YAMAR
Application note

DC-BUS Communication Test Environment

1. General

The performance of data communication over DC power lines (DC-BUS devices) depends on many parameters such as the carrier frequency, cable length, cable capacitance, and the AC loads connected to the power line. A capacitive load contributes to high attenuation of the carrier signal (e.g. 10nF noise fileting capacitor) while an inductive load has a smaller influence (e.g. 10A motor).

To allow quick and efficient DC-BUS power line communication tests in a Lab environment, Yamar has developed a DC-BUS Test environment.

2. Test Environment

The test environment consists of DC-BUS Evaluation boards, EVB Tester, a PC Test program, and a DC-Powerline Attenuator that distributes DC power to two DC-BUS EVBs from any power supply. The DC-BUS EVBs has a built-in switching power supply operating between 10V to 36Vdc.

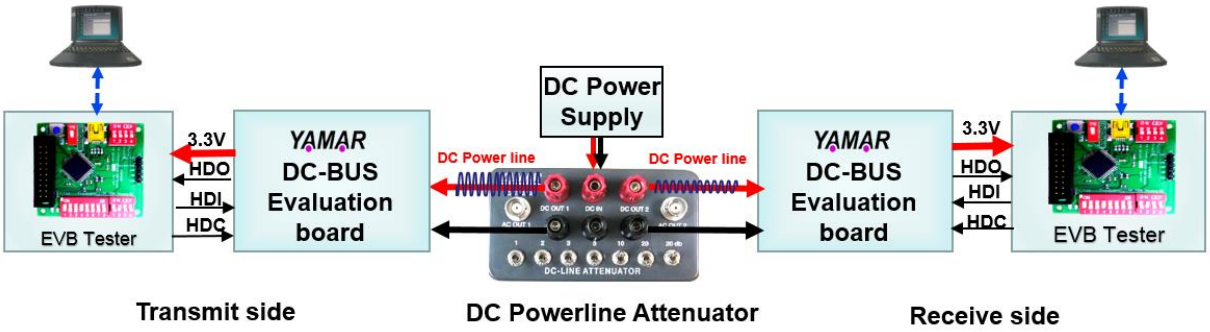

Figure 1 - DC-BUS Test setup using the PC program.

Test messages are generated either by the PC test program or directly by the EVB Tester (When the PC is not connected). The messages are modulated by the DC-BUS devices on its evaluation board. Figure 1 presents the test setup.
The modulated messages are attenuated by the DC Powerline attenuator. At the receiving side, the messages are demodulated by the DC-BUS device and transferred to the EVB Tester. The messages are analyzed by the EVB tester or the PC Test program. The DC voltage is not affected by the attenuation.

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3. EVB-Tester Board

The evaluation board (EVB) Tester is a tool to evaluate the DC-BUS devices' communication performance. Upon power-up, the EVB Tester configures its connected DC-BUS EVB to the desired operation parameters according to its switches setting (Frequency, coding, etc.). If the EVB Tester is connected to a PC via a USB interface, the PC Test program controls the test environment operation.

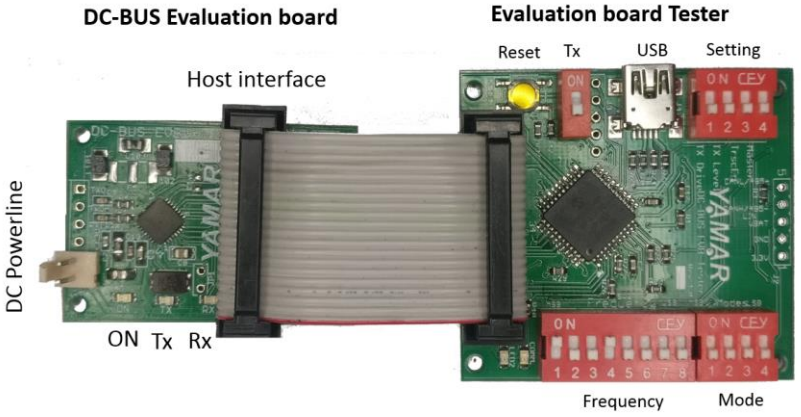

Figure 2- DC-BUS evaluation board with EVB Tester

3.1. EVB Tester Board Mode of operations

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

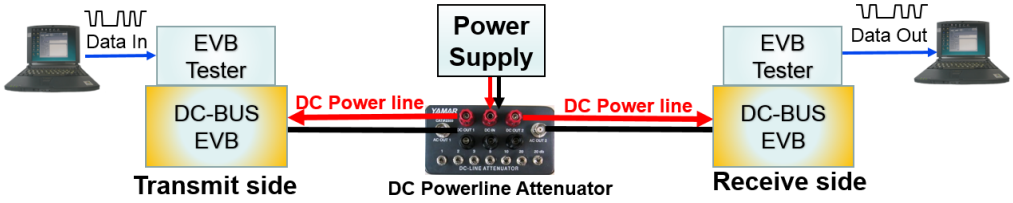

Figure 3 - PC to PC testing

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

Figure 4 - EVB Tester to PC testing

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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 (Stand-alone mode).

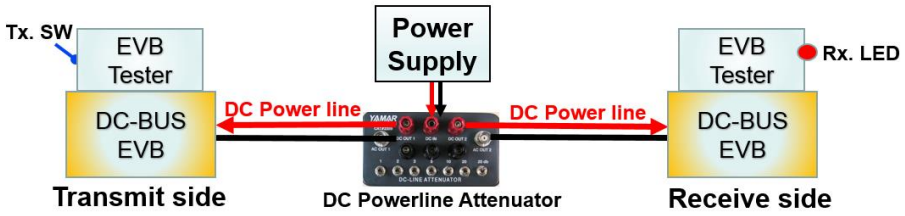

Figure 5 - EVB Tester to EVB Tester testing

User can select the following stand-alone (When not connected to the PC) modes of operations:

- **Auto Tx -** When the TX switch is ON, the tester generates continuous test messages to the connected EVB according to the switches' positions (i.e. bitrate selection, carrier frequency, protocol interface, TX signal level).
  During transmission, Comm. LED is ON. Other EVBs connected to the DC-BUS test software can detect the test messages over the powerline and perform BER analysis.
- **Auto Rx -** When the TX switch is OFF the EVB Tester board waits for valid test messages over the powerline from other TX EVB, analyzes it, and turns ON the Comm. LED if the Rx data is without errors, blinks when an error is detected, or turns LED OFF if no data detected.
- **TX-Sweep -** When the Tx switch is ON and the Frequency switch is **0xFF** (all switches are ON), test messages are transmitted for a period of ~250ms on each frequency starting from 5MHz up to 30MHz with 0.1MHz spacing (cyclic). During the frequency change period, the Comm. LED is OFF. This mode allows the user a quick assessment of its powerline channel frequency response (RX signal level-wise) within device carrier frequency selection full range (i.e. user can observe the powerline full range carrier frequency level using an oscilloscope or spectrum- analyzer in various optional nodes located along the powerline).
- **BER-Sweep –** This mode allows a full carrier frequency Sweep BER measurement over the powerline. This test is under the control of a TX EVB connected to a PC running the DC-BUS Test SW. Only the RX EVB is in Standalone mode. The RX EVB Tester responds to test messages from the TX EVB Tester with data errors information for each carrier frequency between 5MHz to 30MHz, 100kHz spacing.

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Notice that the transition from flawless communication performance to no communication is very sharp, at the communication edge, adding 2dB to 3dB of attenuation stops the communication.

4. PC Test Software

The DC-BUS Test software tests and configures Yamar's new generation of devices. The program tests the communication performance of SIG102, SIG100, DCB1M, DCAN500, and DMX250 devices over the powerline. The PC operates as a host through the EVB Tester's USB port. The Program exclusively operates with Yamar's EVB Tester board. Otherwise, the Test Program is in Demo mode.

4.1. Test Program Main features

- ✓ Automatic EVB type detection.
- ✓ BER Mode - Transmit and receive test pattern and perform BER measurements over a fixed carrier frequency.
- ✓ BER Sweep Mode – Auto transmit and receive test pattern and perform BER measurements over a total of 251 carrier frequencies selection.
- ✓ DATA Mode - Transmit and receive data in HEX or ASCII formats.
- ✓ File Mode - Transmit and receive a File.
- ✓ Logging of BER statistics and data.
- ✓ Internal register configurations (read and write operations).

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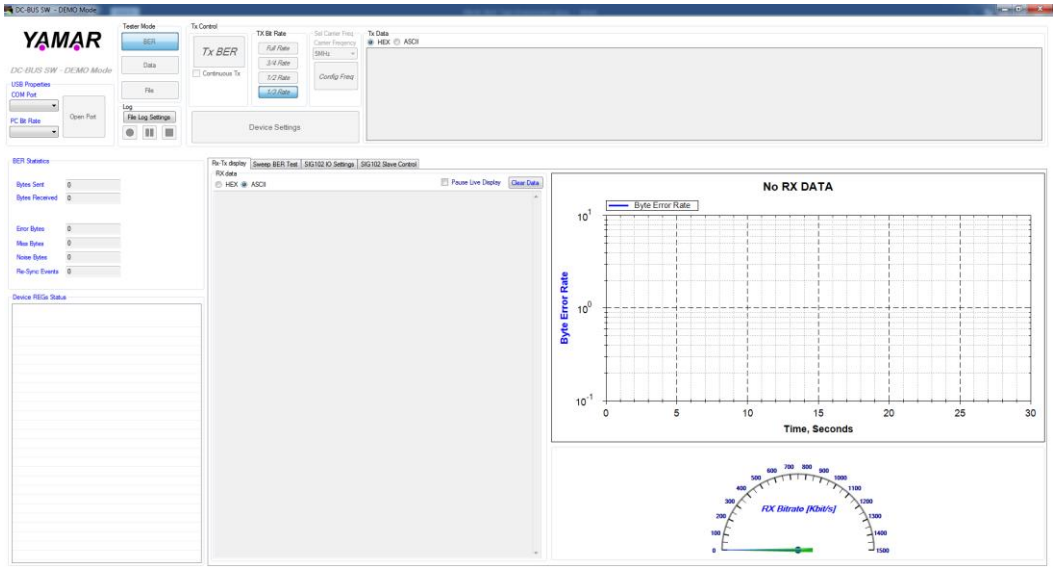

Figure 6 – PC Test Software Main Display

5. DC Powerline Attenuator

The DC-powerline Attenuator is used for testing communication performance over the powerline in a lab environment, enabling emulation of a real powerline channel environment. The attenuator allows adding attenuation (0 to 71dB) to the TX AC modulated signal over the battery powerlines (DC-Lines) while keeping the DC voltage level unchanged.

Figure 7 - DC Powerline attenuator

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For more details please see Yamar's Products and Test Tools

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