YAMAR
EVB Manual

DMX250 Evaluation Board Manual

1. Overview

The DMX250 evaluation board (EVB) allows easy testing of the DMX250 device for DMX network communication over the Power line. Multiple DMX250 EVBs can communicate over DC power lines using the DMX512/RDM protocol.

Figure 1 depicts the EVB. This manual describes how to use and interface with the EVB. The DMX250 datasheet is a reference to this document.

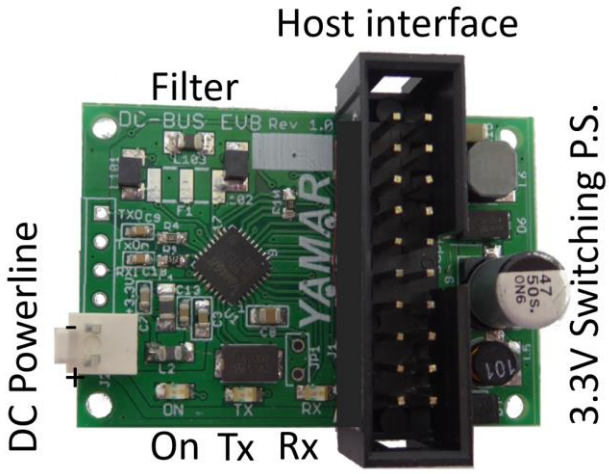

Figure 1 - DMX250 EVB

2. DMX250 EVB Description

2.1 Block Diagram Description

The EVB contains all the required hardware for the DMX250 device operation such as a line protection network, filter, 16MHz crystal, and a 3.3V switching power supply. The board operates as a physical layer for the DMX512/RDM protocol over DC powerlines at a data rate of 250Kbit/s. The EVB connects directly to a DMX controller (ECU) through its TX and RX pins connected to HDI and HDO pins in the J1 Host connector. The EVB block diagram is depicted in Figure 2. The HDC pin allows device configuration. When low, the data from the ECU is used to configure the DMX250 registers for the desired communication frequency and other parameters as described in the DMX250 datasheet.

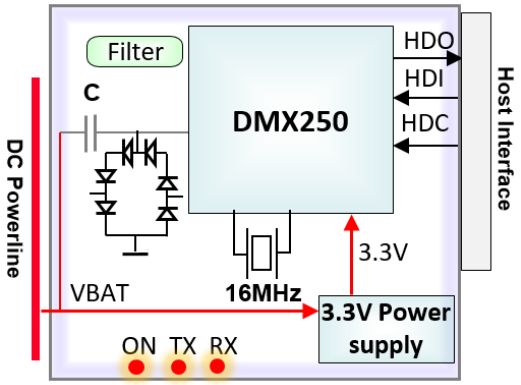

Figure 2 - DMX250 EVB Blocks

The received data signal from the DC powerline passes through a protection network into the DMX250 device. The DMX250 decodes the data and output it on the HDO pin of the Host interface connector.

On the transmitter side, the DMX controller transfers data to the DMX250 via an HDI pin. The DMX250 processes the data. The DMX frame is modulated at the selected carrier frequency and transmitted on a TXO pin that drives the DC powerline via the protection network and a coupling capacitor.

The built-in switching power supply provides the 3.3V voltage required for the DMX250 device operation. The power supply operates in a wide input voltage range between 10V and 36V. The EVB current consumption is in the range of 30mA depending on the supply input voltage (powerline voltage).

The DMX250 internal registers, as described in the DMX250 datasheet determine the EVB operation conditions such as carrier frequency. The carrier frequency is determined either by resistors on Freq-Sel0 to Freq-Sel4 pins routed to the J1 Host interface connector by connecting the pins to VCC or GND. When HDC signal Low, the data to/from the EVB is directed as a command, allowing WRITE-REG and READ-REG to/from the DMX250 internal registers.

2.2 Hardware features

- Noise robust DC powerline Communication
- DMX512/RDM interface
- Powerline bitrate 250Kbps
- 31 selectable operating frequencies (7MHz to 30MHz) using FREQ_SEL[4:0] pins.
- 10V to 36V operation using switching power supply
- Indication LEDs
- Small size EVB

2.3 EVB Connectors

2.3.1 J1 – Host Interface Connector

Table 1 – J1 Host interface connector

Pin Name	Direction	PU	Pin #	Pin Name	Direction	PU	Pin #
Reserved			1	Reserved			2
NRESET	I	PU	3	Reserved			4
INH	O		5	TXON	O		6
FREQ_SEL0	I		7	FREQ_SEL1	I		8
FREQ_SEL3	I		9	FREQ_SEL4	I		10
FREQ_SEL2	I		11	NC			12
NSLEEP	I	PU	13	HDC	I	PU	14
HDO	O		15	HDI	I	PU	16
VCC (3.3V) output	P		17	GND	P		18
GND	P		19	VBAT (powerline) * Requires R6 = 0Ω	P		20

All input and output signals are compatible with 3.3V CMOS logic.

2.3.2 J2 – DC Power Line and test points

Table 2 J2 – DC Power Line and test points

Name	Pin #
TXO test-pin	1
TXON test-pin	2
RXI test-pin	3
3.3V output from the power supply	4
GND	5

VBAT DC powerline input	6

VBAT input connects the EVB to the DC powerline for communication and power supply.

Power supply requirements: 10V to 36V, minimum 150mA.

2.3.3 Display LEDs

- TX LED - Indicates transmission.
- RX LED - Data output, indicates reception.
- ON LED - Indicates 3.3V power on.

2.4 Mechanical Data

The EVB board layout is depicted in Figure 3.

2.4.1 Top Layer

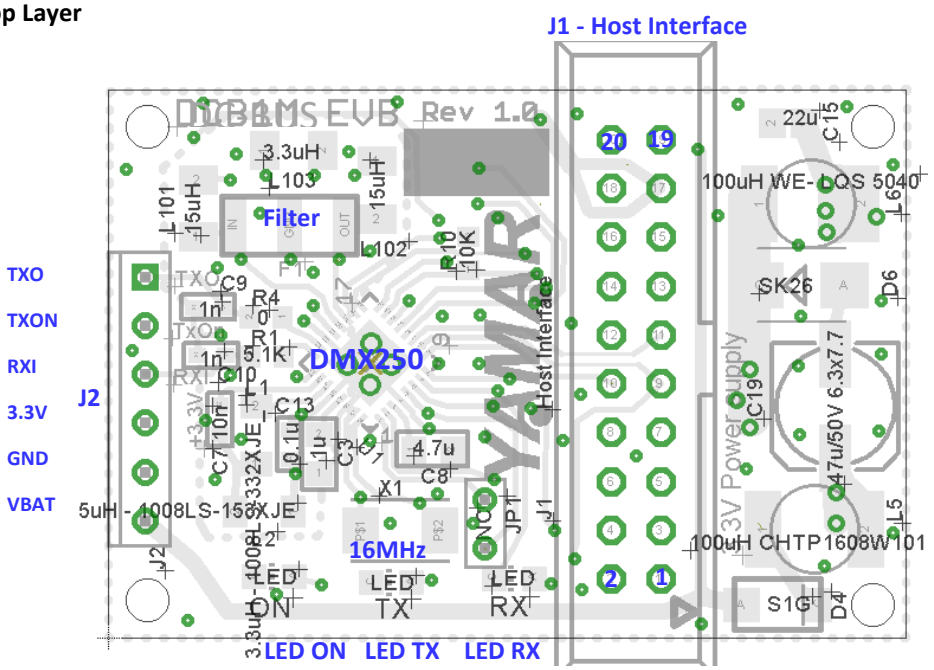

Figure 3 - EVB Top layer

2.4.2 Bottom Layer

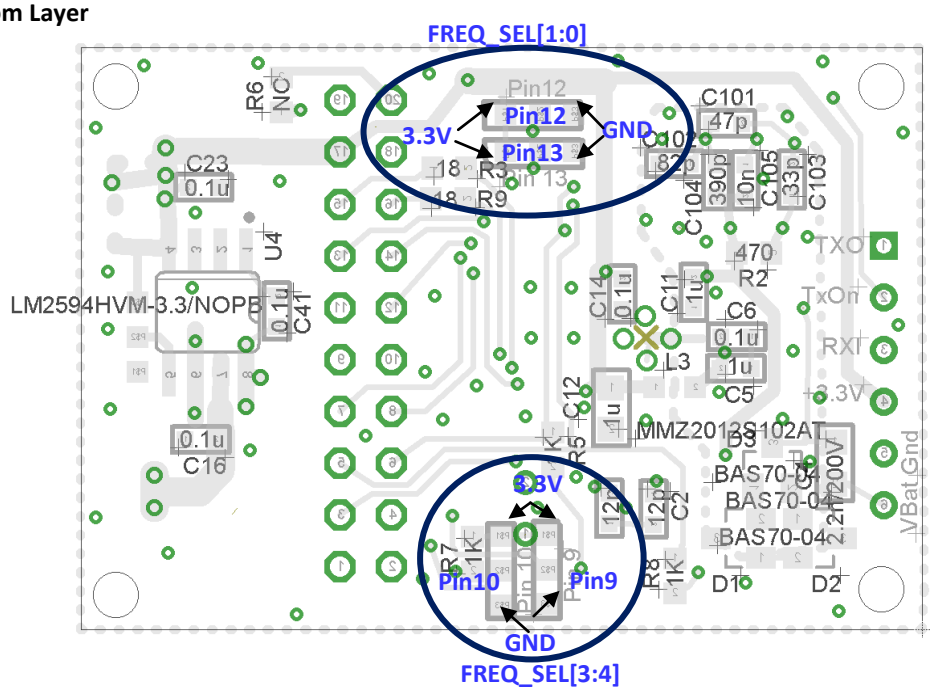

Figure 4 - EVB Bottom layer

3. EVB Operation

3.1 Configuration

DMX250 operation mode and its settings are configured at Power-up, Reset, and when ECU writes into its internal register (command mode, using the HDC pin). Refer to the DMX250 datasheet for further configuration information.

3.2 Interface DMX250 EVB directly with DMX/RDM controller

The DMX250 EVB interfaces directly to DMX512/RDM controller.

The Host Interface connector J1 has all the signals required for the EVB operation. The operating frequency is determined by five pins. The initial conditions of FREQ_SEL[0:1] and FREQ_SEL[3:4] are set upon power-up according to the corresponding J1 pins or by resistors on the PCB bottom layer. Two 100K resistors connected to the device pin 9 and Pin 10 and two 100K resistors to the device pins 12 and 13. FREQ_SEL[2] pin is floated and has to be interfaced directly from the DMX512/RDM controller.

When using an external power supply in parallel to the EVB's power supply, it is recommended to add an inductor of at least 22uH in serial to the external power supply to avoid strong attenuation due to the power supply's internal filtering capacitors.

Figure 5 demonstrates an example of a UART interface using HDO, HDI, and HDC signals.

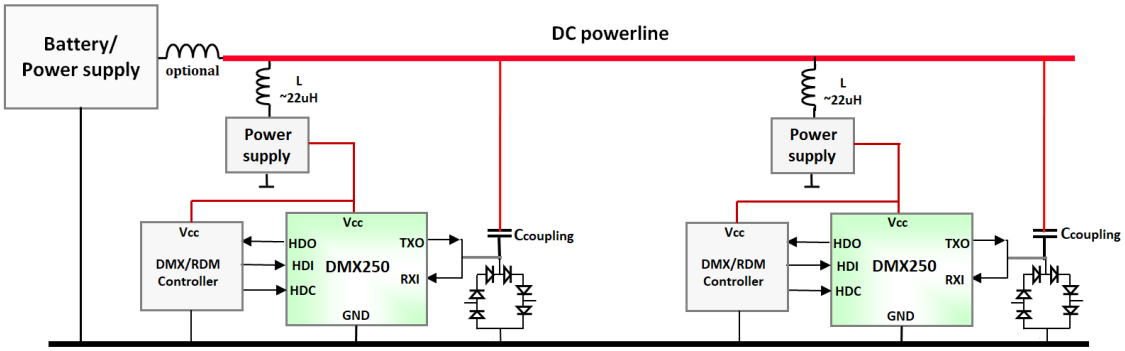

Figure 5 - DMX250 EVB Interface with DMX Controller and DC Powerline.

3.3 Interface DMX250 EVB to an existing DMX/RDM module

When interfacing to an existing DMX/RDM module that has already a built-in RS485 transceiver, an additional RS485 transceiver is required to translate the signals to Tx and Rx 3.3V logic.

Figure 6 depicts a typical DMX250 to RS485 transceiver interface connection.

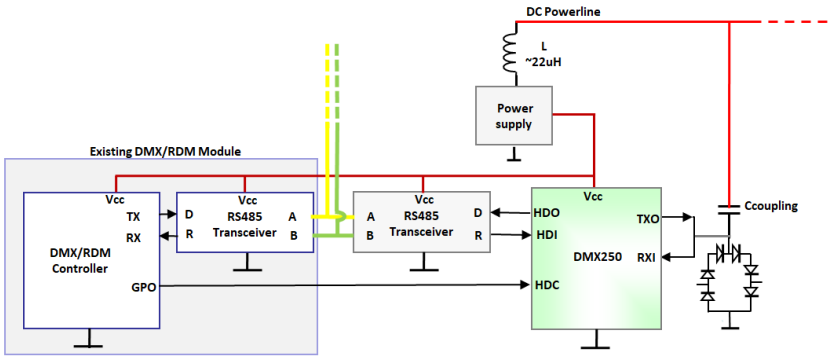

Figure 6 – Typical DMX250 to RS485 transceiver interface

* Yamar's EVB-Tester has an on-board RS485 transceiver for back-to-back DMX cable interface (see https://yamar.com/product/dc-bus-evb-tester/).

3.4 The DC-BUS EVB Test Environment

The DC-BUS test environment contains an EVB Tester board controlling the tested EVB to its operating parameters. When operating as a transmitter it generates test messages transmitted over the powerline or via DC Powerline Attenuator that emulates the DC powerline channel attenuation. A second EVB operating as a receiver transfer the received data to a second EVB Tester that analyzes the received data or transfers it via its USB interface (when connected) to a PC for further analysis and display of the results.

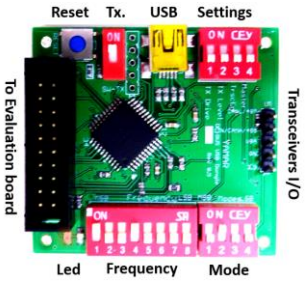

Figure 7 - EVB Tester

I. PC to PC communication via the powerline using the USB interface built in the EVB tester

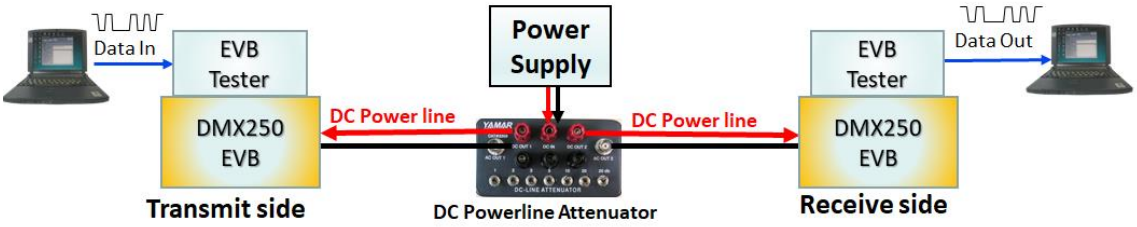

Figure 8 - PC to PC testing

II. TX test messages transmission from the EVB tester to a PC with a test program via the powerline.

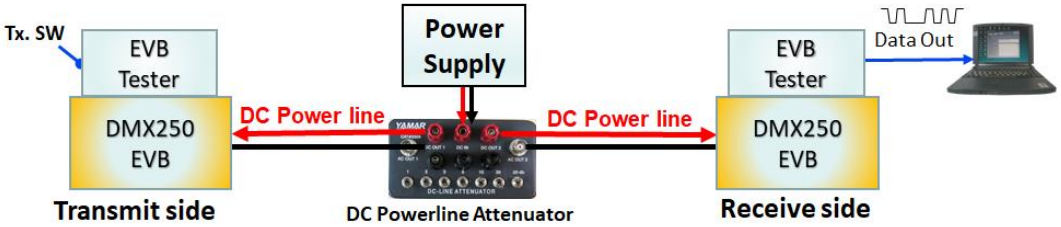

Figure 9 - EVB Tester to PC testing

III. TX test messages transmission from EVB Tester to Rx EVB Tester that analyzes the received test messages and indicates the results with a LED.

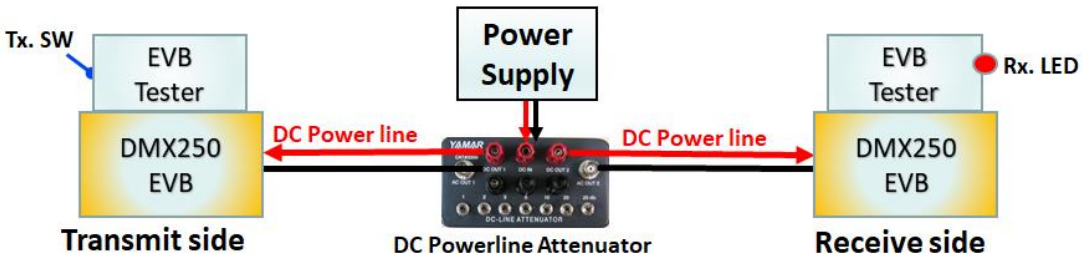

Figure 10 - EVB Tester to EVB Tester testing

The DC-powerline Attenuator is used for testing communication performance over the powerline in the lab. The attenuator allows adding attenuation (0 to 61dB) to the AC modulated signal over the battery powerlines (DC-Lines) keeping the DC voltage level unchanged. When connecting the EVB directly to a power supply, it is recommended to add in serial to the power supply an inductor (>22uH) to avoid strong attenuation due to the power supply input filtering capacitors.

Figure 11 - DC Powerline attenuator

3.5 EVB Quick setup

- ✓ Connect the communication signals via J1 to the DMX/RDM controller, or connect the EVB to Yamar's EVB-Tester board (see https://yamar.com/product/dc-bus-evb-tester/)
- ✓ Connect the EVBs to the DC powerline (J2, VBAT).
- ✓ Transmit and receive DMX/RDM data to and from DMX250 EVBs connected to the DC powerline.

4. EVB DMX250 schematic

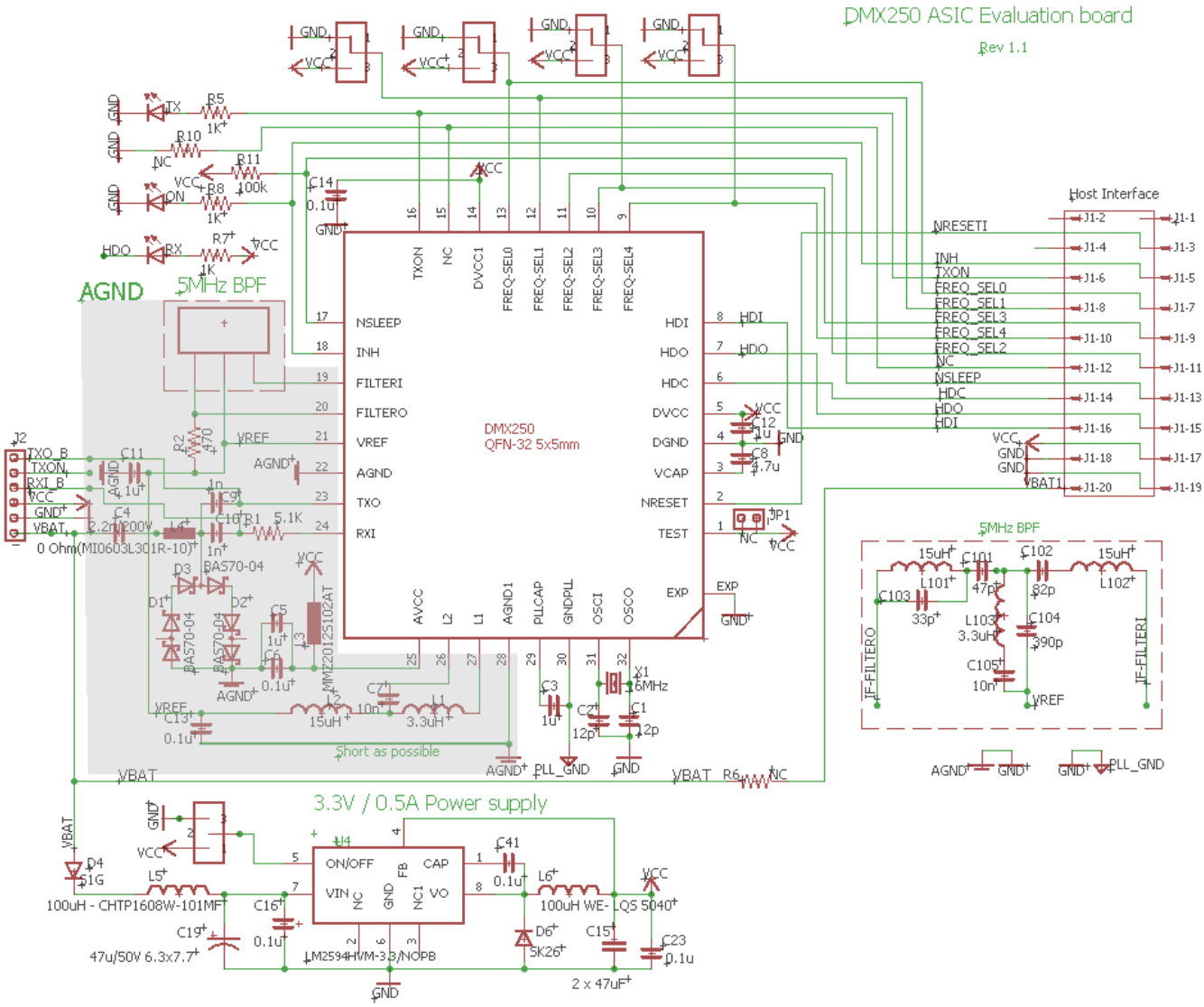

Figure 12 - DMX250 EVB circuitry

Revision History

Rev.	Date	Description
0.1	19-9-2019	Initial version
0.2	28-10-2019	Add sections 3.3, 3.4 and 5.
0.3	26-05-2020	Update test environment in section 3.4.
0.4	15-11-2020	Update Figure 12 to Rev 1.1.
0.5	14-01-2021	Editing.