment	The value by which the UE IP addresses will be incremented. This refers to all IP addresses assigned to the UE connected to multiple DNNs. When a UE is connected to multiple DNNs, it will have multiple IPs (at least one for each DNN connection). You configure the mapping between DNNs and UE IPs using the UE Range Settings DNNs Config panel
Allowed SSC Modes	The Session and Service Continuity (SSC) Mode for the PDU Sessions that UEs in this range will initiate. • SSC Mode 1: The network preserves the connectivity service provided to the UE. The PDU Session IP address (IPv4, IPv6, IPv4v6) is preserved. • SSC Mode 2: The network may release the connectivity service delivered to the UE and release the corresponding PDU Sessions. The release of the PDU induces the release of the IP addresses (IPv4, IPv6, IPv4v6) that had been allocated to the UE. • SSC Mode 3: Changes to the user plane can be visible to the UE, while the network ensures that the UE suffers no loss of connectivity. A connection through a new PDU Session Anchor point is established before the previous connection is terminated to allow for better service continuity. The IP address (IPv4, IPv6, IPv4v6) is not preserved in this mode when the PDU Session Anchor changes. SSC mode associated with a PDU Session does not change during the lifetime of a PDU Session.
Paging Delay (ms)	The time that will elapse before Paging is initiated after UE gets into idle state.
Handover/	Enable for Measurement Config to be configured during RRC Configuration msg.

Setting	Description
Meas Config	This will command UEs to send RRC Measurement Report messages to be send periodically as configured. Handovers will be triggered according to the RRC Measurement Report msgs received. Currently Supported HO types: • Intra-CU/Inter-DU Handovers • Intra-DU/Inter-Cell Handovers

DRBs Config

You use the DRBs Config panel to configure one or more Data Radio Bearers (DRBs) for each UE Range.

From the panel, you can select a DRB Config for editing and add addition DRB configurations. Select the **Add DRBs Config** button to add a new DRB configuration:

To configure DRBs for a subscriber range:

1. Select the range from the **UE RANGES** panel.
2. In the **UE RANGE** panel, select **DRBs**. CuSIM opens the DRBs panel, from which you can add, delete, and select DRBs for the selected range of subscribers.

Setting	Description
DRBs:	
	Select the **Add DRB** button to add a new DRB for the selected subscriber range.
	Select the **Delete DRB** button to remove this DRB from the selected subscriber range configuration.
RLC Mode	RLC Mode identifies the NR RLC Mode. • TM: No RLC Header, Buffering at Tx Only, No Segmentation/Reassembly, No feedback • UM: RLC Header, Buffering at both Tx and Rx, Segmentation/Reassembly, No feedback • AM: RLC Header, Buffering at both Tx and Rx, Segmentation/Reassembly, Feedback (ACK/NACK)
PDCP Uplink/Downlink Sequence Number Size	• PDCP Uplink Sequence Number Size • PDCP Downlink Sequence Number Size
SDAP Uplink Header	Select if SDAP header should be included for this DRB for Uplink Data. SDAP is responsible for mapping between a quality-of-service flow (QoS Flow) from the 5GCore network and data radio bearer (DRB).

Setting	Description
SDAP Downlink Header	Select if SDAP header should be included for this DRB for Downlink Data.

DNN Config

In the 5G architecture, a Data Network Name (DNN) serves as the identifier for a data network. It is the equivalent of an APN (Access Point Name) in an LTE network. A DNN is used when selecting an SMF and UPF for a PDU session, selecting an N6 interface for a PDU session, and determining policies to apply to a PDU session.

The **DNN** panel contains the configuration settings for an individual DNN. In this panel, you can:

- Select the **Delete DNN** button to delete the DNN configuration.
- Edit the DNN settings.

The following table describes the DNN settings:

Setting	Description
DNNs:	
	Select the **Add DNN** button to add a new DNN to your test configuration.
DNN settings:	
	Select the **Delete DNN** button to remove this DNN from your test configuration.
DNN	Enter the DNN value for this DNN definition. For example: `dnn.keysight.com`. A DNN (as is the case with an EPS APN) is composed of two parts: • A mandatory Network Identifier that defines the external network to which the UPF is connected. • An optional Operator Identifier that defines the PLMN backbone in which the UPF is located. A 5GS Data Network Name (DNN) is equivalent to an EPS APN. It is a reference to a data network, and it may be used to select an SMF or UPF for a PDU session and to determine policies applicable to the PDU session. The DNN field supports dynamic values. These values can be obtained with a sequence generator. The sequence can be added anywhere in the DNN name (beginning, middle or end). The syntax is `[start_value-end_value,increment]`. NOTE The `start_value` and `end_value` must have the same length. For example, we can configure `dnn[008-999,1]` and obtain `dnn008,dnn009,…,dnn998,dnn999`. Syntaxes `dnn[8-999,1]` or `[008- 1000,1]` are not valid as the start and end value lengths are different.

Setting	Description
	The start value is mandatory. Omitting certain parameters results in behaviors as exemplified below: • dnn[4-9,] an implicit increment of 1 is used • dnn[4-9] as above • dnn[4-,1] is used as dnn[4-9,1], 9 being the maximum value with the configured length, length of 1 in this case • dnn[4-,] as above • dnn[4-] as above • dnn[4] as above UEs will use the DNN values from the pool in a round robin manner. If multiple sequence generators are configured and their pools overlap (for example: `dnn[000-600,1].keysight.com dnn[500- 999,1].keysight.com`), for UEs that use the second DNN pool, the DNN generated values might not be allocated starting with the `start_value` (they might start with an intermediate value in the second pool).
Local Ipv4 Address	The UE IP address – This is the UE IP Address assigned to the first UE in this UE range during PDU Session Establishment procedure. For the consecutive UEs, **IP Address Increment** defined at **UE Settings** used as an increment value for each UE.
AMBR	Each DNN configuration has its own AMBR settings as defined below Session AMBR Configuration settings.
Qos Flows	The 5G QoS model is based on QoS Flows. A 5G QoS Flow is the finest level of granularity for QoS forwarding treatment in the 5G System. All traffic mapped to the same 5G QoS Flow receives the same forwarding treatment.

Session AMBR Configuration settings

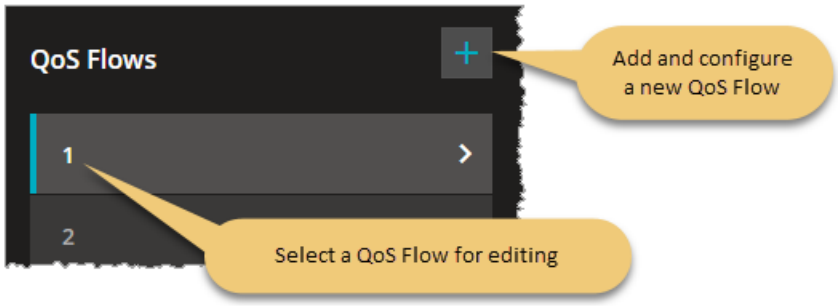
Parameter	Description
Session AMBR Uplink	Specify the DNN session AMBR (Aggregate Maximum Bit Rate) uplink rate.
Session AMBR Uplink Unit	The unit in which the rate is expressed. The options range from bps to Tbps.
Session AMBR Downlink	Specify the DNN session AMBR (Aggregate Maximum Bit Rate) downlink rate.
Session AMBR Downlink Unit	The unit in which the rate is expressed. The options range from bps to Tbps.

QoS Flow Panel

The 5G QoS model is based on QoS Flows. A 5G QoS Flow is the finest level of granularity for QoS forwarding treatment in the 5G System. All traffic mapped to the same 5G QoS Flow receives the

same forwarding treatment.

Accessing the configuration settings:



QoS Flow configuration setting

Setting	Description
Is Default	Select this option if this QoS Flow is associated with the default QoS rule. In the 5G System, a default QoS rule is required for each UE session, and this rule will be associated with a QoS Flow.
QFI	Enter a QoS Flow Identifier (QFI) for this QoS Flow. This identifier will be used to uniquely identify a QoS Flow in the 5G System.
5QI	Specify the 5QI value (decimal number). 5G QoS Identifier (5QI) is a scalar that is used as a reference to 5G QoS characteristics defined in TS 23.501, clause 5.7.4. These are access node-specific parameters that control QoS forwarding treatment for the QoS Flow (such as scheduling weights, admission thresholds, queue management thresholds, link layer protocol configuration, among others). Standardized 5QI values have a oneto-one mapping to a standardized combination of 5G QoS characteristics as specified in TS 23.501, table 5.7.4-1.
5QI Priority Level	Specify the 5QI Priority Level for this QoS Profile. 5QI Priority Level is a Policy Control parameter that accepts values from 1 through 127 (where 1 is the highest priority). It indicates a priority in scheduling resources among QoS Flows.
Resource Type	Select the type of resource that the QoS Flow requires: Guaranteed Bit Rate (GBR), Non-Guaranteed Bit Rate, or Delay Critical GBR. The Resource Type determines whether dedicated network resources related to a QoS Flowlevel Guaranteed Flow Bit Rate (GFBR) value are permanently allocated to the flow.
Averaging Window	Specify the Averaging window value for this 5GI. Each GBR QoS Flow is associated with an Averaging window. It represents the time duration (specified in milliseconds) over which the GFBR and MFBR are calculated.
QoS Rule Preference	Specify the desired QoS Rule Precedence value for this QFI. The QoS rule precedence value (and the PDR precedence value) determines the order in which a QoS rule or a PDR, respectively, will be evaluated. The evaluation of the QoS rules or PDRs is performed in increasing order of their precedence value.
DRB	Specify the DRB Id, this QoS Flow should be carried on. Data Radio Bearer with

Setting	Description
	assigned DRB Id, will be created when this QoS Flow is created. Currently one QoS Flow per DRB is supported. Please refer to section DRBs Config
ARP	See QoS Flow ARP configuration settings.
MBR	See QoS Flow MBR configuration settings.
GBR	See QoS Flow GBR configuration settings.

QoS Flow ARP configuration settings

The Allocation and Retention Priority (ARP) settings specify the priority level, preemption capability, and preemption vulnerability of a resource request. It is used to determine whether a new QoS Flow should be accepted or rejected—and to determine whether an existing QoS Flow can be preempted by another QoS Flow—in response to resource limitations.

The QoS Flow ARP settings are described in the table that follows.

Parameter	Description
ARP Priority Level	Specify the ARP priority level. The ARP Priority Level defines the relative importance of a resource request, where 1 is the highest priority and 15 is the lowest priority.
Preemption Capability	Select this option if the packets in this QoS Flow can preempt other flows. When a flow is preemption-capable, it can be allocated resources that were already assigned to another data flow that has a lower ARP priority level.
Preemption Vulnerability	Select this option if the packets in this QoS Flow are candidates for being preempted by other flows. When a flow is preemption-vulnerable, it can be dropped to free up resources for packets that have a higher ARP priority level.

Qos Flow MBR configuration settings

MBR indicates the maximum bit rates allowed for service data flows that are mapped to this QoS flow. Separate MBR values are configured for uplink and downlink traffic.

The QoS Flow MBR settings are described in the table that follows:

Parameter	Description
Uplink Bitrate Unit	Select the uplink bitrate unit from the drop-down list.
Uplink Bitrate Value	Set the maximum bit rate value for uplink traffic.
Downlink Bitrate Unit	Select the downlink bitrate unit from the drop-down list.
Downlink Bitrate Value	Set the maximum bit rate value for downlink traffic.

Qos Flow GBR configuration settings

GBR indicates the guaranteed bit rates for service data flows that are mapped to this QoS flow. Separate GBR values are configured for uplink and downlink traffic.

The QoS Flow GBR settings are described in the table that follows:

Parameter	Description
Uplink Bitrate Unit	Select the uplink bitrate unit from the drop-down list.
Uplink Bitrate Value	Set the maximum bit rate value for uplink traffic.
Downlink Bitrate Unit	Select the downlink bitrate unit from the drop-down list.
Downlink Bitrate Value	Set the maximum bit rate value for downlink traffic.

CHAPTER 11

UE Test Objective settings

Each UE subscriber range defines its own test objectives. The objectives specify the properties of the application traffic that the subscribers in the range will generate and transmit over the user plane. Each range can define more than one type of application traffic.

Chapter contents:

User Plane panel

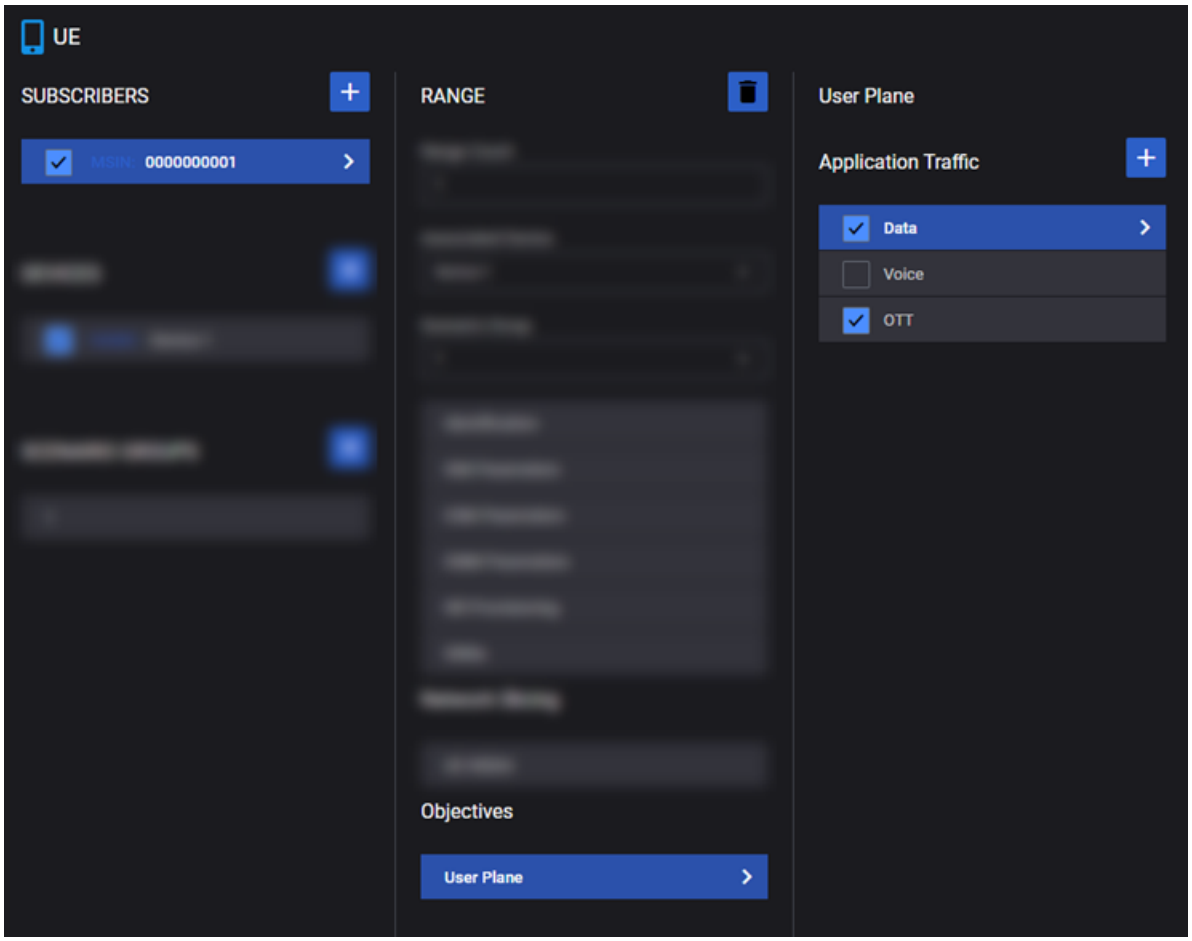
The User Plane Objectives focus on the rate and volume of user plane traffic that the simulated UEs are sending to the network.

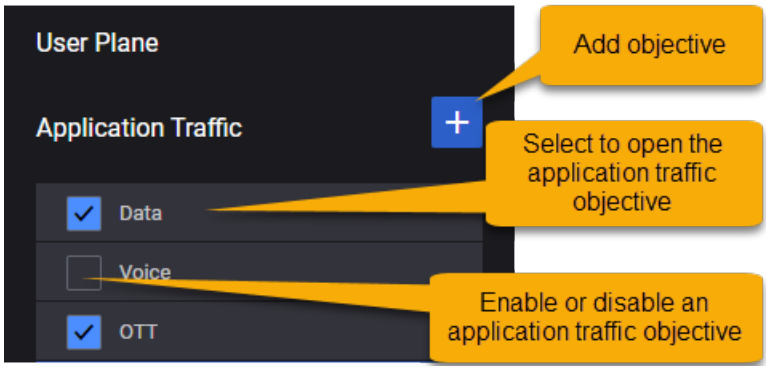
You define separate User Plane objectives for each UE subscriber range. Based on your test requirements, the configuration of the User Plane Objectives involve settings for the traffic generators on the UE.

From the **User Plane** panel, you can add additional traffic applications and access the properties panels for traffic applications that are already defined.

How to access the User Plane Objectives

1. Select the **Subscribers** panel in the UE node. This opens the Range panel:
2. Select **User Plane** in the Objectives section. This opens the **User Plane** panel.





The following table describes the Application Traffic generation parameters.

Parameter	Description
+	Click the **Add Objective** button to add a new add a new application traffic objective.
🗑	Click the **Delete Objective**button to remove the application traffic objective from your test configuration. *This button is available when you select the application traffic objective and you*

Parameter	Description
	open the properties panel.
Application Type	Select the type of traffic you want to generate. The available traffic applications are: • **Stateless UDP** • **Data** • **Voice** • **Video OTT** • **DNS Client** *This field is available when you select the application traffic objective and you open the properties panel.*
MSS	The desired Maximum Segment Size (MSS) for the user plane traffic that will be generated for this UE range, specified in bytes. The MSS is the largest TCP segment that the IP device can transmit as a single, unfragmented unit. It is typically calculated as the MTU minus the TCP header size minus the IP header size. For example, for traditional Ethernet, the MSS value is 1460 (1500 minus 40).
L7 Server IP Address	L7 Server IP Address of the L7 Server
L7 Server IP Address Count	The number of L7 Server IP count. (L7 Server IP Addresses sequentially increased by one.)
Application Traffic Flows	Each Application Traffic entry requires at least one traffic flow definition and can support multiple such definitions. • To select an existing traffic flow definition, click its name to open the Flow panel where you can view and modify the flow settings. • To add another traffic flow, click the Add Flow button. UI will open the Flow panel where you will select the flow type and configure the flow settings. See Application Traffic Flows.

Application Traffic Flows

You can add and delete traffic flows as needed to meet your test objectives. The Application Traffic Flow parameters are described in the following table.

Parameter	Description
	Click the **Delete Objective**button to remove the application traffic objective from your test configuration.
Type	Select the L4/L7 protocol type from the list of pre-defined flows. The available types include:

Parameter	Description
	• **HTTP GET, HTTP PUT, and HTTP POST** • **HTTPS GET, HTTPS PUT, and HTTPS POST**
Port	The port used by the flow.
Iterations	Not Applies (NA)
Percentage	Not Applies (NA)
Page Size (bytes)	The page size represents the size of the web page or data file that will be retrieved from or stored to an HTTP or HTTPS server.
URL	The URL that is being accessed by the flow's protocol.
Destination Hostname	Not Applies (NA). See L7 Server IP Address.
Max Transaction per Connection	Not Applies (NA)
DNN ID	Select the DNN ID for the drop-down list. For more details about DNN configuration, see DNNs Config.
Qos Flow ID	Select the QoS Flow ID from the drop-down list. For more detail about QoS Flow configuration, see QoS Flow Panel.

External Traffic Servers

If you need to use other traffic types not supported with CuSIM, you can configure Passthrough interface at CUUP Node and use CuSIM with external traffic servers. When Passthrough Interface is configured, CuSIM traffic configurations does not apply. All traffic is routed to External Servers through passthrough interface.

CHAPTER 12

Manage and use test sessions

When you create a new test, CuSIM establishes a *test session* which remains available until such time as you decide to delete it (if ever). This way, you can access existing test configurations to change the settings and to view details, or to re-run a test session.

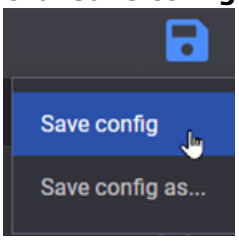
Chapter contents:

Save test sessions

Once a test is configured (for details, refer to Create a new test config), you can record its configuration as a session, edit and save it for future use.

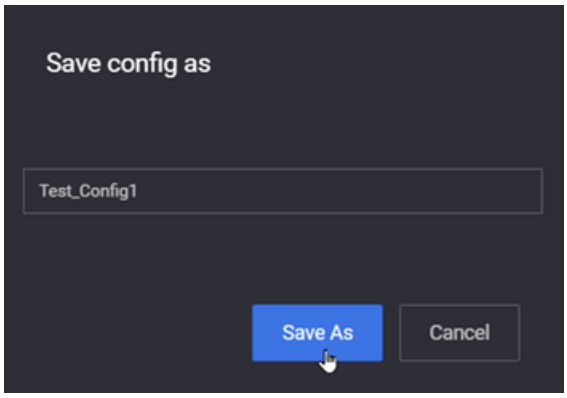
To save a configuration file, do the following:

1. Click the **Save** icon from the upper-right corner of the **Test Overview** page.
2. Click **Save config** to quickly save your test configuration.



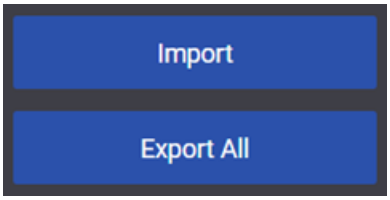
3. Click **Save config as** to save your test configuration with a specific name.
4. Provide the name for the test configuration in the **Save config as** window and click the **Save**

as button.



Import and export sessions

You can import and export test configurations by clicking the **Import** or **Export all** buttons which are found on the **Config Categories** area of the **Browse Configs** page.

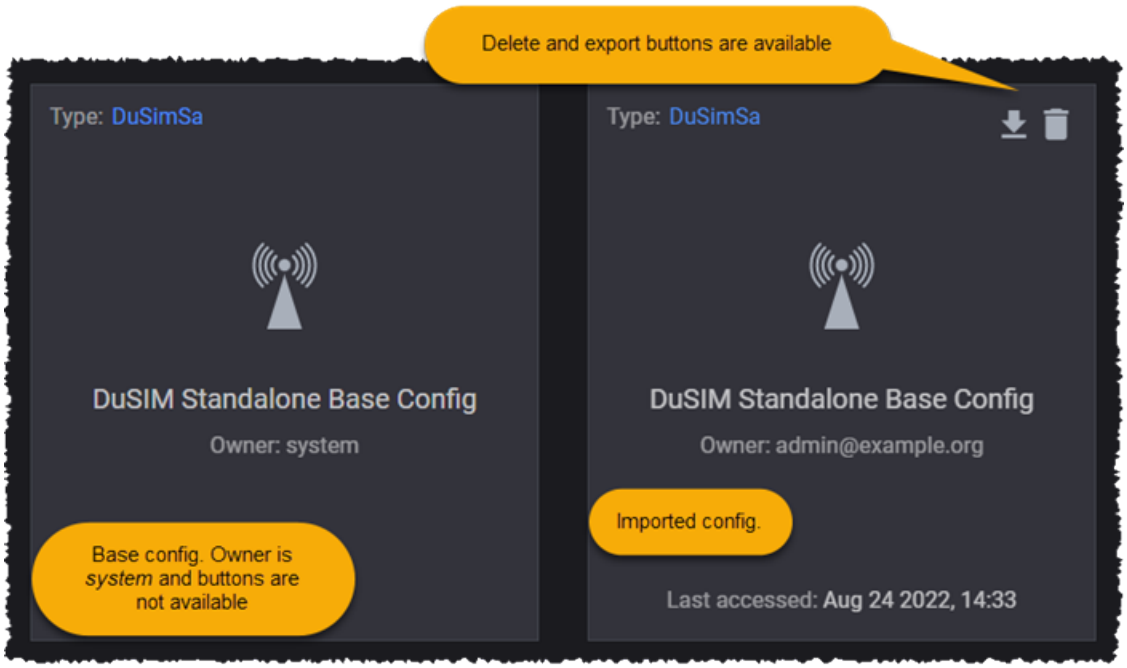


Import test configurations

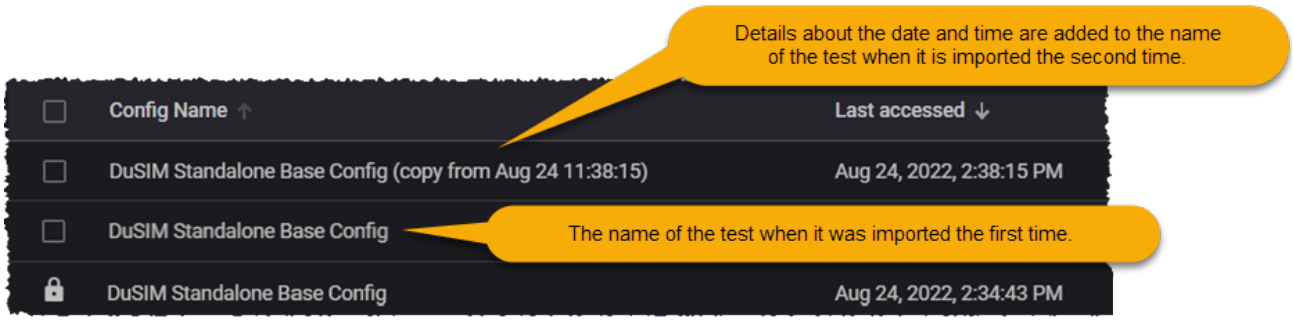
To import a saved test configuration from disk, do the following:

1. From the **Dashboard** page, click the **Browse Configs** button. The **Browse Configs** page appears.
2. From the **Test Categories** section, click the **Import** button.
3. Select the test configuration you want to import from the ones available at your download location.
4. Select **Open** to add the test configuration to the dashboard.

Imported tests can have any name, even the name of the base configuration tests. You can differentiate between a base configuration test and an imported test by the icons on the top-right corner of the test tile. The imported test is a user test that has the delete and export buttons on the top-right corner of the test tile. Also, each test will display the name of the test owner.



If a test is imported twice with the same name, the second time the test name will be displayed with details about the date and time of the import.



NOTE By default, when you import a new test, the displayed name is the name you have in the JSON file under `displayName` - in this case, the `displayName` is CuSIM Standalone Base Config. The second time it is imported, the test name is concatenated with *Imported* `<date> <time>`.

Export a saved test configuration

To export a saved configuration, do the following:

1. From the **Dashboard** page, click the **Browse Configs** button. The **Browse Configs** page appears.
2. From the **Test Categories** section, select the category containing the test to be downloaded.
3. Select the test configuration you want to download and click the **Export** button. When in tile view mode, click the **Download** button from the test tile.
4. Specify the download file name and select the download location.

5. Click **OK** to download the test configuration.

   NOTE The configuration file is exported as a JSON file.

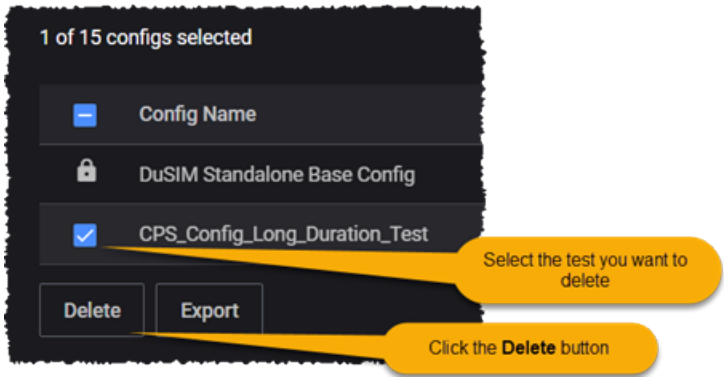
Delete configs and sessions

The terms *test config* and *test session* are not entirely synonymous. A "config" refers to a configuration definition file (JSON format), whereas a "session" is an instance of that file that is loaded in memory and is capable of being run.

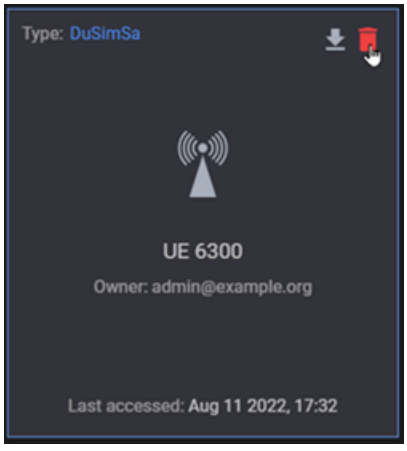
How to delete a CuSIM config

To delete a saved configuration from the **Browse Configs** page, do the following:

1. From the **Dashboard** page, click the **Browse Configs** button. The **Browse Configs** page appears.
2. From the **Test Categories** section, select the category containing the test to be deleted.
3. Select the test configuration you want to delete and click the **Delete** button.



When in tile view mode, click the **Delete** button from the test tile .



This will delete the configuration from the database, but not the session itself.

Important notes

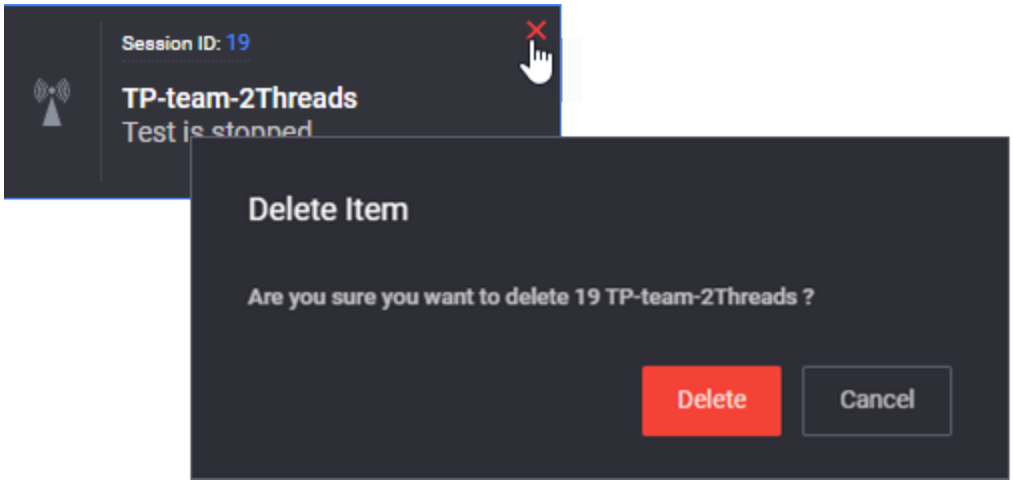
Before deleting a session, be aware of the following application behaviors:

- The session will be permanently removed and cannot be recovered.
- However, when you delete a session, the session's config is not deleted. Therefore, you can create new sessions based on that config.
- If you have a session open, and you delete the config upon which the session is based, the session is not deleted. Therefore, you can open the session and save a new config from it.

How to delete a CuSIM session

You can also delete a test session from the Dashboard:

1. Go to the **Dashboard**. (Click the Keysight logo from any point in the interface to return to the dashboard page.)
2. Locate the tile for the session that you plan to delete, then click the **X** in the upper right corner. CuSIM opens a confirmation dialog.



3. Select **Delete** to confirm the action.

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CHAPTER 13

Manage CuSIM licenses

CuSIM is a licensed product. You can manage licenses using either the integrated CuSIM License Manager or a centralized License server that is managed by your organization.

Chapter contents:

Licensing Requirements

The license server is shipped as a separate `.ova` file.

After deploying the `.ova`, you will have access to a web interface for the license server (for example: `https://10.38.156.169`) .

You can:

- activate licenses by selecting the **Activate** button,
- sync licenses,
- generating a license request bin file by selecting **Offline Operations** and then **Generate Request**,
- import offline licenses by selecting **Offline Operations** and then **Import Licenses**,
- check the license statistics,
- deactivate Licenses by selecting the **Deactivate** button.

After activation, the licenses and features will be available in the CuSIM web UI.

License Manager

The first time you use CuSIM, you need to active at least one license. You activate and manage your licenses using the CuSIM **License Manager** functions, which are accessed from the setup menu.

- How to open License Manager on the next page
- Activate a license on the next page
- Deactivate a license on the next page
- Sync licenses on the next page
- Reserve a license on the next page

- Get license statistics on the facing page
- Perform offline license operations on the facing page

How to open License Manager

To access the CuSIM License Manager:

1. Select **Administration** from the setup menu (⚙).
2. Select **License Manager** (from the **Adminstration** menu).

Activate a license

To activate one or more CuSIM licenses:

1. Select **Administration** from the setup menu (⚙), then select **License Manager**.
2. Select **Activate licenses**.
   CuSIM opens the **Activate Licenses** dialog.
3. Enter your license data in the dialog box.
   You can use either activation codes or entitlement codes (one or more).
4. Select **Load Data**, indicate the number of licenses you want to activate, then click **Activate**.

Your new licenses—which should now be listed in the License Manager page—are now available for running tests.

Deactivate a license

To activate one or more CuSIM licenses:

1. Select **Administration** from the setup menu (⚙), then select **License Manager**.
2. Select **Deactivate licenses**, then and indicate a new quantity for each of the existing licenses.
3. Select **Perform the Activation** to complete the task.

Sync licenses

To synchronize one or more CuSIM licenses:

1. Select **Administration** from the setup menu (⚙), then select **License Manager**.
2. Select **Sync licenses**.

Reserve a license

To reserve one or more CuSIM licenses:

1. Select **Administration** from the setup menu (⚙), then select **License Manager**.
2. Select the **Manage Reservation** icon.
   CuSIM opens a new window.
3. Select the license you wish to reserve.
4. Enter the number of desired licenses in **New Reserved Count** field.
5. Enter the duration of the reservation (in hours) in the **Duration to Reserve** field.

NOTE The License Statistics display shows all reserved features, ordered by count and reserved time. The initial reserved count and duration is overwritten when a new reservation is performed.

Get license statistics

To activate one or more CuSIM licenses:

1. Select **Administration** from the setup menu (⚙), then select **License Manager**.
2. Select **License statistics**.

Perform offline license operations

Offline license management is required for cases in which your test network is operating in an isolated environment with no Internet access. To perform offline CuSIM license operations:

1. Select **Administration** from the setup menu (⚙), then select **License Manager**.
2. Select **Offline operations**.
   CuSIM opens the **Keysight Licensing Offline Operations** dialog.
3. Click **Generate request**.
4. Using a system that has Internet connectivity, access the KSM Offline Operations Page, and follow the steps provided for the desired operation.
5. From your offline system, return to the **Keysight Licensing Offline Operations** dialog, then click **Import license**.
6. Click **Finish** to complete the task.

License server

Rather than using the internal CuSIM License Manager, you can use a centralized License server that is managed by your organization.

Add a License Server

To add a license server in the CuSIM web UI:

1. Log in the CuSIM web UI.
2. Under the Settings Menu (⚙), select License Servers.
   The dialog shows the license server currently used.
   NOTE To see the list of installed licenses, you need to access the license server in a web browser: https://<license-Server-IP>
3. Enter the license server IP address in the empty license server field, then select the Add button (**+**) next to the field.
4. Select **CLOSE** to confirm your action and close the License server dialog.

Remove a License Server

To remove a license server that was previously added in the CuSIM web UI:

1. Log in the CuSIM web UI.
2. Under the Settings menu (⚙), select License servers.
   The license servers dialog opens. listing the previously-set license servers.
3. Select the **Delete** button next to the license server that you want to remove.
4. Select **CLOSE** to confirm your action and close the License server dialog.

Activate a license

To activate one or more CuSIM licenses:

1. From the Setting menu (⚙), select **Application Settings**.
   CuSIM opens the **Applications Settings** dialog.
2. Select a **License Provider** from the drop-down list.
3. Enter the IP address in the **License Server IP** field.
4. Click **Update**.

CHAPTER 14

Manage CuSIM users

Managing the users who can access the application is one of the primary CuSIM administrative requirements.

User categories

CuSIM user accounts can be of one of the following types:

- Administrative user: Can access the Access Control functions and perform various administrative tasks, including the definition and management of other user accounts.
- Regular user: Can access the application and use all of the resources involved in test creation, execution, and analysis.

Creating users

Each user who requires access to the CuSIM application must have a user account. To add a user:

1. Select the settings menu (⚙) and then select **Administration**.
2. Select **Access Control** from the **Administration** menu.
   CuSIM opens the **Keycloak Admin Console** in a new browser tab.
3. Select **Users** from the list of **Manage** functions (in the navigation pane).
4. Select the **Add user** button.
5. Enter the required information in the **Add user** form, then select the **Save** button.
   The following values are required for the new user:
   - Username (which must be unique within the realm).
   - Email address
   - First and Last Name
   - *User Enabled* set to **ON**.
6. Select the **Save** button.
   CuSIM adds the user and displays that user's information in the **Details** tab.

7. Set the initial password for the user:
   a. Select the **Credentials** tab.
   b. Enter the *Password*.
   c. Re-enter the password in the *Password Confirmation* field.
   d. Set *Temporary* **ON** if the user will be required to change the password upon initial log in.
   e. Select the **Set Password** button.
   CuSIM displays a confirmation dialog.
   f. Select the **Set Password** button to confirm the action.

Reset a user's password

Administrative users can reset a user's password:

1. Select the settings menu (⚙) and then select **Administration**.
2. Select **Access Control** from the **Administration** menu.
   CuSIM opens the **Realm Settings** window.
3. Select **Users** from the list of **Manage** functions.
4. Select the user.
5. Select the **Credentials** tab.
6. Enter the new *Password*.
7. Re-enter the new password in the *Password Confirmation* field.
8. Set *Temporary* **ON** if the user will be required to change the password upon initial log in.
9. Select the **Reset Password** button.
   CuSIM displays a confirmation dialog.
10. Select the **Reset Password** button to confirm the action.

Disable a user account

Administrative users can temporarily disable a user's account:

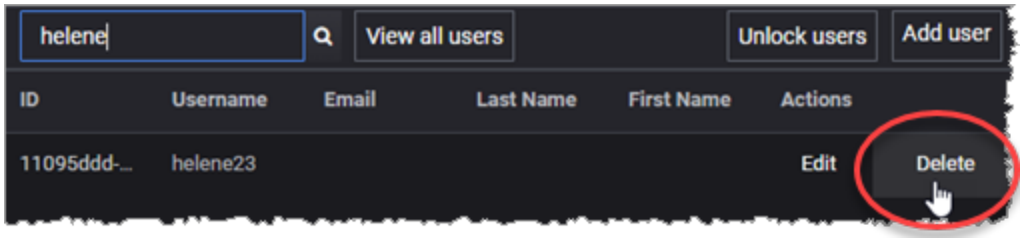
1. Select the settings menu (⚙) and then select **Administration**.
2. Select **Access Control** from the **Administration** menu.
   CuSIM opens the **Realm Settings** window.
3. Select **Users** from the list of **Manage** functions.
4. Select the user.
5. Set *User Enabled* to **OFF**.

This user account will not be able to log in until the account access is set to **ON**.

Delete a user account

Administrative users can reset a user's password:

1. Select the settings menu (⚙) and then select **Administration**.
2. Select **Access Control** from the **Administration** menu.
   CuSIM opens the **Realm Settings** window.
3. Select **Users** from the list of **Manage** functions.
4. View all users or search for the Username of the account that you will delete.
5. Click **Delete**.



6. CuSIM opens a confirmation dialog.
7. Select **Delete** to confirm that you are permanently deleting this user account.

Additional user management functions

Additional user management functions are available, in addition to those described in the procedures described above. Most of the functions provide a tool tip that describes it function and usage.

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CHAPTER 15

License Manager

The first time you use CuSIM, you need to active at least one license. You activate and manage your licenses using the CuSIM **License Manager** functions, which are accessed from the setup menu.

How to open License Manager

To access the CuSIM License Manager:

1. Select **Administration** from the setup menu (⚙).
2. Select **License Manager** (from the **Adminstration** menu).

Activate a license

To activate one or more CuSIM licenses:

1. Select **Administration** from the setup menu (⚙), then select **License Manager**.
2. Select **Activate licenses**.
   CuSIM opens the **Activate Licenses** dialog.
3. Enter your license data in the dialog box.
   You can use either activation codes or entitlement codes (one or more).
4. Select **Load Data**, indicate the number of licenses you want to activate, then click **Activate**.

Your new licenses—which should now be listed in the License Manager page—are now available for running tests.

Deactivate a license

To activate one or more CuSIM licenses:

1. Select **Administration** from the setup menu (⚙), then select **License Manager**.
2. Select **Deactivate licenses**, then and indicate a new quantity for each of the existing

licenses.

3. Select **Perform the Activation** to complete the task.

Sync licenses

To synchronize one or more CuSIM licenses:

1. Select **Administration** from the setup menu (⚙), then select **License Manager**.
2. Select **Sync licenses**.

Reserve a license

To reserve one or more CuSIM licenses:

1. Select **Administration** from the setup menu (⚙), then select **License Manager**.
2. Select the **Manage Reservation** icon.
   CuSIM opens a new window.
3. Select the license you wish to reserve.
4. Enter the number of desired licenses in **New Reserved Count** field.
5. Enter the duration of the reservation (in hours) in the **Duration to Reserve** field.

NOTE The License Statistics display shows all reserved features, ordered by count and reserved time. The initial reserved count and duration is overwritten when a new reservation is performed.

Get license statistics

To activate one or more CuSIM licenses:

1. Select **Administration** from the setup menu (⚙), then select **License Manager**.
2. Select **License statistics**.

Perform offline license operations

Offline license management is required for cases in which your test network is operating in an isolated environment with no Internet access. To perform offline CuSIM license operations:

1. Select **Administration** from the setup menu (⚙), then select **License Manager**.
2. Select **Offline operations**.
   CuSIM opens the **Keysight Licensing Offline Operations** dialog.
3. Click **Generate request**.
4. Using a system that has Internet connectivity, access the KSM Offline Operations Page, and follow the steps provided for the desired operation.
5. From your offline system, return to the **Keysight Licensing Offline Operations** dialog, then click **Import license**.
6. Click **Finish** to complete the task.

CHAPTER 16
Troubleshooting

CuSIM provides a number of tools and methods to help you evaluate, troubleshoot, and correct problems that may arise during test development and execution.

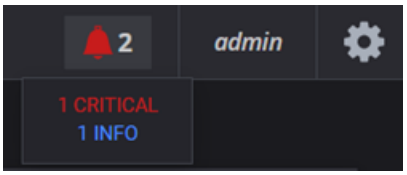
The main debugging tools that CuSIM provides are notification and event management, messages displayed during test execution, test diagnostics data, and log files.

Chapter contents:

View Notifications and Test Events

The navigation bar displays a notifications icon and a counter showing the total number of triggered notifications since the counter was last reset for the current CuSIM instance. The icon and the counter are visible from all the pages of the CuSIM web UI. The notification icon ( ) indicates in real-time the number of registered events.

When a notification is triggered, a color-coded banner is displayed when you hover over the notification icon:



Blue- for informational messages

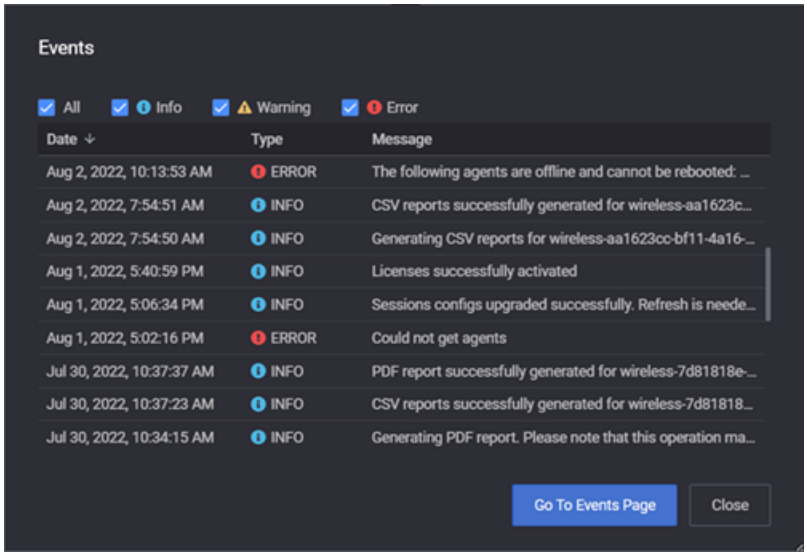
Orange - for messages informing you of actions you are not allowed to perform

Red - for error messages

Types of events:

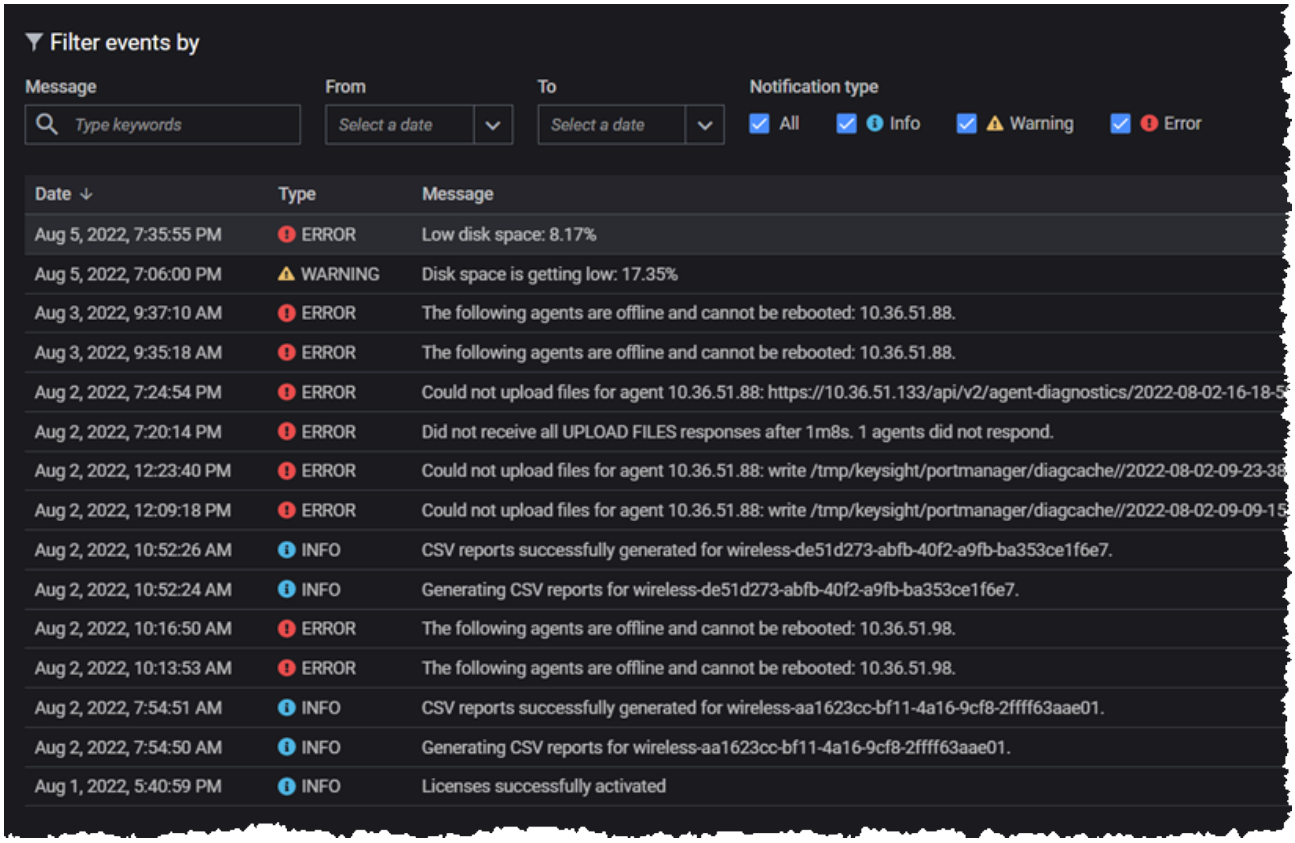
- **ERROR** - An *error* notification indicates that an error has occurred that impacts application stability. The application is possibly in an unstable or indeterminate state, and the should either be restarted or should carry out error recovery or re-initialization routines.
- **INFO** - An *info* notification indicates a general-purpose notification, such as logging data or a heartbeat indicator.
- **WARNING** - A *warning* notification indicates an error has occurred that potentially impacts application stability.

To view more details on the triggered events, select the notifications icon. The **Events** window is displayed.



Here you can view details on the registered events regarding the logging date, their severity type and description. You can choose to display all events or certain types of events, based on their severity, by selecting or clearing the associated check-box.

To view the events page, click the **Go to Events Page** button. Here you can search for events based on the available filtering criteria, like date, message, or event type.

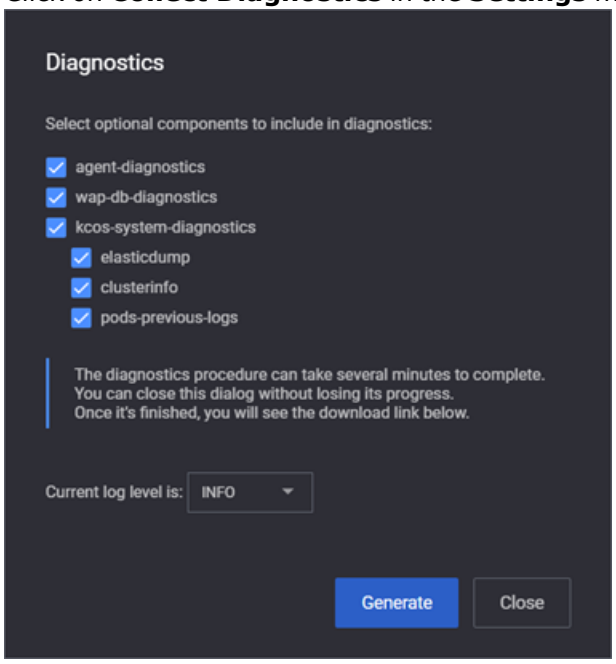


Collect Diagnostics

CuSIM diagnostics tool is used to collect debug logs and other essential information needed in troubleshooting any encountered issues.

To collect diagnostics, do the following:

1. Click on **Collect Diagnostics** in the **Settings** menu. The **Diagnostics** window appears.



2. If needed, select the optional components to include in the diagnostics report.
3. Select the log level used to collect diagnostics. Available options are:
   - **ERROR**- Designates messages indicating that an error has occurred that impacts application stability.
   - **WARN** - Designates messages indicating that an error has occurred that potentially impacts application stability.
   - **INFO** - Designates informational messages that highlight the progress of the application at coarse-grained level.
   - **DEBUG** - Designates fine-grained informational events that are most useful for debugging the application.
4. Select**Generate**. The diagnostics procedure can take several minutes to complete. Once it is finished, a download link will be displayed.
5. Select the download link in order to retrieve the diagnostics report.

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