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

RENESAS

WARNING: The Y-G-HYBRID-PLC-RF solution kit contains an FEM module on the AFE of the Sub-GHz RF. Directly connecting two Y-G-HYBRID-PLC-RF communication boards with an un-attenuated SMA cable will cause permanent damage the to the boards.

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 RF PHY layer which is based on the IEEE 802.15.4 SUN FSK PHY. For the PLC part please refer to the "Y-G-HYBRID-PLC-RF (PLC)" quick start guide. There is no CD available with the kit. For associated software packages, users are requested to refer to 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 "RFTestStudio" release for RF characteristic evaluation of Renesas Sub-GHz transceivers. This software requires installation. After installation, the tool should appear as an "RFTestStudio" application in the start menu with a shortcut on the desktop. Please note that the user may require administration rights to install 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 IEEE 802.15.4 SUN FSK PHY Layer evaluation software: "RFTestStudio". This will allow the user to exchange IEEE 802.15.4 SUN FSK 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 "RFTestStudio" please refer to the user manual, which is available as part of the tool release.

Y-G-HYBRID-PLC-RF
2 x Y-G-HYBRID-PLC-RF boards
1 x SMA Coaxial Cable (not supplied)
1 x 50dB SMA attenuator suitable for 800 MHz to 1GHz frequencies (not supplied)
2 x DiPole W1063M 900MHz Antenna
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 IEEE 802.15.4 SUN FSK PHY layer evaluation firmware.
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) CENELEC B (95-125 kHz) ARIB/FCC (150 – 500 kHz)	NA

Switches	Setting	Switches	Setting
DIP1:1	ON	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 will 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 LEDs 10 and 11, should also illuminate.
8. Connect the RF section of the boards, this can either be done in a wired or wireless configuration. Renesas recommends a wired connection to minimise any external RF interferences. For this, connect the boards using an SMA connector with 50dB attenuation between. Alternatively, a wireless configuration may be used. In this case connected the RF antennas (supplied) to each of the evaluation boards.
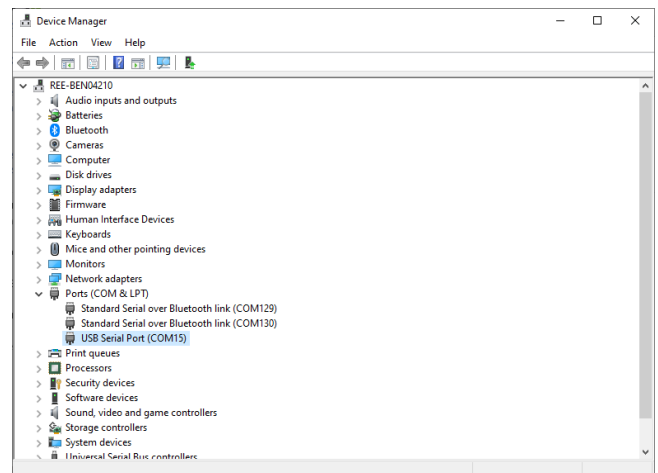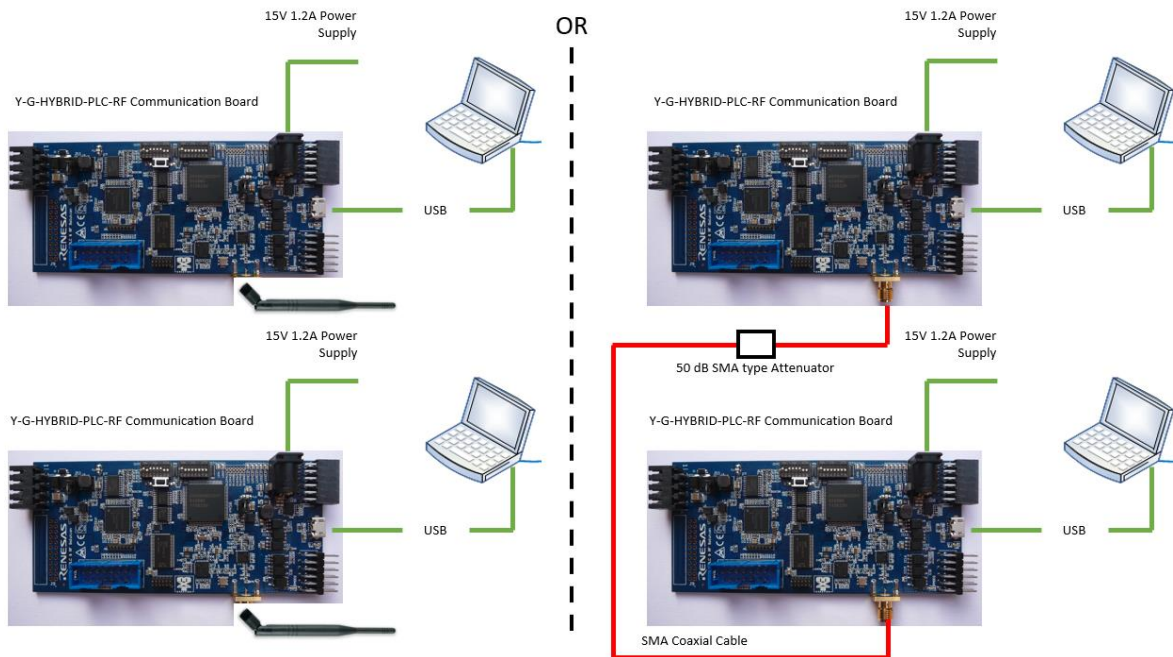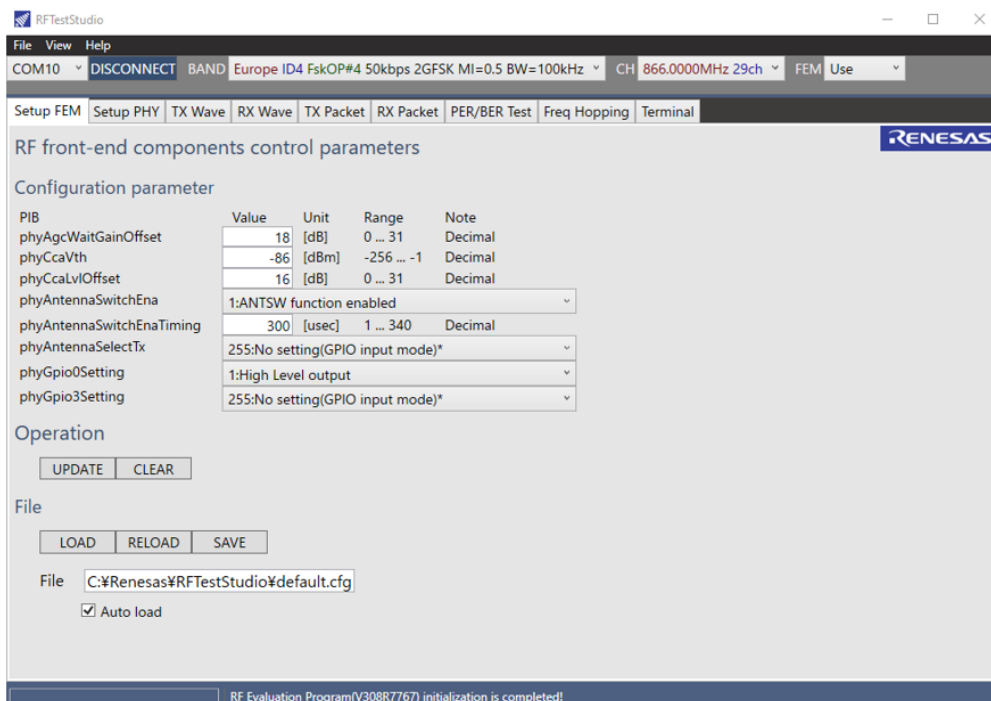
4. Starting the demonstration

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

1. Execute the RF Test Studio tool: "RFTestStudio.exe".
2. The application contains 4 drop down menus, the user should configure each in order.
3. Select the one of the COM ports associated with the Y-G-HYBRID-PLC-RF hardware. Press "Connect".
4. Select the band to be evaluated, e.g., "Europe ID#4 FSKOP#4 50kbps 2GFSK MI = 0.5 BW=100kHz".
5. Select the channel to be evaluated, e.g., "866.0000MHz 29ch".
6. Select FEM "Use". This is important as it allows configuration of the FEM mounted on the Y-G-HYBRID-PLC-RF hardware.
7. The following user interface should then be displayed, ensure that the configuration parameters for the FEM match those shown in the figure shown:

8. For this demonstration two instances of the RF Test Studio application are required. Repeat steps 1 to 7 above, selecting the other COM port which is associated with the Y-G-HYBRID-PLC-RF hardware.
9. Decide which instance of the RF Test Studio will be used as a transmitter, master, and decide which instance will be used as a receiver, slave.
10. 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 TAB window from "Setup FEM" to "RX Packet.
2. Press the "Start" button.
3. The interface should then match the one shown to the right.
4. The status bar at the bottom should show "Receiving…"
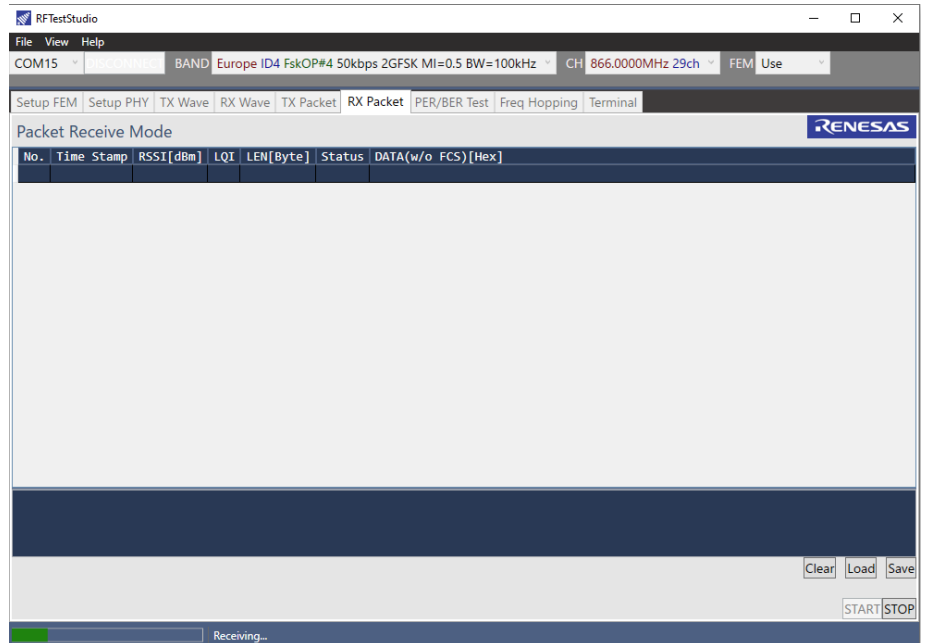
Configuring the GUI to act as a Master

1. Change the TAB window from "Setup FEM" to "TX Packet.
2. (Optional). Change the "Number of Transmit Packets" from 10 to a user defined number.
3. Change the Transmit Interval [us] to "200000".
4. Change the Transmit Power:
   a. d'62: +27dBm
   b. d'5: +14dBm
5. Select the transmitted packet data type radio button, "Send Predefined PN9 Data".
6. The interface should then match the one shown to the right.

Clicking on the "Start" button on the Master will transfer 10 (or user defined number of) frames from the Master to the slave. This can be confirmed by checking the "RX Packet" TAB of slave the GUI.
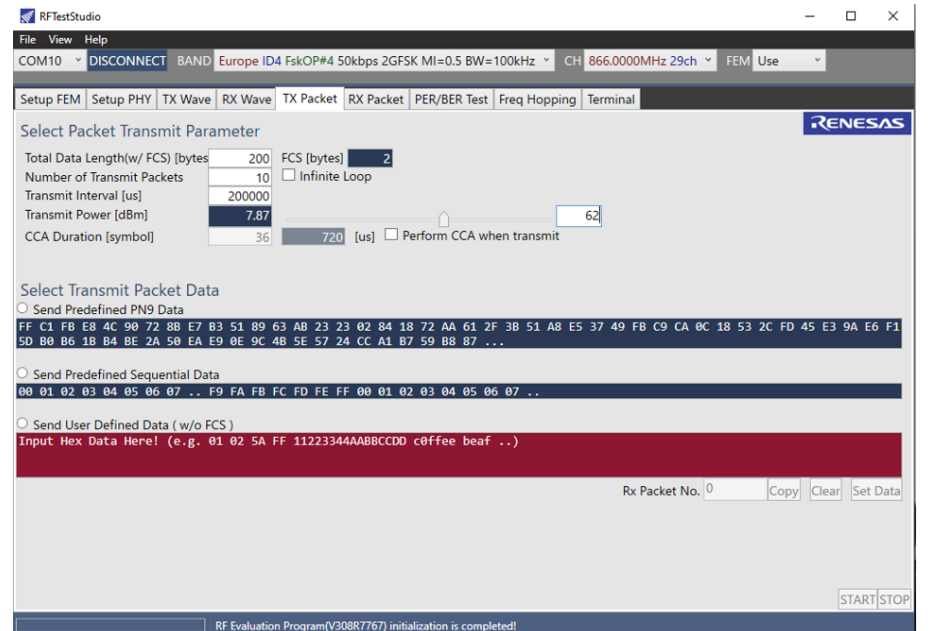
5. Demonstration summary

For full details on the operation of the "RF Test Studio" please refer to the user manual.

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

- Change the TAB to "TX Wave", here the user can select to send either continuous unmodulated transmissions or continuous modulated transmissions. This is useful when evaluating a hardware design, it can be used to measure the output level and the frequency deviation of the solution.
- Whilst using the above configuration a receiver can be configured to measure the RSSI over time.
- The "BER/BER Test" TAB can be used to measure packet errors.
- The "Freq Hopping" TAB can be used to configure a frequency hopping schedule, configuring channel orders and range, useful to test the performance of a frequency hopped solution which is mandatory in some regulated regions.

6. Next Step

For more information about any of the demonstrations described above or for details on the operation of the "RF Test Studio" please refer to the 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.

G3-PLC SimpleMAC

The Y-G-HYBRID-PLC-RF solution kit also supports the G3-PLC PHY layer evaluation software named "G3-PLC SimpleMAC". This will allow the user to exchange G3-PLC PHY layer packets between two boards in a similar manner to that explained above. For more information on the operation of the G3-PLC SimpleMAC please refer to the user manual. Please also refer to the "Y-G-HYBRID-PLC-RF (PLC)" quick start guide.

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.

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

America:	techsupport.america@renesas.com
Europe:	tools.support.eu@renesas.com
Japan:	csc@renesas.com

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

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