EVLKST8500GH-2: getting started with the ST8500 Hybrid PLC&RF connectivity development kit

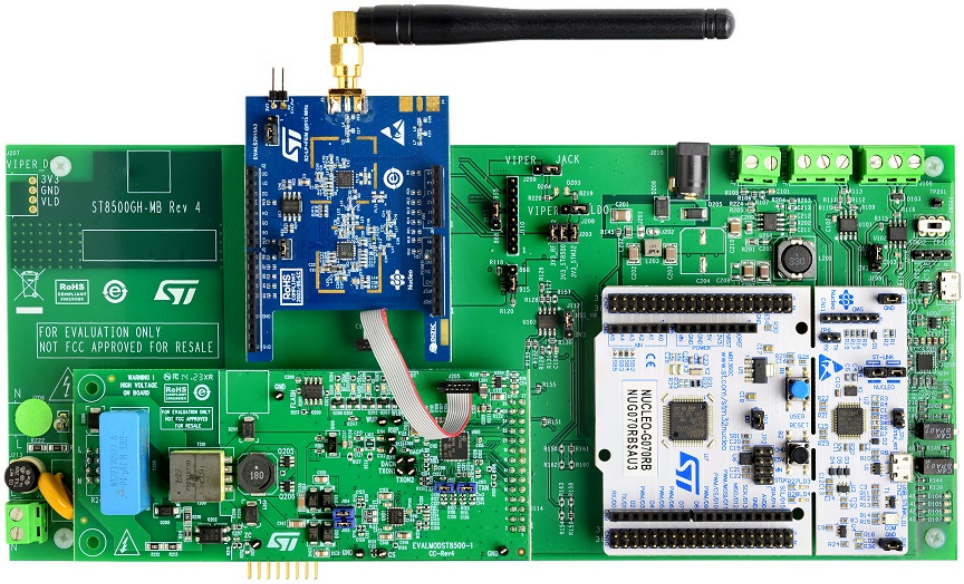
Introduction

This user manual explains the EVLKST8500GH-2 hardware and software installation, and it details the evaluation and development possibilities offered by the kit. In particular it contains:

- General information about the EVLKST8500GH-2 HW package
- An overview of the hardware configurations
- A short guide to the FW upgrade of the kit

This user manual does not explain the functionalities of the various PLC protocols running on the ST8500. Detailed information can be found in protocol specific documentation, available within the software packages, separately delivered under the Software License Agreement by contacting your local STMicroelectronics sales office.

Figure 1. EVLKST8500GH-2 picture



1 Safety precautions

The development kit must be used only by expert technicians.

The kit is intended for use on extra low voltage (ELV): <50 V AC, <75 V DC.

The kit is designed for evaluation only and is not for resale.

Warning: *STMicroelectronics assumes no responsibility for any consequences that may result from the improper use of this tool.*

2 Getting started

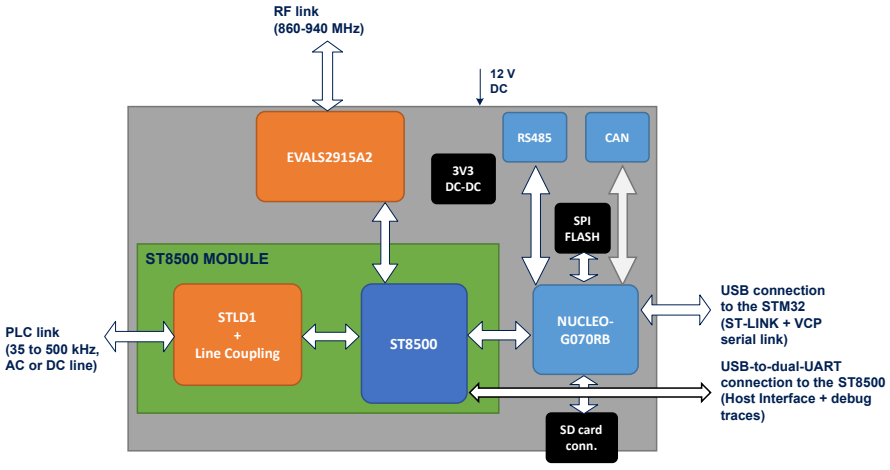
2.1 Included with the EVLKST8500GH-2

The EVLKST8500GH-2 package contains:

- One EVLKST8500GH-2 kit, based on 4 hardware boards:
  - EVALMODST8500-1: full PLC modem based on ST8500 and STLD1
  - EVALS2915A2: Sub-1 GHz (860-940 MHz) RF expansion board based on S2-LP radio
  - NUCLEO-G070RB: STM32 Nucleo-64 development board with STM32G07RB MCU as a programmable application controller with an onboard ST-LINK, acting also as a USB virtual COM port
  - ST8500GH-MB: connectivity motherboard including a USB-to-dual-UART converter to ST8500, 3V3 supply based on L6981, plus additional features for STM32 application development such as RS485 and CAN transceivers, an SD card connector, and an SPI FLASH for FW storage
- One Micro-USB cable to connect the evaluation kit to the PC
- One AC/DC universal adapter to provide 12 V - 1 A DC supply
- One bag with a 4.7 µH coil for best performance in case of usage for PLC CEN-B band

Figure 2 depicts the block diagram of the EVLKST8500GH-2.

Figure 2. EVLKST8500GH-2 block diagram



2.2 Software packages

The ST8500 Hybrid PLC&RF connectivity development kit is fully programmable, including both the ST8500 modem and the STM32G070RB MCU. The STSW-ST8500GH-2 software package includes a complete application example and all the necessary tools for a complete evaluation of G3-Hybrid communication (PLC & RF).

The kit is delivered with both the STM32 MCU and the ST8500 modem pre-programmed with the application example and the G3-Hybrid FW images from the STSW-ST8500GH-2 package.

Please visit the EVLKST8500GH-2 page on www.st.com or contact an STMicroelectronics sales representative to obtain the latest available SW packages.

3 Hardware description and configuration

The EVLKST8500GH-2 kit includes an EVALS2915A2 module for RF communication, but it is also compatible with the X-NUCLEO-S2868A2 module from the previous EVLKST8500GH868 kit as well.

When using the X-NUCLEO-S2868A2 module, J115 and J116 must be closed on the "868" position instead of the "915" position (default, to be used when using the EVALS2915A2 module).

The EVLKST8500GH-2 kit includes a NUCLEO-G070RB, but the ST8500GH-MB interconnection board also supports the NUCLEO-G474RE and NUCLEO-L476RG development boards. These development boards can replace the NUCLEO-G070RB with the same features, plus the CAN bus interface (not available on NUCLEO-G070RB).

When using the NUCLEO-G474RE or the NUCLEO-L476RG instead of the NUCLEO-G070RB, the following hardware modifications are required to preserve the kit's functionalities:

Table 1. Hardware modifications related to the NUCLEO board model

Feature	Pin	Resistor (0 ohm)	NUCLEO-G070RB	NUCLEO-G474RE/ NUCLEO-L476RG
RS485	USART2 TX	R158	Not mounted	Mounted
		R159	Mounted	Not mounted
	USART2 RX	R160	Not mounted	Mounted
		R161	Mounted	Not mounted
SPI FLASH	SPI2 MISO	R127	Mounted	Not mounted
		R157	Not mounted	Mounted
SD card	SPI2 MISO	R136	Mounted	Not mounted
		R137	Not mounted	Mounted

For up-to-date documentation including schematics, BOM, and PCB layout please visit the dedicated webpages on www.st.com.

All the documentation related to the NUCLEO-G070RB and EVALS2915A2 is available on the designated webpages on www.st.com.

3.1 External connectors and switches

The kit includes:

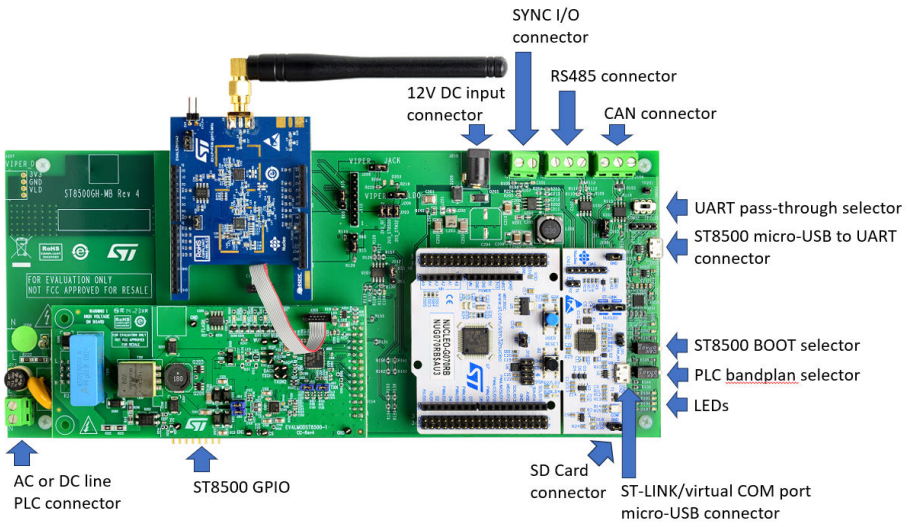
- A DC jack connector to supply the kit with a 12 V, 1 A DC adapter (provided with the kit).
- A two-line PLC connector for wiring the kit to an AC or DC bus, or even directly to another ST8500 board for lab communication tests.
- One switch (SW201) to select the UART pass-through to the ST8500:
  - STM32 (default) = The ST8500 host interface UART is connected to the STM32 (normal mode).
  - CP2105 = The ST8500 host interface UART is connected to the CP2105 serial-to-USB converter and is directly accessible from the USB connector (UART pass-through mode).
- Two DIP switches to select ST8500 BOOT mode and the PLC bandplan:
  - SW101 selects the ST8500 BOOT mode:
    - Down (default) = ST8500 boots from SPI FLASH on the ST8500 module.
    - Up = ST8500 boots from the host interface.
  - SW102 selects the PLC bandplan(1):
    - Down (default) = the modem communicates on the CENELEC-A bandplan.
    - Up = the modem communicates on the FCC bandplan.
- Connectivity to the PC via the ST-LINK integrated into the NUCLEO-G070RB, for FW development and communication tests.

- Several features that can be used for STM32 application development:
  - RS485 and CAN(2) connectors to develop industrial communication connectivity applications.
  - An SD card and SPI FLASH to develop data storage solutions for any application.
  - A SYNC I/O connector providing access to an STM32 GPIO or, alternatively, to an ST8500 pin for test purposes.

1. *The S2 switch function is software implemented inside the STM32 application example and therefore it can be modified via software.*
2. *The CAN interface is not available on NUCLEO-G070RB. If needed, it can be replaced by a different NUCLEO board, such as NUCLEO-G474RE or NUCLEO-L476RG, by the user.*

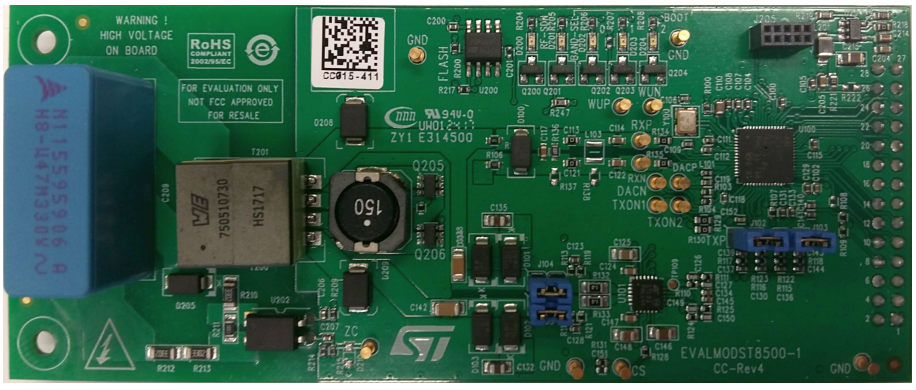
Figure 3 shows the positions of the EVLKST8500GH-2 connectors and switches.

Figure 3. EVLKST8500GH-2 connectors and switches



3.2 ST8500 module

Figure 4. EVALMODST8500-1 image



The EVALMODST8500-1 is connected to the baseboard through two connectors:

- J201 line connector to interface the PLC to the AC or DC line
- J200 digital and supply connector to interface the module to the STM32 microcontroller

The basic interface between the STM32 host controller and the ST8500 includes the following lines:

- UART RX/TX as ST8500 host interface
- RESETn signal (active low)

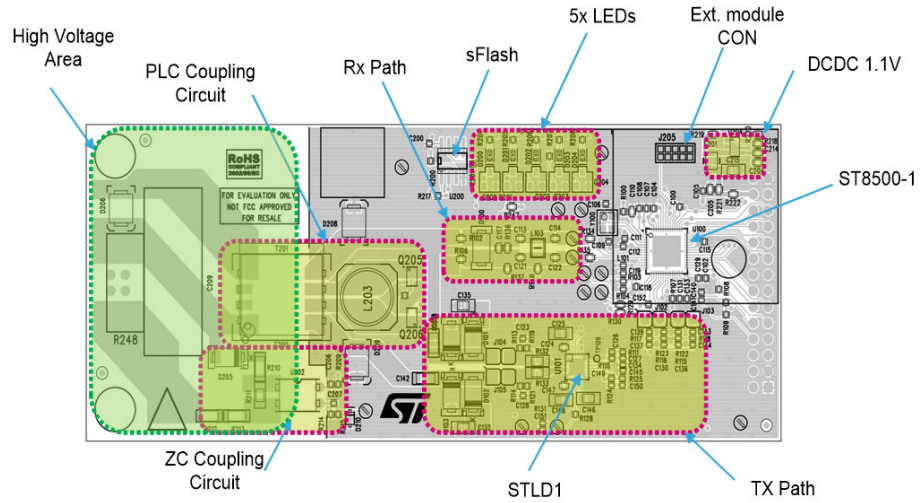
- BOOT1 to control the ST8500 boot mode
- LPMODEn to control the ST8500 low power mode (active low)
- UART Trace TX to output firmware binary traces for debug

Two DC voltages are provided to the ST8500 module:

- 12 V to supply the STLD1 line driver
- 3.3 V to supply the ST8500 section (including 1.1 V on-board DCDC input and 2.5 V integrated LDO input)

Figure 5 indicates the main sections on the ST8500 module.

Figure 5. EVALMODST8500-1 overview



3.3 Interconnection details

3.3.1 NUCLEO-G070RB interconnections

Table 2. NUCLEO-G070RB – ST8500 interconnections

	Function	NUCLEO-G070RB				EVALMODST8500-1		
		Connector name	Connector pin	STM32 pin	Signal	Connector name	Connector pin	Signal
ST8500 interface	Host IF UART	CN107	1	PC10	ST8500_HI_RXD	JP200	14	GPIO00_4
		CN107	2	PC11	ST8500_HI_TXD	JP200	11	GPIO00_5
	Debug Trace UART	CN110	37	PC5	ST8500_DBG_TX	JP200	15	GPIO01_4
		CN110	35	PC4	ST8500_DBG_RX	JP200	18	GPIO01_5
	Reset	CN107	35	PC2	ST8500_RESETn	JP200	10	RESETn
	Low Power Mode	CN107	32	PA4	ST8500_LPMODEn	JP200	8	LPMODEn
	BOOT	CN107	21	PB7	ST8500_BOOT0	JP200	25	BOOT0
		CN110	24	PB6	ST8500_BOOT1	JP200	23	BOOT1
		CN110	29	PB5	ST8500_BOOT2	JP200	24	BOOT2
	GPIO	CN110	13	PA6	ST8500_GPIO00_6	JP200	12	GPIO00_6
		CN110	15	PA7	ST8500_GPIO00_7	JP200	9	GPIO00_7

Table 3. **NUCLEO-G070RB – other interconnections**

	Function	NUCLEO-G070RB			
		Connector name	Connector pin	STM32 pin	Signal
SD Card connector (J113)	SD Card SPI	CN10	26	PB15	SDC_MOSI
		CN10	25	PB14	SDC_MISO
		CN10	30	PB13	SDC_SCK
		CN10	16	PC1	SDC_CSn
	SD Card GPIO	CN10	18	PC0	SDC_Detect
SPI Flash (U103)	External FLASH SPI	CN10	26	PB15	eFlash_MOSI
		CN10	25	PB14	eFlash_MISO
		CN10	30	PB13	eFlash_SCK
		CN10	23	PA8	eFlash_CSn
RS-485 connector (J107)	RS485 UART	CN10	35	PC4	RS485_TX
		CN10	37	PC5	RS485_RX
	RS485 GPIO	CN7	30	PA1	RS485_DE
CAN connector (J109)	CAN UART	CN10	12	PA12	CAN_TX
		CN10	14	PA11	CAN_RX
LEDs	GPIO	CN7	4	PD2	LED0
		CN10	1	PC9	LED1
		CN10	2	PC8	LED2
		CN10	4	PC6	LED3
ST8500 boot mode switch (SW101)	GPIO	CN10	24	PB6	ST8500_BOOT1
STM32 switch (SW102)	GPIO	CN7	3	PC12	PC12
SYNC connector (J106)	GPIO	CN10	22	PB2	STM32_SYNC

3.3.2 EVALS2915A2 interconnections

Table 4. **EVALS2915A2 interconnections**

	EVALS2915A2			EVALMODST8500-1			Function
	Connector name	Connector pin	Signal	Connector name	Connector pin	Signal	
S2-LP interface	J2	4	SCLK	J205	5	GPIO00_0	SPI2_CLK
	J2	8	SDN	J205	3	GPIO00_7	S2-LP_SDN
	J5	4	SDI	J205	7	GPIO00_1	SPI2_MOSI
	J5	5	SDO	J205	10	GPIO00_3	SPI2_MISO
	J6	2	CSn	J205	9	GPIO00_2	SPI2_CS
	J6	6	GPIO3	J205	1	GPIO01_6	S2-LP_IRQ

4 Firmware upgrade

4.1 How to upgrade the STM32 firmware

The kit supports a STM32 FW upgrade through the ST-LINK USB by using the STM32CubeProgrammer software available on www.st.com (STM32CubeProg).

The ST-LINK USB connection can be used for FW debugging and development while at the same time acting as a Virtual COM port (VCP). The related driver is available on www.st.com (STSW-LINK009).

4.2 How to upgrade the ST8500 firmware

On the EVALMODST8500-1 module, the ST8500 is connected through SPI to an external FLASH memory that stores the FW loaded at start-up by the ST8500 in "Boot from SPI FLASH" mode. This SPI FLASH memory can be reprogrammed using specific tools and techniques provided by STMicroelectronics.

Please refer to the documentation and tools that come with the latest STSW-ST8500GH-2 software package available from the EVLKST8500GH-2 page on www.st.com or contact an STMicroelectronics sales representative.

5 Formal notices required by the U.S. Federal Communications Commission ("FCC")

FCC NOTICE: This kit is designed to allow:

1. Product developers to evaluate electronic components, circuitry, or software associated with the kit to determine whether to incorporate such items in a finished product.
2. Software developers to write software applications for use with the end product. This kit is not a finished product and when assembled may not be resold or otherwise marketed unless all required FCC equipment authorizations are first obtained. Operation is subject to the condition that this product not cause harmful interference to licensed radio stations and that this product accepts harmful interference. Unless the assembled kit is designed to operate under part 15, part 18 or part 95 of Title 47 Chapter I, the operator of the kit must operate under the authority of an FCC license holder or must secure an experimental authorization under part 5 of the FCC Rules.

The kit is designed for evaluation only and is not for resale.

5.1 Antenna requirements

Since the kit is destined for professional users, a standard connector is used to attach the antenna to it.

The kit must be used with the antenna that is already provided in the package.

It can be replaced only by an identical one: LPRS ANT-900MS / ANT-900MR 868-915 MHz Flexible ¼ Wave Whip Antenna.

Revision history

Table 5. **Document revision history**

Date	Version	Changes
29-Sep-2023	1	Initial release.

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