Keysight U5040A Open RAN Studio

This software is designed to run on a BittWare server and BittWare FPGA card.

Version 1.1.10901.0

Released Date:	9 December, 2020
Operating System:	Windows 10, 64-bit

Bug Fixes

- Fixed a problem with floating licenses not being dynamically checked in/out. Also added OPENRANSTUDIO as a selection in Keysight License Manager 6.
- Fixed a problem where 25G modes (25G No FEC and 25G RS-FEC) would not achieve link up or block lock on the first attempt.

Version 1.1.10702.0

Released Date:	21 October, 2020
Operating System:	Windows 10, 64-bit

Bug Fixes

- When Open RAN Studio is launched on BittWare hardware with no Internet access, the following error occurred: "Cannot load CclBridge.dll".

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Version 1.1.10701.0

Released Date:	07 October, 2020
Operating System:	Windows 10, 64-bit

Enhancements

- Added LTE TDD and LTE FDD support applications to the installation.
- Added documentation for the hardware REST API.
- On-line help has been updated.
- Added support for the U5040MDLA license.

Bug Fixes

- In some cases, the Frame ID would not increment on the second frame of a two-frame stimulus file.
- In some cases, Stimulus generated with a large tcp_adv_dl value would cause every other radio frame to be skipped during continuous playback. This has been fixed and radio frames are not skipped.
- When Trigger Out is enabled and set to "Trigger on Start Stimulus", the trigger is now correctly scheduled at time 0.0 relative to the PCAP file timing (10ms before the "air time" of the first radio frame).
- When an error occurs writing out a capture file, an error dialog is displayed.

Known Limitations

- The LTE applications only support 10ms waveforms and does not support 15MHze carriers.
- The timestamp accuracy for captured packets is currently about 80 ns. This occasionally results in small back-to-back packets having the same timestamp.
- When C-Plane messages overlap and should be scheduled before the final U-Plane messages of the prior radio frame, they are not interleaved with the U-Plane messages, but rather will be send immediately after the last U-Plane message of the prior radio frame.

Version 1.1.10521.0

Released Date:	31 August, 2020
Operating System:	Windows 10, 64-bit

Enhancements

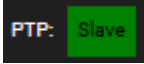- External Reference Clock in support

- PTP Slave support
- SFN support
- API to control the hardware programmatically
- Modulation compression support
- MIMO (<4 layers) support
- Downlink reMask support
- Downlink SymInc support
- DCI support
- PUCCH support
- For 25Gbps Ethernet, Clause 108 Reed-Solomon Forward Error Correction (RS-FEC) is now supported. When selecting a 25G port speed, there are now two options that can be selected: "25G NO FEC" or "25G RS-FEC".

Bug Fixes

- Allow a program to include both the ORAN Studio API and the Signal Studio API.

Known Limitations

- It is recommended to use Signal Studio 5G NR 2020 (version 6.0.0.0) with this release 1.1 of Open RAN Studio. To use MIMO, a patch version (6.1.1.3) of Signal Studio is required which can be provided from technical support upon request.
- In some cases, the Linkup will show a false positive.
- When running the O-DU emulator in PTP Slave mode, the eCPRI Frame numbers may not match the SFN specification (see ORS-WG4.CUS.0-v02.00 section 9.7.2 for a definition of the SFN computation).   Normally after launching Open RAN Studio, or after disabling and re-enabling PTP Slave mode, the SFN will be correct. However, after several minutes the SFN will skip one number and will be off until PTP slave mode is disabled and re-enabled or the Open RAN Studio application is restarted.
- When using an external reference clock, the following clock types can be used
    o 10 MHz external reference. **In this case, the clock signal must be a square wave with 50% duty cycle.**
    o 100 MHz external reference. In this case the clock signal can be a square or sine wave.
- Please be sure that the external reference clock is connected before selecting 10 MHz or 100 MHz external reference clock. If there is not a good clock signal, the system will revert to the internal oscillator. However, the system may require being shutdown to a power off state and restarted to recover the clock.
- When changing the reference clock, sometimes two error messages will be displayed. This is normal on some systems and the system must be shutdown to a power off state and restarted to properly apply the reference clock settings.

- When running the O-DU emulator in PTP Slave mode, it takes about 1 minute for PTP to synchronize. After synchronization, the status bar should show the PTP Status as "Slave" in Green . This indicates that PTP is synchronized within 100 nanoseconds.
- The code does not support Auto-Negotiate so the connection speed will have to be set manual on both ends.
- If a stimulus file has a large Tcp_adv_dl value, when played continuously, the C-Plane messages for the next radio frame will not be interleaved properly with the U-Plane messages at the end of the current radio frame.

Version 1.0.10601.0

Released Date:	16 June, 2020
Operating System:	Windows 10, 64-bit

Enhancements

- When PTP is in Master mode, the announced clock parameters simulate a locked GPS grandmaster.

Bug Fixes

- Fixed a bug with generating pcap file for PDSCH with IQ Bitwidth equal to 16.
- Several fixes to the following API.
    - o Flow_TableEntry
    - o Beam_TableSize
    - o Beam_TableEntryBeamWeights
- Added support for the next Signal Studio version that will be released later.

Known Limitations

- O-RAN System Frame Number (SFN), which assigns the radio frame number based on PTP time is not supported.

Version 1.0.10428.0

Released Date:	16 April, 2020
Operating System:	Windows 10, 64-bit

Enhancements

- Initial release of the software.

Known Limitations

- Ethernet Forward Error Correction (FEC) and Auto-negotiation are not supported. Please pay attention to the following notes:

    o When connecting to a 25G Ethernet port on a radio (O-RU), FEC must be disabled on the O-RU.

    o When connecting to a 10G Ethernet port on a radio (O-RU), FEC does not apply, so no changes should be necessary.

- Since Auto-negotiation is not supported, the Ethernet port must be manually configured in Open RAN Studio for the correct speed setting. To configure the port settings, select the menu item **Setup → Instrument Configuration…**. Then under **Port Settings**, change the speed drop down setting to **10G** or **25G**. When the link is established, the Port Status icon in the status bar at the bottom of the application should turn green.

- In some cases, in order to get the link to come up, you may need to switch the port back to **Disabled or Loopback** and then to **10G** or **25G** to get the link to establish successfully.

- For a "Complete" install, fast startup will be disabled in Windows. This is necessary because after FPGA updates the system must shutdown to a power off state. If fast startup is enabled, the system may not completely power off on shutdown.

- When capturing traffic in Open RAN Studio, the application will capture all packets transmitted and received on the Ethernet port. However, only eCPRI/O-RAN packets will be displayed in the Explorer view. If you need to look at other packets (e.g. PTP), use another tool to examine the capture file. Note that the extension on captured files is .pcap, however, they are actually pcapng format.

- When capture is configured to capture a specific number of radio frames by selecting 1 through 4 in the **Record Length** dropdown, the size of what is actually captured will be larger than what was specified, to make sure that you get at least the selected number of radio frames.

- Captures are not trimmed to full radio frames. It is common to see partial radio frames at the beginning or the end of the capture.

- When capturing data until full, the uplink or downlink side can have more frames at the end of the file than the other side in some cases.