FemtoClock 2 – Generating Synchronous Ethernet (SyncE) Clocks

This document describes how a high-performance FemtoClock®2 clock generator with jitter attenuating capabilities can be configured to comply with Synchronous Ethernet (SyncE) Clock requirements.

Contents

1. Introduction

FemtoClock 2 is a high-performance clock generator with jitter attenuating capabilities that can be configured to comply with Synchronous Ethernet Clock requirements. ITU-T G.8262/Y.1362 outlines requirements for timing devices used in synchronizing network equipment that support synchronous Ethernet or SyncE. SyncE is used to distribute the primary references clock (PRC) for network synchronization.

G.8262 requirements include clock accuracy, noise transfer, holdover performance and noise generation. It contains two options for SyncE:

1. EEC-Option 1 applies to synchronous Ethernet equipment that is designed to work with networks optimized for the 2048Kbps hierarchy.
2. EEC-Option 2 applies to synchronous Ethernet equipment that is designed to work with networks optimized for the 1544Kbps hierarchy.

FemtoClock 2 configurations can be created with the Renesas IC Toolbox (RICBox™) software. The RICBox software is aware of the above two options and the jitter attenuator can be properly and fully configured, simply by selecting “G.8262 Option 1” or “G.8262 Option 2” in a drop-down menu. The RICBox software also has a third selection for G.8262.1 eEEC “enhanced SyncE”.

The recommended FemtoClock 2 device for use with SyncE is the RC32504A. Instead of using a quartz crystal, a TCXO or other stable frequency reference is required to drive the XIN pin on the RC32504A. Consult application note AN-807 for acceptable frequency reference devices.

Compliance of FemtoClock 2 with the synchronous Ethernet requirements has been thoroughly tested. For more details, see the RC32504A ITU-T G.8262 and G.8262.1 Compliance Test Report and the following test setup diagram.

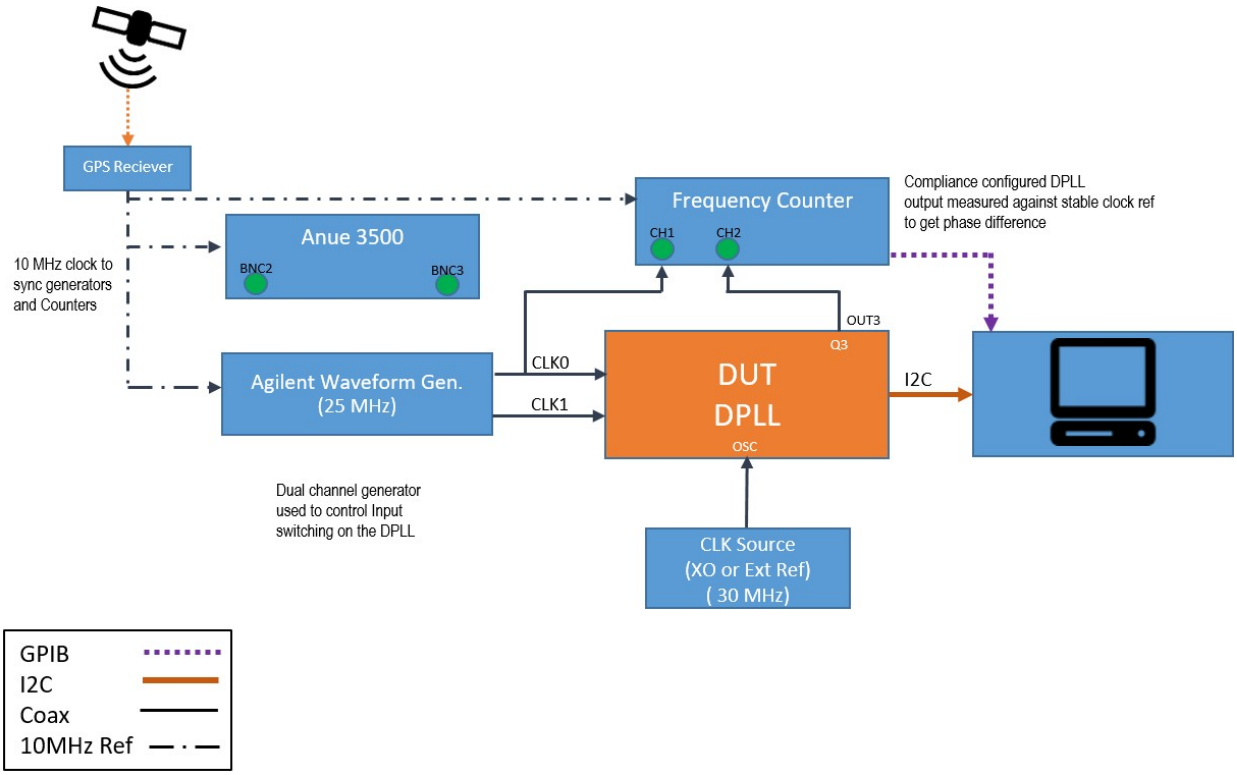

Figure 1. FemtoClock 2 SyncE Compliance Test Setup

2. Renesas IC Toolbox (RICBox) Software for FemtoClock 2 Configuration

The FemtoClock 2 Renesas IC Toolbox (RICBox) software can be downloaded from the RC32504A webpage. The software consists of a main “Toolbox Installer” and the “GUI Installer” that is specific for the FemtoClock 2 products.

Downloads

Title	Type	Format	File Size	Date
Software				
FemtoClock2 Renesas IC Toolbox GUI Installer v2.0.0	Software & Tools - Software	ZIP	5.47 MB	Apr 23, 2021
Renesas IC Toolbox Installer v3.3.0	Software & Tools - Software	ZIP	191.06 MB	Apr 23, 2021

Figure 2. FemtoClock 2 Webpage Downloads

When Toolbox Installer software is already installed for use with a different product family, only the GUI Installer for FemtoClock 2 needs to be installed. After installing both packages, run the software and the opening screen should be similar what is shown in Figure 3:

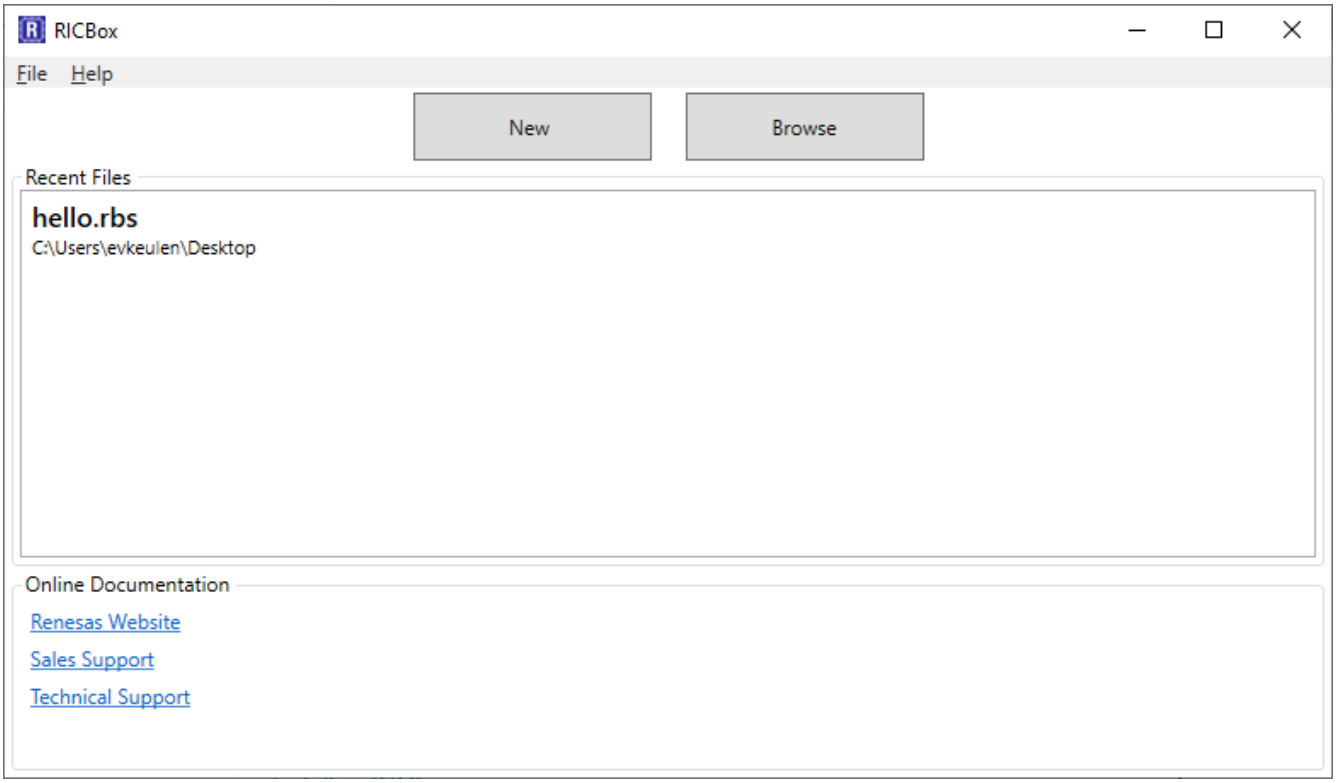

Figure 3. RICBox Opening Screen

Click *New* to start a new configuration, *Browse* to find a ".rbs" file with a previously saved configuration, or double-click on one of the most recently saved configurations (e.g., like the "hello.rbs" in above Figure 3).

For this application note, we will continue creating a new configuration. After clicking *New*, the following screen appears:

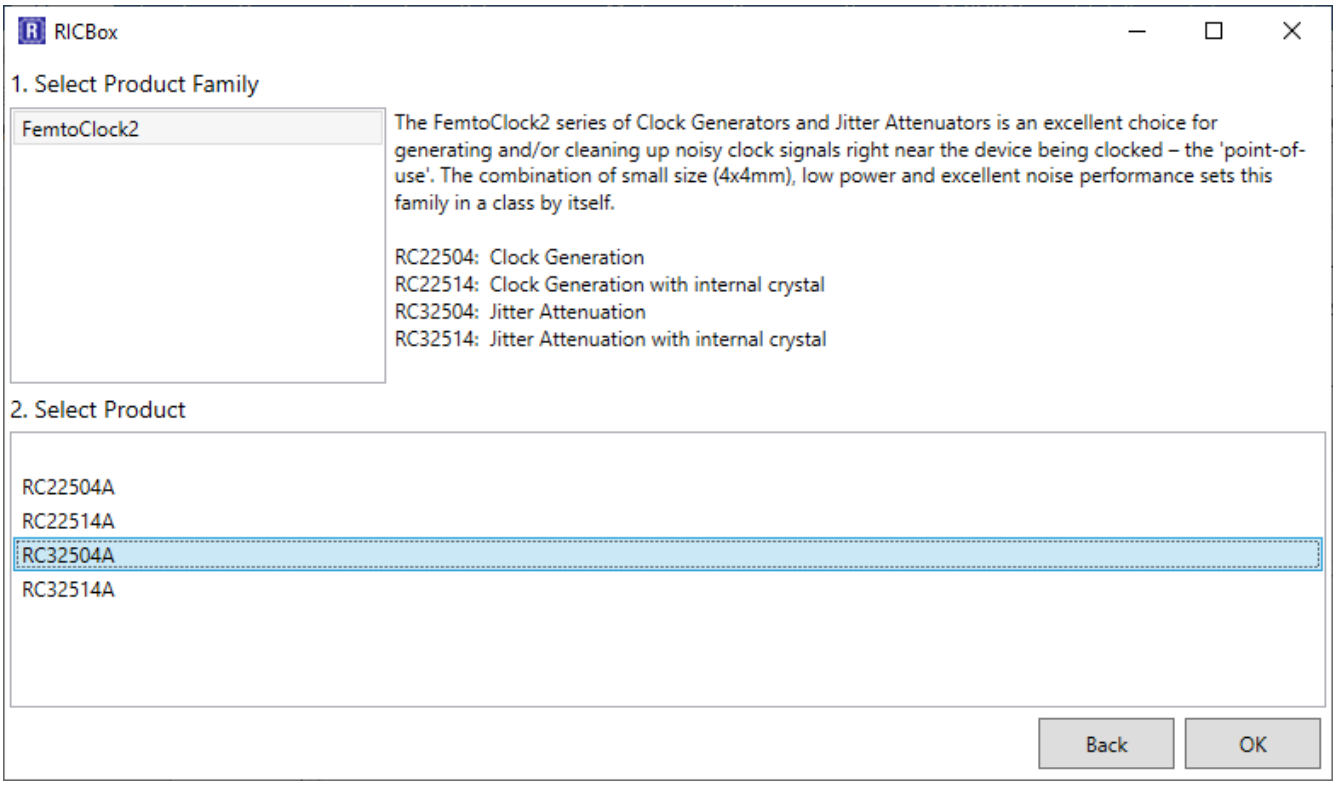

Figure 4. RICBox –Select Product Family and Specific Product

First, select a Product Family. When this is a new RICBox installation and only the FemtoClock 2 GUI is installed, the screen should look exactly like Figure 4 with only the FemtoClock 2 Family showing at item 1.

Next, select the specific product. We want to use Jitter Attenuator features, so select the RC32504A. The RC32514A is not recommended because it has an internal crystal. A plain crystal is not stable enough for SyncE.

The RICBox software starts a configuration with a Wizard for entering the most important information needed for the configuration. Selection of the SyncE options is part of the Wizard (see the first Wizard screen as shown in Figure 5).

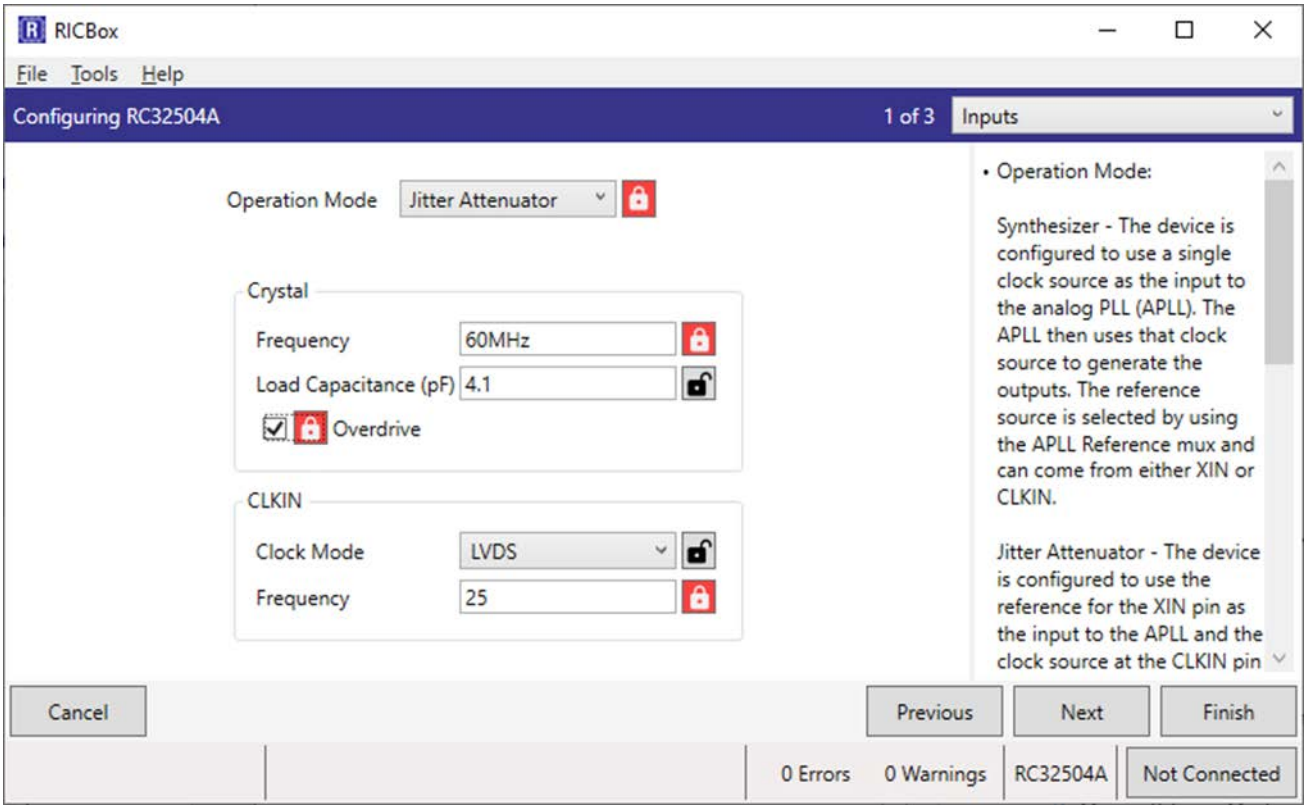

Figure 5. RICBox – First Wizard Screen

First, select the Operating Mode to be “Jitter Attenuator”. Then select a crystal frequency. Note that in this case it will be the frequency of a TCXO or other stable frequency reference. Select “Overdrive” to indicate that the Crystal Oscillator Input pin (XIN) will be overdriven with an external clock. When selecting “Overdrive”, the Load Capacitance value is reduced to the smallest value to minimize loading of the external clock (consult the RC32504A datasheet for circuit recommendations when overdriving the crystal interface).

Finally, on this wizard screen you can also enter the reference clock input properties. You can enter the reference clock frequency and the Clock Mode. The “LVDS” clock mode is the most versatile selection where the input can essentially handle any differential clock that is AC coupled. For more details of the reference clock settings, see the RC32504A datasheet.

The second Wizard screen (see Figure 6) sets up the Jitter Attenuator features and this is where the SyncE settings are found.

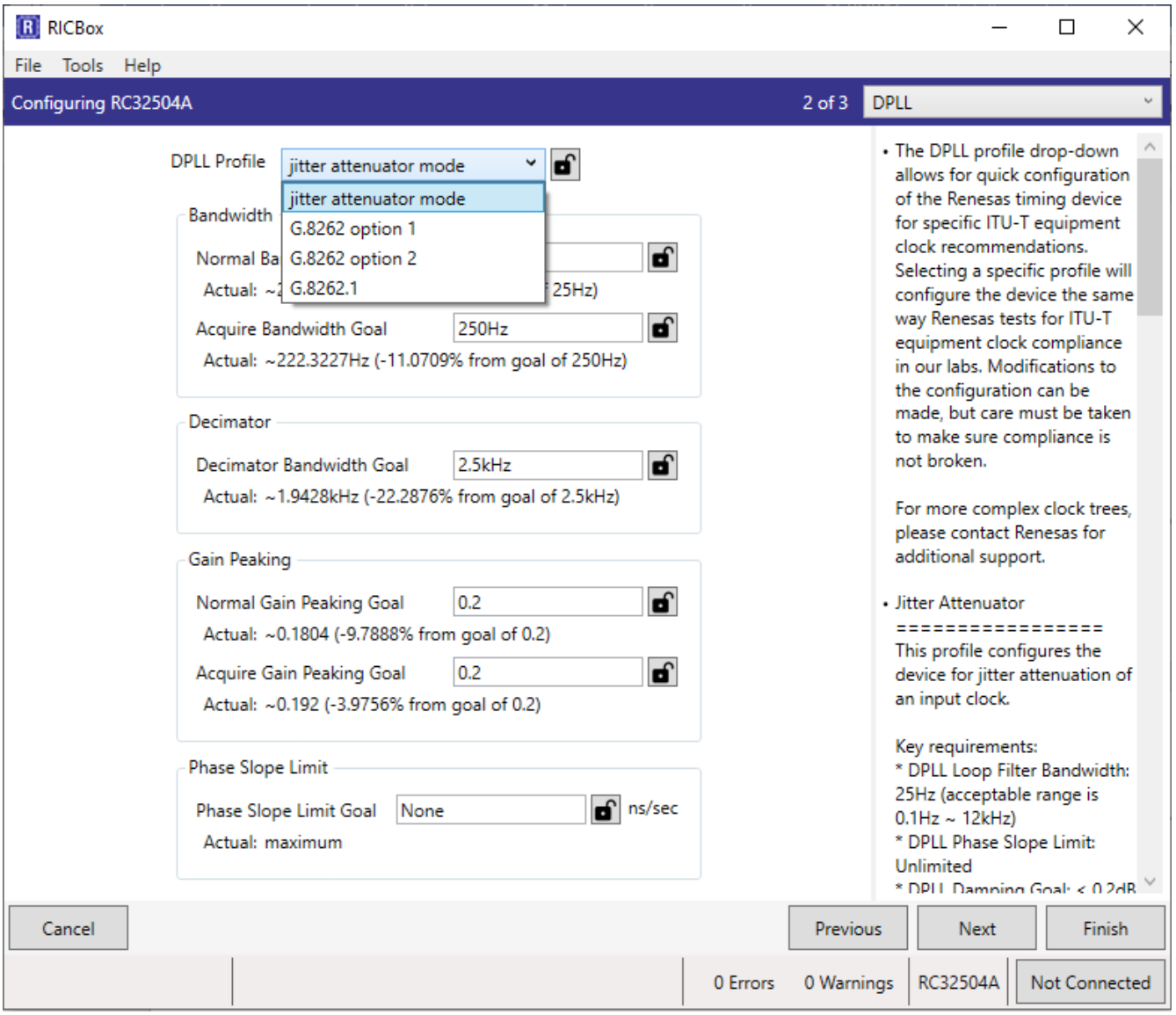

Figure 6. RICBox – Second Wizard Screen

The SyncE option can be selected at the top of the screen with the “DPLL Profile” setting. With this setting, all the other fields will be populated with the appropriate values so the DPLL Profile setting is the only setting needed.

The top selection of “jitter attenuator mode” from the pull-down list allows you to edit each of the parameters. After selecting a SyncE option, you can still modify settings but the software will warn that the configuration may no longer comply with the selected SyncE option.

Select G.8262 option 1 as shown in Figure 7. This screen shows the values when selecting G.8262 option 1.

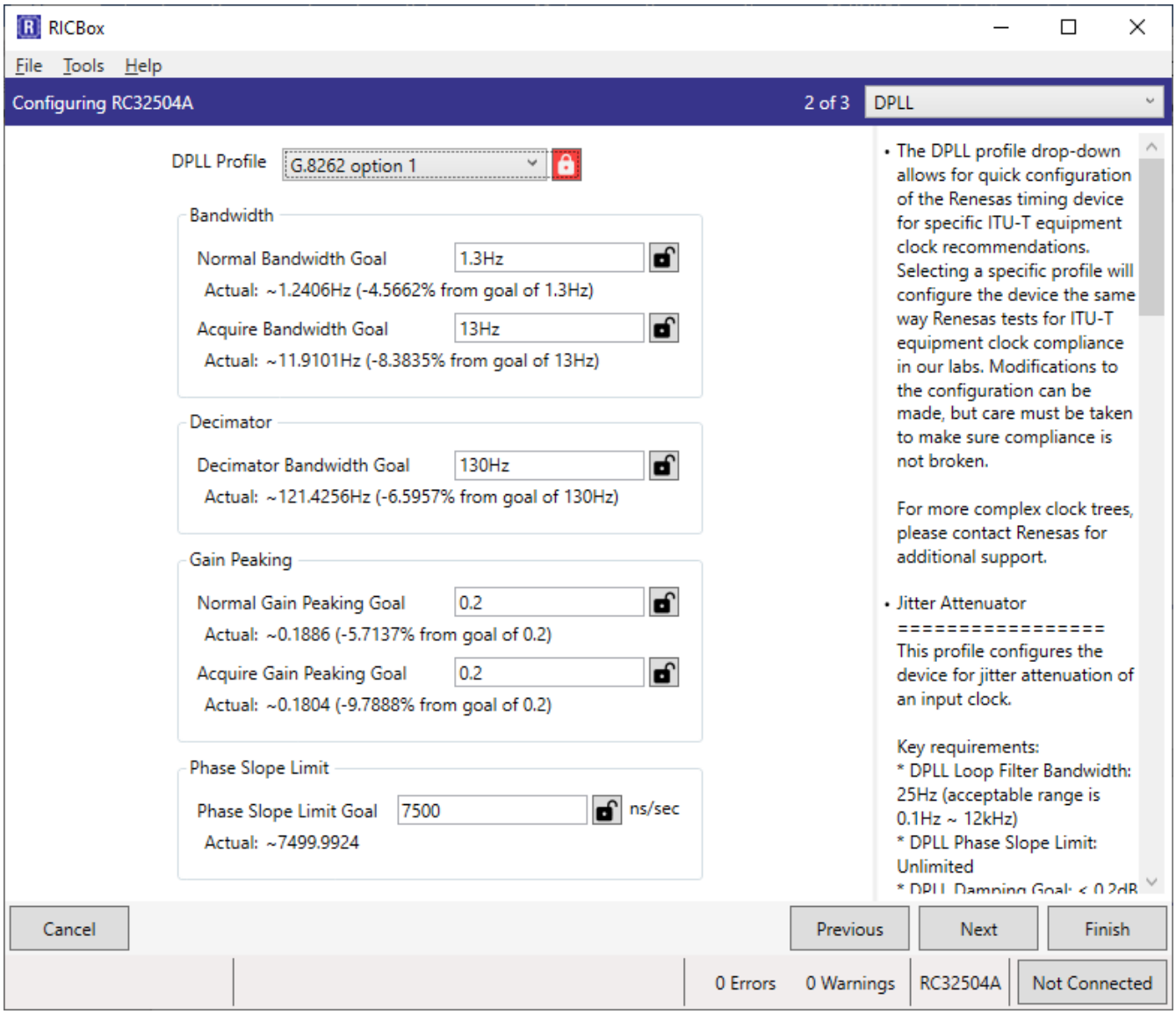

Figure 7. RICBox – Select G.8282 Option 1

Select G.8262 option 2 as shown in Figure 8. This screen shows the values when selecting G.8262 option 2.

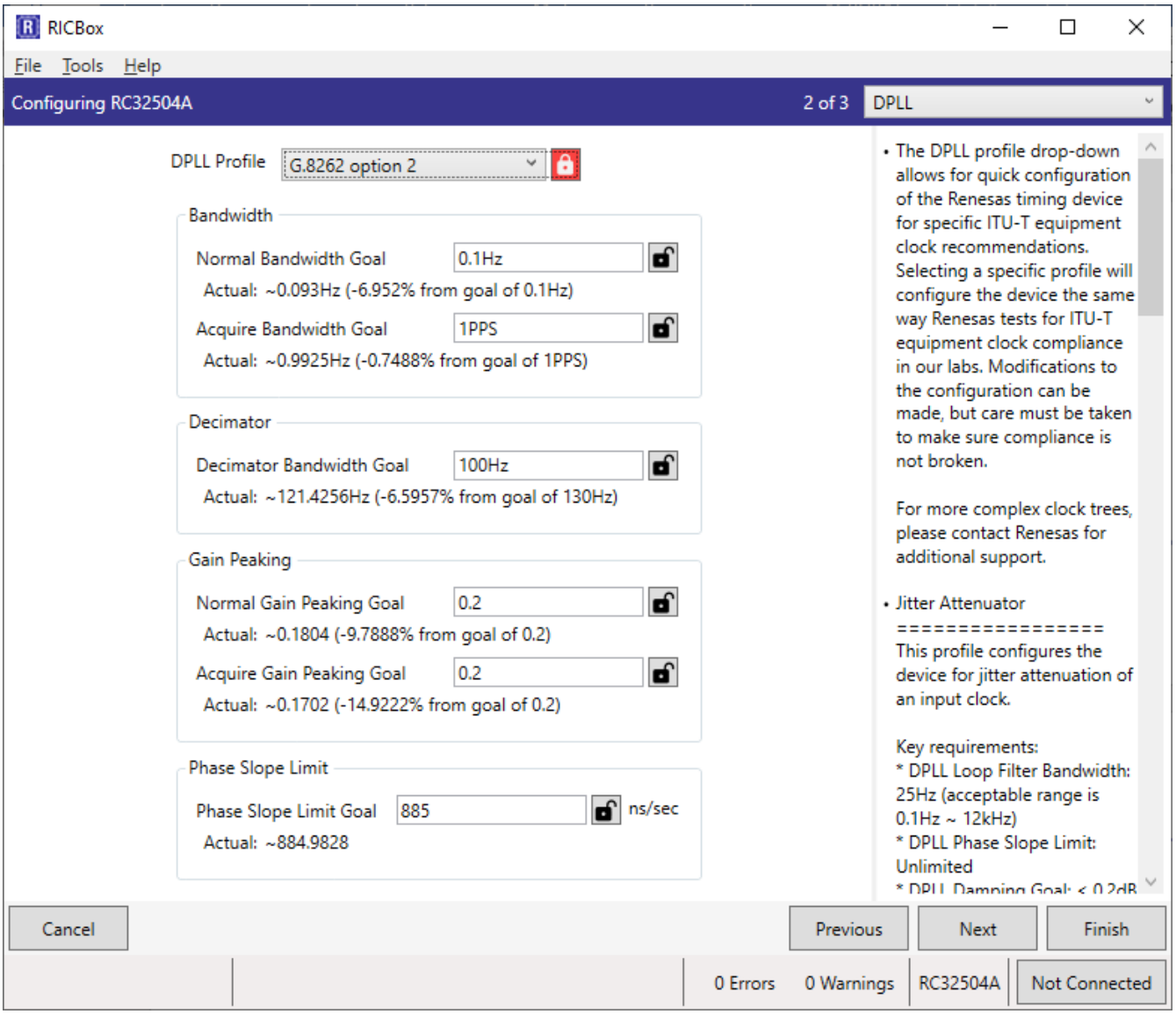

Figure 8. RICBox – Select G.8282 Option 2

The third and last screen of the Wizard allows you to set up the clock outputs of FemtoClock 2. Consult the FemtoClock 2 GUI User Guide for more details about using the RICBox software. The GUI User Guide can also be downloaded from the RC32504A webpage.

3. Revision History

Revision	Date	Description
1.00	Sep 20, 2021	Initial release.

IMPORTANT NOTICE AND DISCLAIMER

RENESAS ELECTRONICS CORPORATION AND ITS SUBSIDIARIES (“RENESAS”) PROVIDES TECHNICAL SPECIFICATIONS AND RELIABILITY DATA (INCLUDING DATASHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES “AS IS” AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, WITHOUT LIMITATION, ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR NON-INFRINGEMENT OF THIRD-PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for developers who are designing with Renesas products. You are solely responsible for (1) selecting the appropriate products for your application, (2) designing, validating, and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, or other requirements. These resources are subject to change without notice. Renesas grants you permission to use these resources only to develop an application that uses Renesas products. Other reproduction or use of these resources is strictly prohibited. No license is granted to any other Renesas intellectual property or to any third-party intellectual property. Renesas disclaims responsibility for, and you will fully indemnify Renesas and its representatives against, any claims, damages, costs, losses, or liabilities arising from your use of these resources. Renesas' products are provided only subject to Renesas' Terms and Conditions of Sale or other applicable terms agreed to in writing. No use of any Renesas resources expands or otherwise alters any applicable warranties or warranty disclaimers for these products.

(Disclaimer Rev.1.01)

Corporate Headquarters

TOYOSU FORESIA, 3-2-24 Toyosu,
Koto-ku, Tokyo 135-0061, Japan
www.renesas.com

Contact Information

For further information on a product, technology, the most up-to-date version of a document, or your nearest sales office, please visit www.renesas.com/contact-us/.

Trademarks

Renesas and the Renesas logo are trademarks of Renesas Electronics Corporation. All trademarks and registered trademarks are the property of their respective owners.