Quick Start Guide
Y-G-HYBRID-PLC-RF (PLC)

RENESAS

1. Installation

The "Y-G-HYBRID-PLC-RF solution kit comes pre-programed with evaluation SW for evaluating either the PLC PHY Layer or the RF PHY layer. This document is a quick start guide for evaluating the PLC part. For the RF part (IEEE 802.15.4 SUN FSK) please refer to the "Y-G-HYBRID-PLC-RF (RF)" quick start guide. There is no CD available with the kit. For associated software packages, users are requested to see the MyPages section in the demonstration summary and contact their Renesas representative or their Renesas Distribution partner. For this quick evaluation, users are expected to have the "Simple MAC GUI" for G3-PLC. There is no automatic installation of this software. Instead the user is expected to copy the contents of the Simple MAC to a related folder on the local machine. Please note that the user may require administration rights to the host PC in order to install the tool software.

2. Getting Started

The following table indicates which items contained in the Y-G-HYBRID-PLC-RF Powerline and Sub-GHz RF communication solution kit are required for this demonstration, the user is expected to have two evaluation boards.

This quick start guide allows the user to quickly evaluate the Y-G-HYBRID-PLC-RF powerline and Sub-GHz RF communication evaluation board using the G3 PLC PHY Layer evaluation software, "G3 SimpleMAC". This will allow the user to exchange G3 PLC PHY layer packets between two boards. To achieve this all of the items mentioned in the table to the right are required. For more information on the operation of the "G3-PLC SimpleMAC" please refer to the SimpleMAC for G3-PLC user manual, which is available as part of the G3-PLC SimpleMAC tool release.

Y-G-HYBRID-PLC-RF
2 x Y-G-HYBRID-PLC-RF boards
2 x Power Line Communication Line Couplers
2 x Line coupler connector cables.
2 x Mains Cable EU Type (Type C / C7)
2 x USB Cable (Micro-USB)
2 x Power Supply (15DYS818-150120W-K) Power supplies come with the kit depending on the order code and region.

3. Connection

1. The Y-G-HYBRID-PLC-RF evaluation boards come pre-programmed with the G3-PLC PHY layer evaluation firmware which supports all PLC band-plans.
2. Before connecting the Y-G-HYBRID-PLC-RF evaluation boards to the PC, please install the USB-to-Serial device driver from FDTI. This is usually part of the drivers that come as standard with Windows 10 and later. It can also be installed from: http://www.ftdichip.com/Drivers/VCP.htm
3. The Y-G-HYBRID-PLC-RF evaluation boards come pre-configured. To check the configuration, please ensure that both the Y-G-HYBRID-PLC-RF evaluation boards are configured as shown in the following tables (Jumpers and Switches).

Jumpers		Configuration
JP10		SHORT
JP11	CENELEC A (35-90 kHz)	OPEN
	CENELEC B (95-125 kHz)	OPEN
	ARIB/FCC (150 – 500 kHz)	SHORT

Switches	Setting	Switches	Setting
DIP1:1	OFF	DIP2:1	ON
DIP1:2	OFF	DIP2:2	OFF
DIP1:3	OFF	DIP2:3	ON
DIP1:4	OFF	DIP2:4	ON
DIP1:5	OFF	DIP2:5	ON
DIP1:6	OFF	DIP2:6	ON
DIP1:7	OFF	DIP2:7	OFF
DIP1:8	OFF	DIP2:8	OFF

Note that the switch settings and LED operation are firmware dependant and differ per application example or firmware used. Those shown are for this demonstration only.

4. To run this demonstration both of the Y-G-HYBRID-PLC-RF evaluation boards need to be connected as depicted in the figure below.
5. Connect the Y-G-HYBRID-PLC-RF evaluation boards via USB (J4) to the host PC using the USB cable provided. A single PC can be used to run the following demonstration.
6. The evaluation boards should then be recognised as USB Serial Ports. This can be verified in the "Device Manager" as shown opposite. It is worth noting the COM Port number which has been assigned to each hardware.
7. Connect the power supply to the power connector (J5) of the evaluation board and apply power. The power LEDs (3V3 and VIN) should now be illuminated. After a short delay LED10, should also illuminate.
8. Connect the boards to the power line using the power cables, powerline communication line couplers and connecting cable. For this demonstration it is recommended to use a separate (isolated) power line or LISN network.
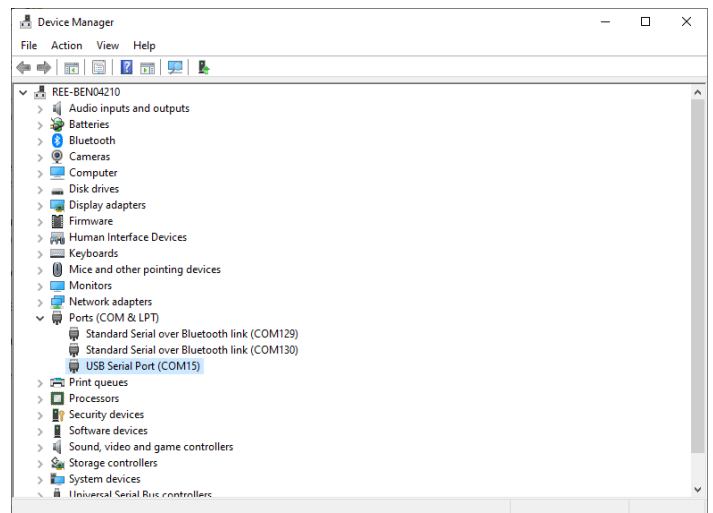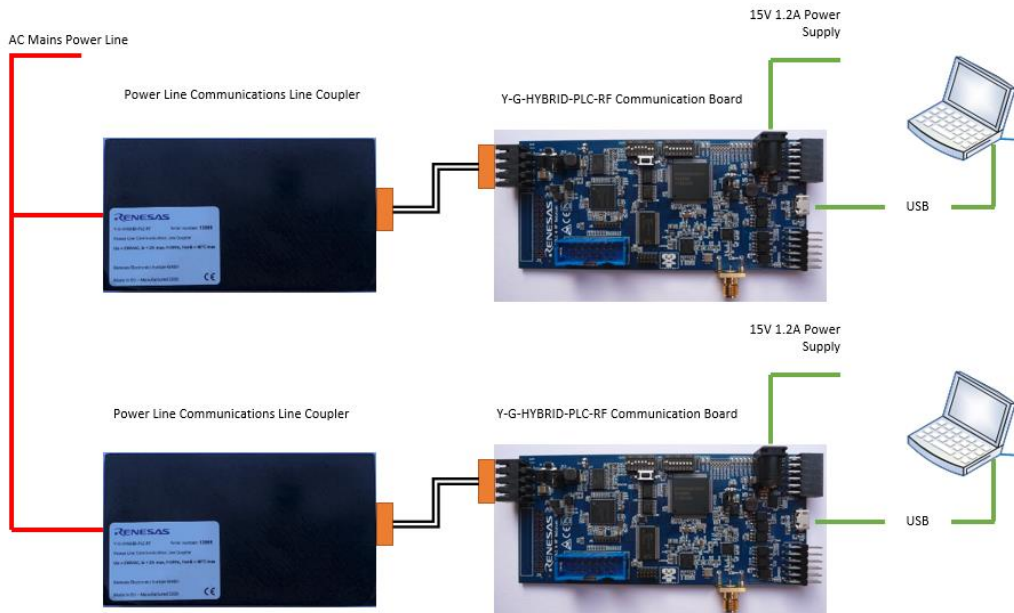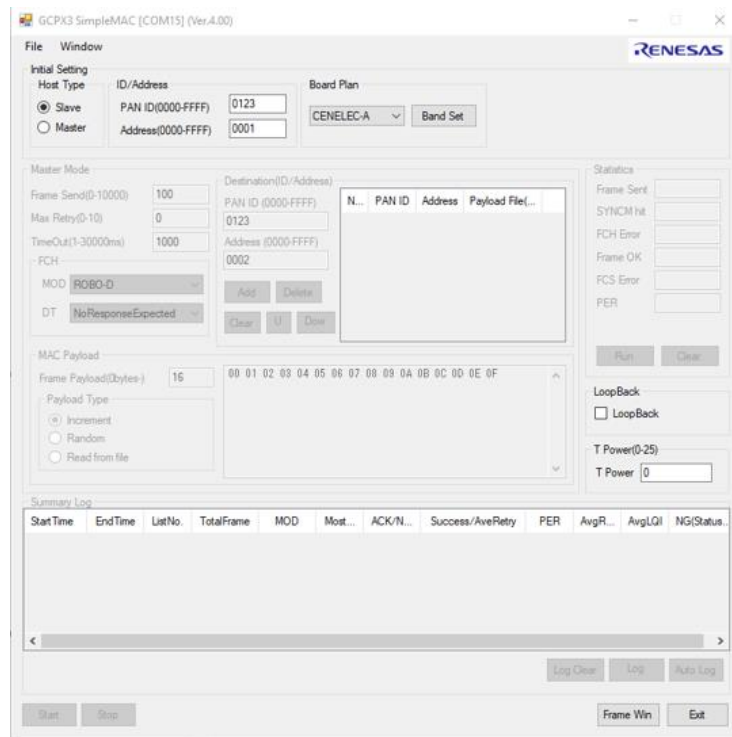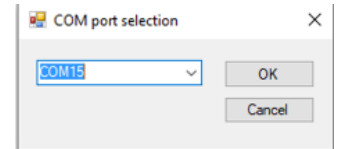
4. Starting the demonstration

To start the demonstration, ensure that the boards are configured as described in section 3.

1. Execute the G3 PLC SimpleMAC GUI tool: "LML_SimpleMAC.exe". It is recommended to copy the SimpleMAC folder to the local machine before running the tool. The SimpleMAC comes as a standalone instance and not as an installer.
2. The following dialog should appear, shown to the right. When prompted, use the dropdown menu to select one of the COM ports associated with the Y-G-HYBRID-PLC-RF hardware.
3. Select OK.
4. The following user interface should then be displayed:

5. For this demonstration two instances of the G3 PLC SimpleMAC GUI are required. Repeat steps 1 to 4 above, selecting the other COM port which is associated with the Y-G-HYBRID-PLC-RF hardware.
6. Decide which instance of the G3 PLC SimpleMAC GUI will be used as a transmitter, master, and decide which instance will be used as a receiver, slave.
7. Follow the steps below to configure one as a Master and one as a Slave.

Configuring the GUI to act as a Slave

1. Change the "Address" to '0002' (Initial Setting: ID/Address).
2. Select the desired Band Plan using the dropdown box, CENELEC A / CENELEC B / FCC / ARIB and push "Band Set" button.
3. Push "Run" (Statistics) button. (Optional).
4. The statistics should then be displayed as shown in the figure opposite, to clear the statistics then the user needs to "Stop" them then "Clear".
5. Push the "Start" button.
6. The Slave is now configured and ready to receive PLC frames. The interface should then match the one shown to the right.
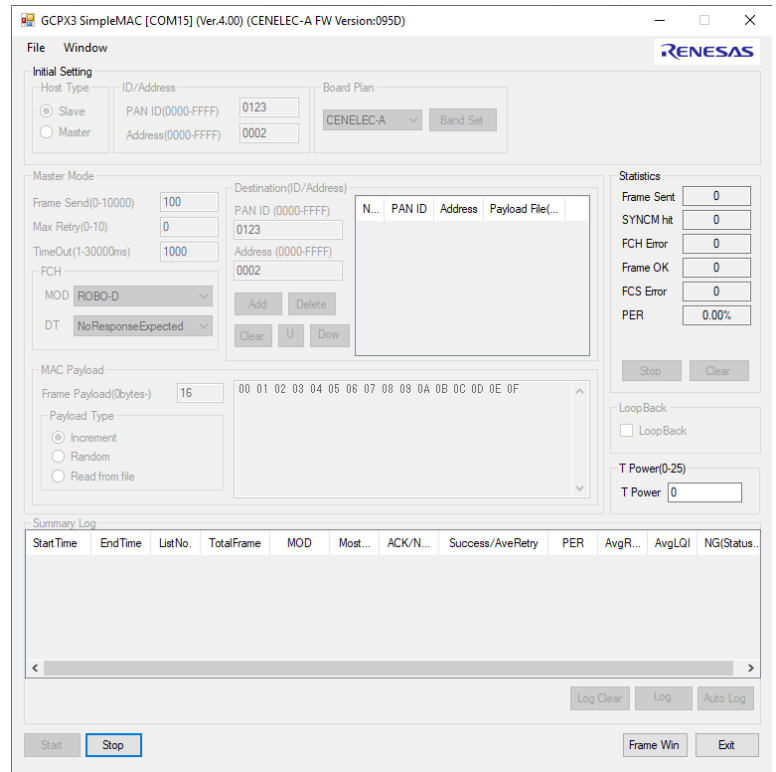
Configuring the GUI to act as a Master

1. Select the desired Band Plan using the dropdown box, CENELEC A / CENELEC B / FCC / ARIB and push "Band Set" button.
2. Select the "Master" radio button at the top left.
3. Push "Run" (Statistics) button. (Optional).
4. The statistics should then be displayed as shown in the figure opposite, to clear the statistics then the user needs to "Stop" them then "Clear".
5. In the "MAC Payload" configure the payload size of the data packets to transfer.
6. In the "Destination (ID/Address)" select "Add".
7. The Master is now configured and ready to transmit PLC frames. The interface should then match the one shown to the right.

Clicking on the "Start" button on the Master will transfer 100 frames from the Master to the slave. This can be confirmed by checking the statistic section of the GUI.
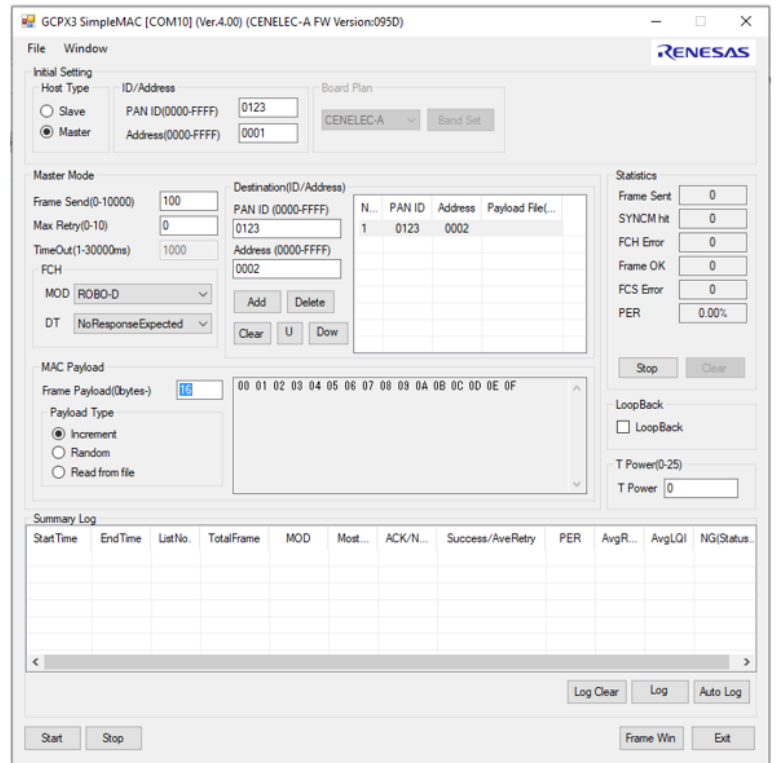
5. Demonstration summary

For full details on the operation of the "G3-PLC SimpleMAC" please refer to the Y-G-HYBRID-PLC-RF SimpleMAC for G3-PLC user manual.

The following is a selection of configuration changes that can be made to quickly familiarise the user with the G3-PLC SimpleMAC tool, these can all be found in the "Master Mode" section of the GUI:

- Change the number of frames to be transmitted by changing the text in the "Frame Send" text box.
- Change the modulation by changing the "MOD" drop down box.
- Change the delimiter type by changing the "DT" drop down box, this can be changed to "NoResponseExpected", "ResponseExpected".
- Change the size of the transmitted frame by changing the text in the "Frame Payload" text box in the "MAC Payload" section of the GUI.

6. Next Step

For more information about any of the demonstrations described above or for details on the operation of the "G3 PLC SimpleMAC" please refer to the Y-G-HYBRID-PLC-RF SimpleMAC for G3-PLC user manual supplied. Additional evaluation and development tools are also available for this kit. These are detailed below and are

available as separate packages. In this case the Y-G-HYBRID-PLC-RF evaluation boards will need to be re-programmed with the related firmware. Users are requested to contact their Renesas representative or their Renesas Distribution partner to obtain these, please refer to the MyPages section below.

Wireshark Protocol Analyser
The Y-G-HYBRID-PLC-RF solution kit also supports the Renesas PLC OFDM, and Wi-SUN Extensions for Wireshark. For more information on the installation and usage of this please refer to the quick start guide "R20UT2156ED0107_PLC_OFDM_WireShark_QSG.pdf".

G3-PLC, PRIME and Meters and More Sample Applications (Including G3-PLC Hybrid and PRIME1.4+MultiPHY)
Renesas provides sample applications for running applications on top of the PLC protocols for both master node and slave nodes. These sample applications are available in full source code and demonstrate how to start a network and exchange data packets, how to initialise the hardware related attributes, include updating firmware and are available (depending on the package) for the following devices: RX651, RX631, RX231, RL78 and RA6M4.

Network Communicator for G3-PLC and PRIME Base Node
Renesas provides sample tools for allowing full network evaluation of the protocol stacks. These tools allow users to operate and manage networks of many devices, allow network configuration and exchanging data frames. These tools are useful for developing applications and testing on large networks.

Renesas RF Test Studio
The Y-G-HYBRID-PLC-RF solution kit also supports IEE 802.15.4 SUN FSK (868/915 MHz) PHY layer evaluation software named "RFTestStudio". This will allow the user to exchange WiSUN or IEEE 802.15.4 SUN FSK PHY layer packets between two boards in a similar manner to that explained above. For more information on the operation of the RF Test Studio please refer to the user manual. Please also refer to the "Y-G-HYBRID-PLC-RF (RF)" quick start guide.

Wi-SUN FAN (Wi-SUN Demonstrator and Wi-SUN Developer GUI)
Renesas provides sample tools allowing full network evaluation of the Wi-SUN FAN protocol stack, this is available as two packages. As a demonstration GUI allowing users to form networks, study the network created and send data packets across the network. Also, as a library version which comes with full source code for a sample application running a Wi-SUN FAN network as either a Border Router or a Router node.

Supporting Documents.
There are many supporting documents for Renesas' wide range of PLC and RF boards and software stacks, these can be found:
https://www.renesas.com/us/en/application/power-and-energy/power-line-communication
https://www.renesas.com/us/en/application/communication-computing-infrastructure/wireless-network/subghz-solutions

My Pages
Renesas currently supports PRIME (1.3.6, 1.4 and 1.4+MultiPHY), G3-PLC Protocols and Meters and More PLC protocols, the Y-G-HYBRID-PLC-RF development board also supports the Wi-SUN FAN protocols and IEEE 802.15.4 MAC layer for RF. The protocol stacks from Renesas are available via "MyPages", please register and sign up to receive protocol updates from Renesas: (Once registered inform your Renesas representative indicating the email address used for registration)

https://www2.renesas.eu/products/micro/download/index.html/auth/register

7. Support

Technical Contact Details

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General information on Renesas Microcontrollers can be found on the Renesas website at:
http://www.renesas.com/

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