**Kocaeli University, Electronics and Telecommunications Engineering Department**

**Digital Communications Laboratory**

**Experiment 3: Line Coding - Lab Report** **(11.03.2024)**

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**SIMULINK PART - The table below is for verification only and filled by the lab instructor.**

|  |  |
| --- | --- |
| Understanding bit time and data rate (5 pts) |  |
| Understanding the difference between polar and unipolar (10 pts) |  |
| Understanding the difference between RZ and NRZ (10 pts) |  |
| Understanding the effect of Line Coding on bandwidth and power consumption (15 pts) |  |

**STM32 PART - Section 1: Transmitting a Data Byte Using Unipolar NRZ Line Coding**

**Step 1:** Choose the proper symbol construction lines in the C code and comment the unnecessary ones. Set the txData values as **it is given on the whiteboard**. Build STM32 code and flash the MCU then reset it, you don’t need to run MCU in debug mode.

**Step 2:** Connect NI Elvis II Scope CH0 to **Frame Sync Signal (D8 on Nucleo-64 or PA9 on Discovery)**.

**Step 3:** Connect NI Elvis II Scope CH1 to **Clock Signal** **(D13 on Nucleo-64 or PA5 on Discovery)**.

**Step 4:** Adjust the Scope divisions (1V/Div, 500µS/Div). Set Scope CH0 vertical position at -3V. Set your Scope “Trigger Type” to “Edge”, “Level” to “1V” and Trigger “Source” to “Scope CH0”.

**Step 5:** How many Clock Signal Cycles (periods) between two Frame Sync Signal Pulses? Fill the Table below. (5 pts)

|  |  |
| --- | --- |
| **Clock Cycle Counts** |  |

**Step 6:** Disconnect Scope CH1 from Clock Signal and connect it to **Line Coding output** **(A2 on Nucleo-64 or PA4 on Discovery).**

**Step 7:** Plot your Scope screen on the graph. (10 pts)

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**Section 2: Transmitting a Data Byte Using Unipolar RZ Line Coding**

**Step 8:** Choose the proper symbol construction lines in the C code and comment the unnecessary ones. Set the duty cycle values as **it is given on the whiteboard**. Build STM32 code and flash the MCU then reset it, you don’t need to run MCU in debug mode.

**Step 9:** Connect NI Elvis II Scope CH0 to **Frame Sync Signal (D8 on Nucleo-64 or PA9 on Discovery)**.

**Step 10:** Adjust the Scope divisions (1V/Div, 500µS/Div). Set Scope CH0 vertical position at -3V. Set your Scope “Trigger Type” to “Edge”, “Level” to “1V” and Trigger “Source” to “Scope CH0”.

**Step 11:** Connect Scope CH1 to **Line Coding output** **(A2 on Nucleo-64 or PA4 on Discovery).**

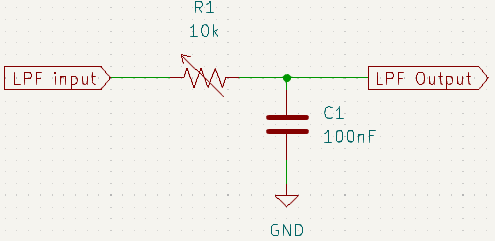
**Step 12:** Plot your Scope screen on the graph. (10 pts)

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**Section 3: Transmitting Unipolar RZ Line Coding over a Bandlimited Channel**

**Step 13:** A Low Pass Filter (LPF) is a suitable circuit which we can use it to resemble a bandlimited transmission channel. Construct the LPF circuit below (R1 is a 10kΩ potentiometer). (5 pts)



**Step 14:** Disconnect Scope CH1 from Line coding output. Connect Line coding output to LPF input and Scope CH1 to LPF output.

**Step 15:** Set R1 value to 0 Ω. Plot your Scope screen on the left graph. (10 pts)

**Step 16:** Set R1 value to 5 kΩ. Plot your Scope screen on the right graph. (10 pts)

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**Section 4: Comments on Bandlimited Channel**

**Step 17:** Answer the question written on the whiteboard. (10 pts)