

RAK13005 Quick Start Guide

Prerequisite

What Do You Need?

Before going through each and every step on using the RAK13005 WisBlock module, make sure to prepare the necessary items listed below:

Hardware

- [RAK13005 WisBlock LIN Module - Controller/Master Mode](#) 
- [RAK13005 WisBlock LIN Module - Peripheral/Slave Mode](#) 
- Your choice of [WisBlock Base](#) 
- Your choice of [WisBlock Core](#) 
- USB Cable
- [Li-Ion/LiPo battery \(optional\)](#) 
- [Solar charger \(optional\)](#) 
- External power source (5.5 V to 27 V)

Software

Arduino

- Download and install [Arduino IDE](#)  .
- To add the RAKwireless Core boards on your Arduino Boards Manager, install the [RAKwireless Arduino BSP](#) 

Product Configuration

Block Diagram

Hardware Setup

RAK13005 is a WisBlock LIN Module that extends the WisBlock system to be used on communication protocol called Local Interconnect Network (LIN). This communication is initiated by the automotive industry for the communication of in-vehicle devices on cars. Today, LIN is also used in other applications that require a robust communication line. For more information about the RAK13005, refer to the [Datasheet](#).

Pin Definition



Figure 1: RAK13005 Pin Definition

LIN Peripheral and Controller Mode Hardware Configuration

RAK13005 supports both **Controller(master)** and **Peripheral(slave)** modes. The two modes uses the same RAK13005 circuit design and configuration is simply determined by an SMD resistor. The resistor location is shown in **Figure 2**.

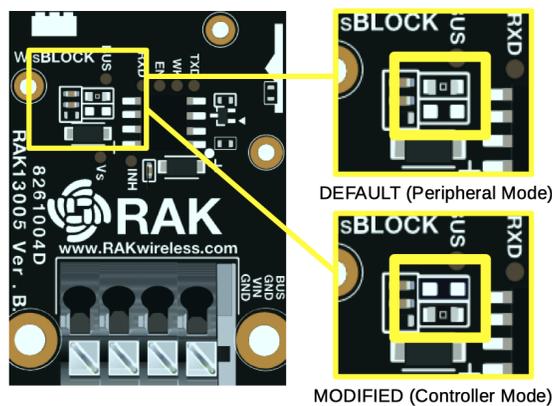


Figure 2: RAK13005 LIN Mode Configuration

Assembling and Disassembling of WisBlock Modules

Assembling

The RAK13005 module can be mounted on the IO slot of the WisBlock Base board, as shown in **Figure 3**. Also, always secure the connection of the WisBlock module by using the compatible screws.

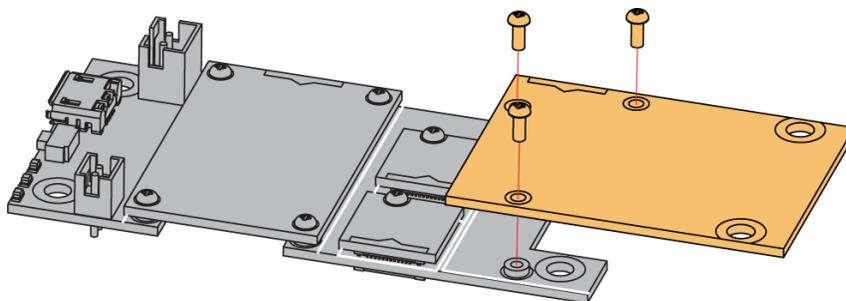


Figure 3: RAK13005 mounting connection to WisBlock Base module

RAK13005 Connector Crimping Mechanism

The RAK13005 features a fast-crimping terminal connector to simplify and ensure the wiring process on the fields. The fast-crimping terminal can support cable with a width between 20 AWG to 24 AWG. The usual stripping length is around 6 to 7 mm.

As shown in **Figure 4**, during the crimping process, you should first press down and maintain the spring head of the crimping terminal firmly, then insert the stripped cable head into the corresponding connector's hole. Once inserted correctly, release the spring head, and the crimping process is completed.

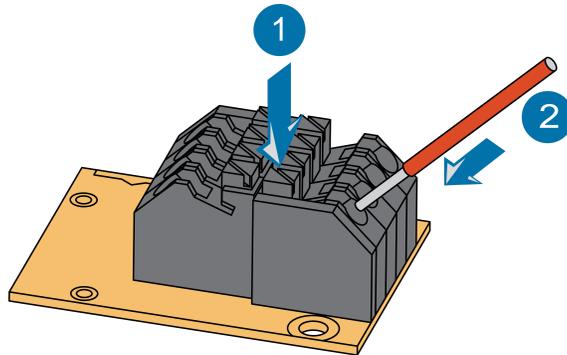


Figure 4: RAK13005 Module Connector

Disassembling

The procedure in disassembling any type of WisBlock modules is the same.

1. First, remove the screws.

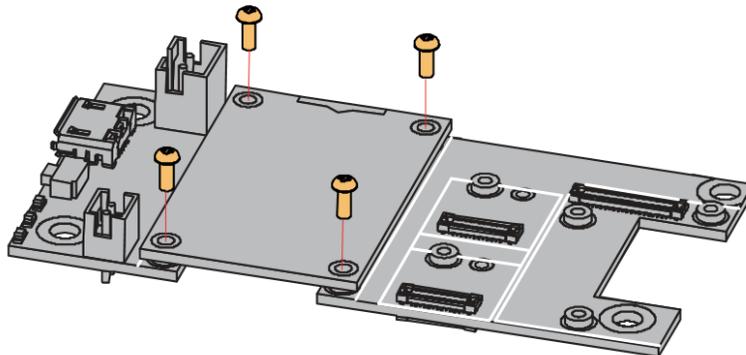


Figure 5: Removing screws from the WisBlock module

2. Once the screws are removed, check the silkscreen of the module to find the correct location where force can be applied.

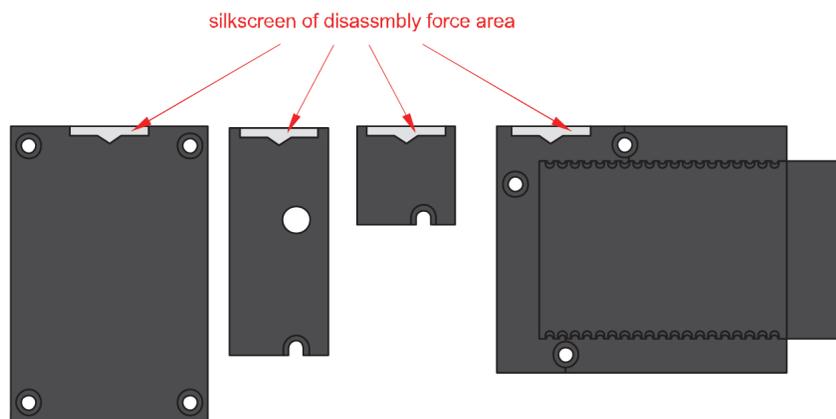


Figure 6: Detaching silkscreen on the WisBlock module

3. Apply force to the module at the position of the connector, as shown in **Figure 7**, to detach the module from the baseboard.

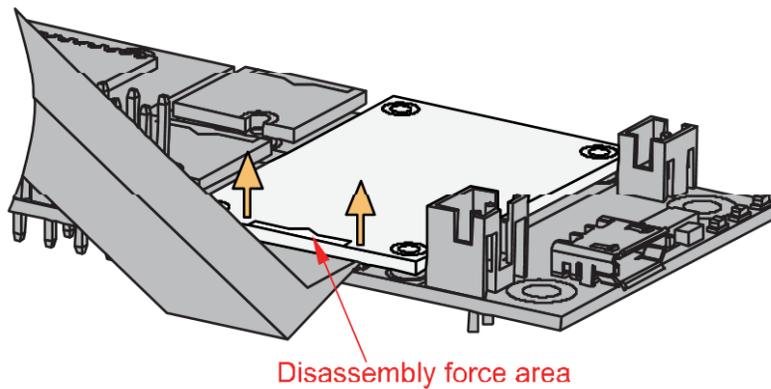


Figure 7: Applying even forces on the proper location of a WisBlock module

 **NOTE**

If you will connect other modules to the remaining WisBlock Base slots, check on the [WisBlock Pin Mapper](#) tool for possible conflicts.

Now, you can connect the battery (optional) and USB cable to start programming your WisBlock Core.

 **WARNING**

- Battery can cause harm if not handled properly.
- Only 3.7-4.2 V Rechargeable LiPo batteries are supported. It is highly recommended not to use other types of batteries with the system unless you know what you are doing.
- If a non-rechargeable battery is used, it has to be unplugged first before connecting the USB cable to the USB port of the board to configure the device. Not doing so might damage the battery or cause a fire.
- Make sure the battery wires match the polarity on the RAK WisBlock Base Board. Not all batteries have the same wiring.
- Only 5 V solar panels are supported. Do not use 12 V solar panels. It will destroy the charging unit and eventually other electronic parts.

Software Configuration and Example

In this example, you will be using two RAK13005 Modules to demonstrate LIN functionality.

These are the quick links that go directly to the software guide for the specific WisBlock Core module you use:

- [RAK13005 in RAK4631 WisBlock Core Guide](#)
- [RAK13005 in RAK11200 WisBlock Core Guide](#)
- [RAK13005 in RAK11310 WisBlock Core Guide](#)

RAK13005 in RAK4631 WisBlock Core Guide

Arduino Setup

Figure 8 is an illustration on how to use two RAK13005 LIN modules for communication applications. One RAK13005 is configured as **Controller** and the other RAK13005 is configured as **Peripheral**. The SMD resistors that set the mode are highlighted in a yellow box.

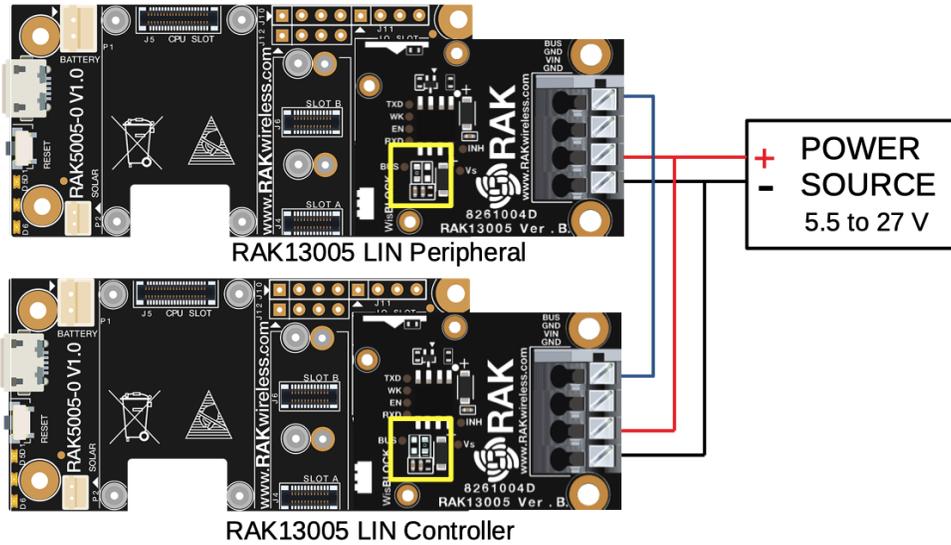


Figure 8: Two RAK13005 Interconnection for Controller and Peripheral mode

1. Select the RAK4631 WisBlock Core.

- Install the [RAKwireless Arduino BSP](#) to find the RAK4631 in the Arduino Boards Manager.

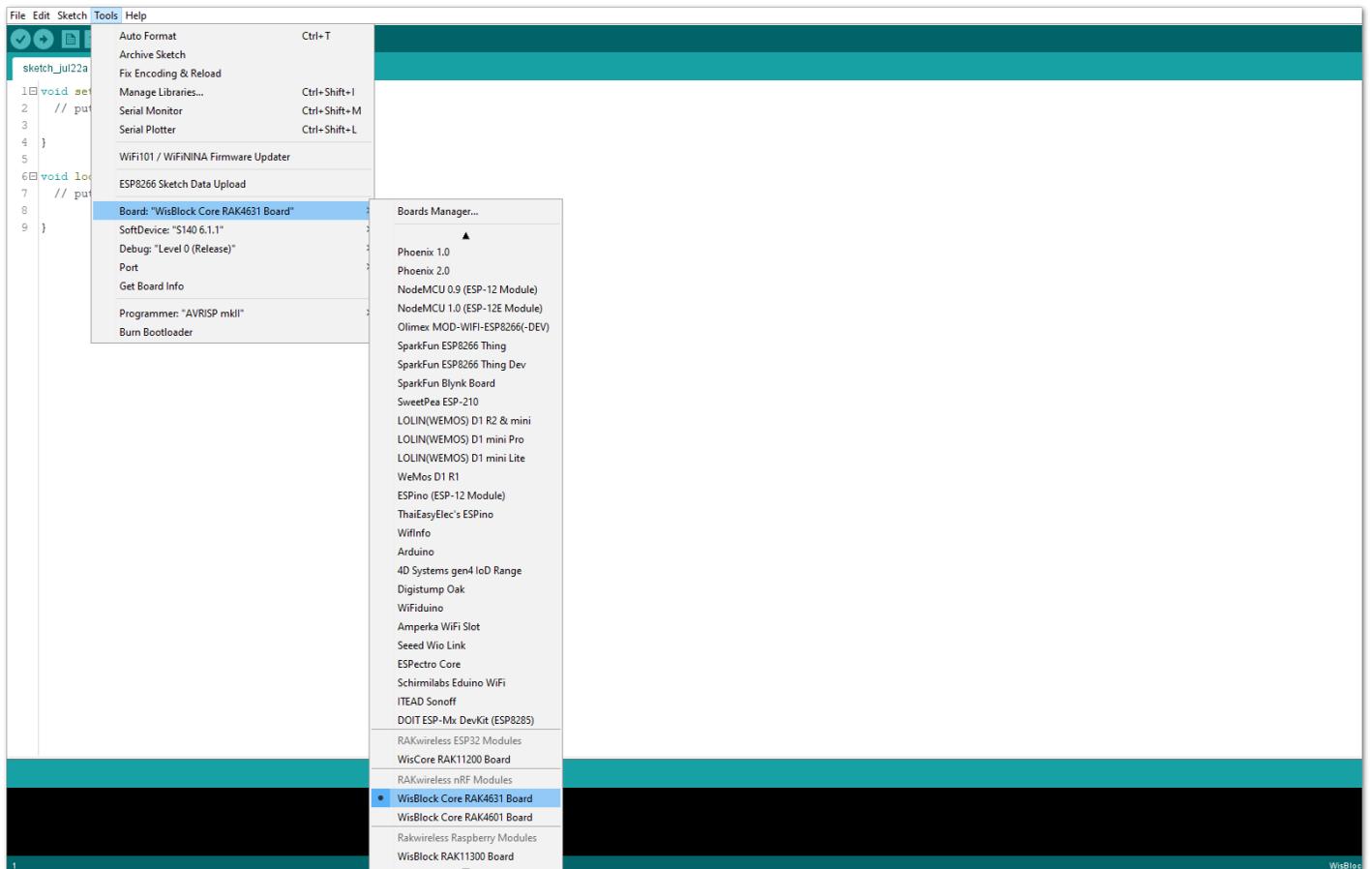


Figure 9: Selecting RAK4631 as WisBlock Core

2. Next, install the **RAKwireless TLE7259** library using the Arduino Library manager.

- Select `Sketch` followed by `Include Library` then `Manage Libraries`.

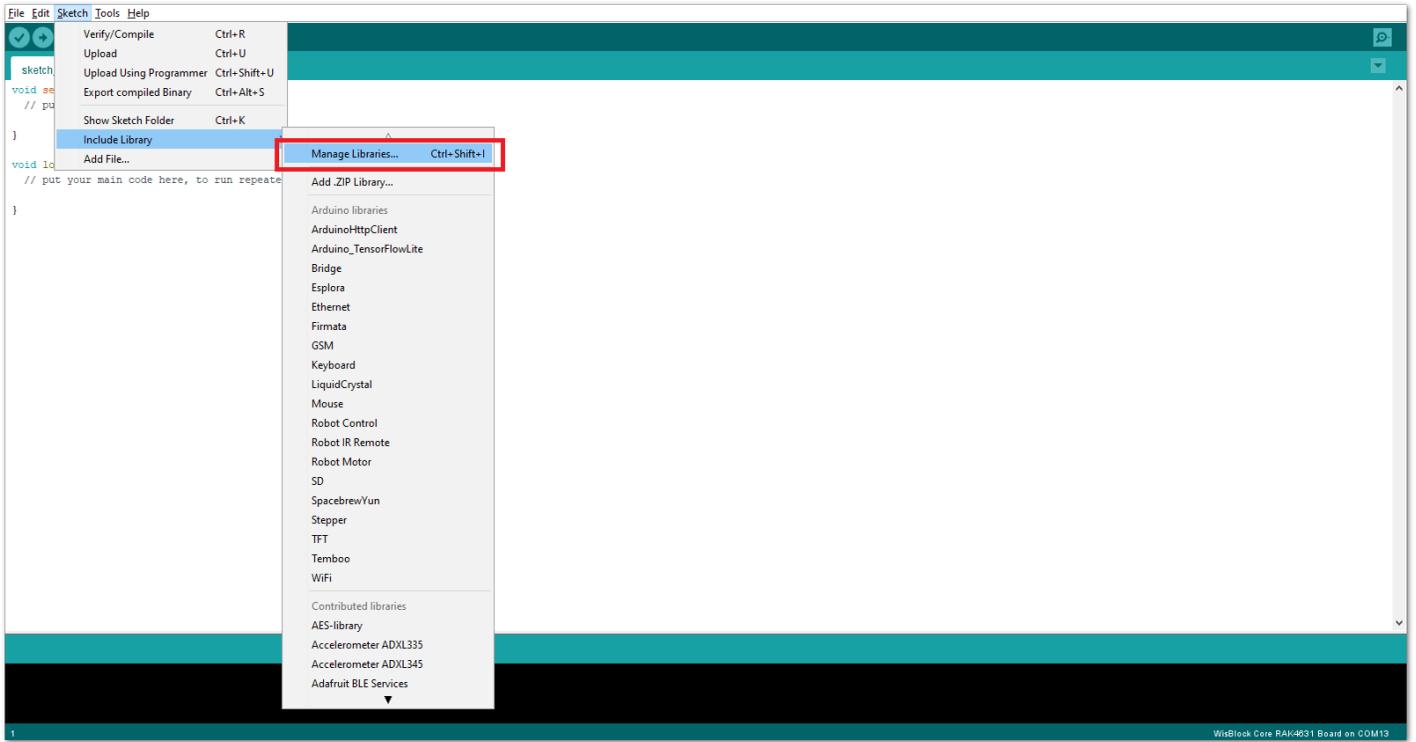


Figure 10: Open Arduino Library Manager

- Search for **RAKwireless TLE7259** on the Library Manager text box.
- Select the latest version of the library then click **Install** button.

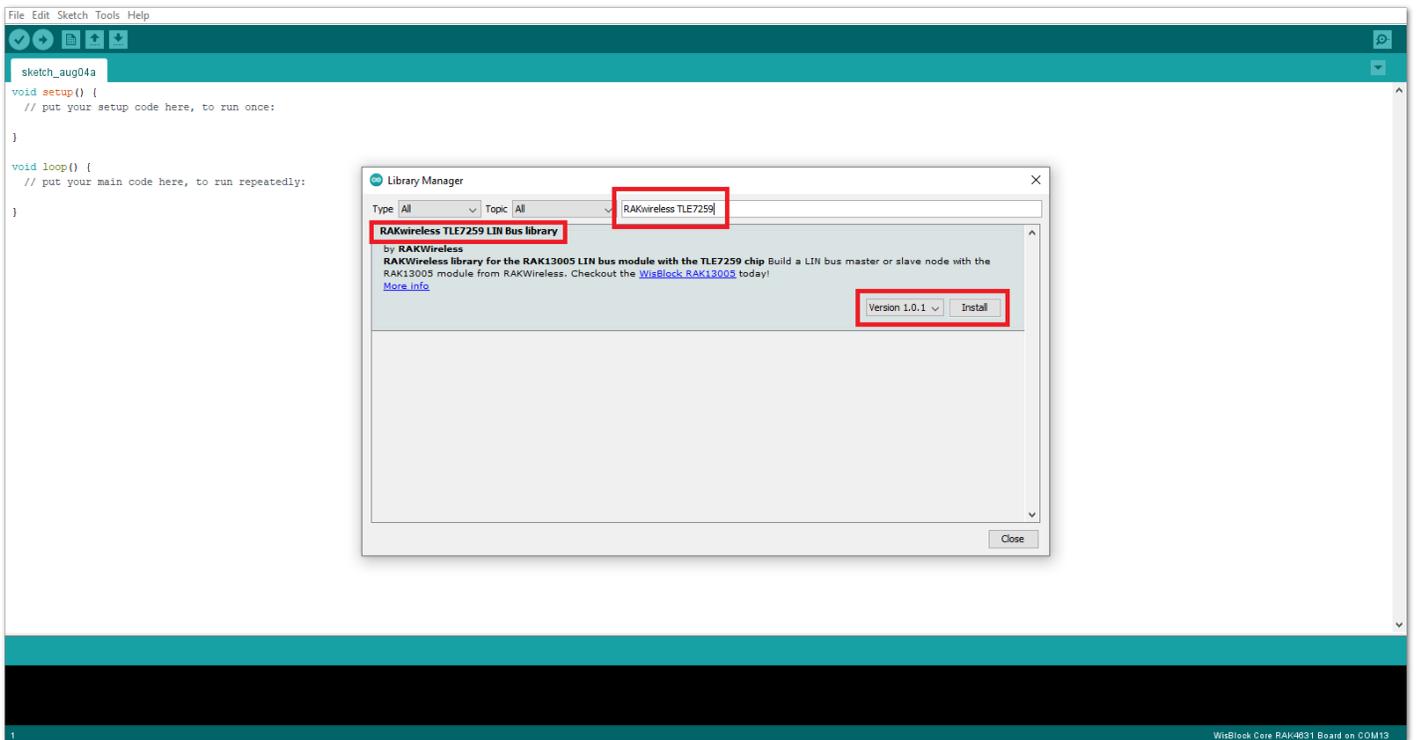


Figure 11: Look for RAKwireless TLE7259 LIN Bus Library

- After successful installation, close the Arduino Library window.

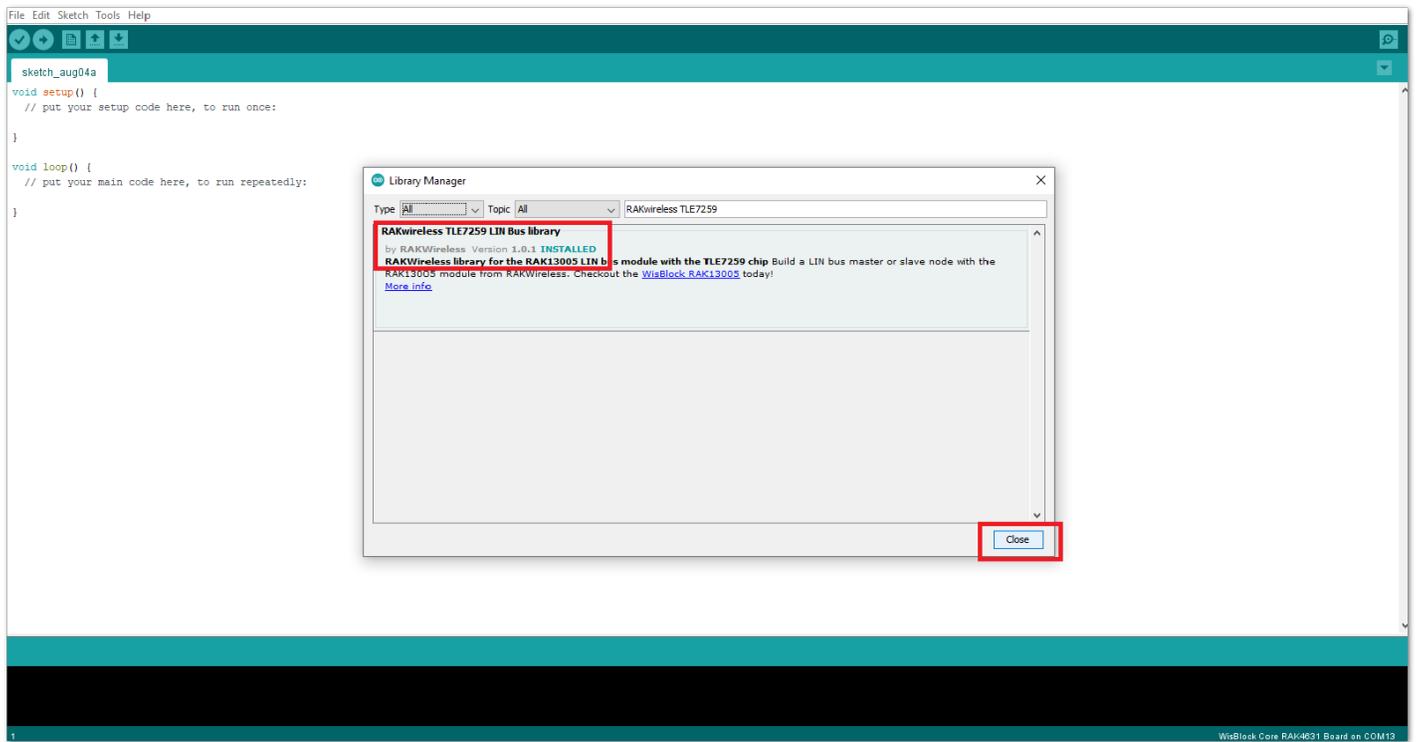


Figure 12: RAKwireless TLE7259 LIN Bus Library Successfully Installed

3. Upload the `RAK13005_linbus_master` **Controller** sketch.

- Connect the first WisBlock with the RAK13005 module in **Controller** mode and select the `RAK13005_linbus_master`.

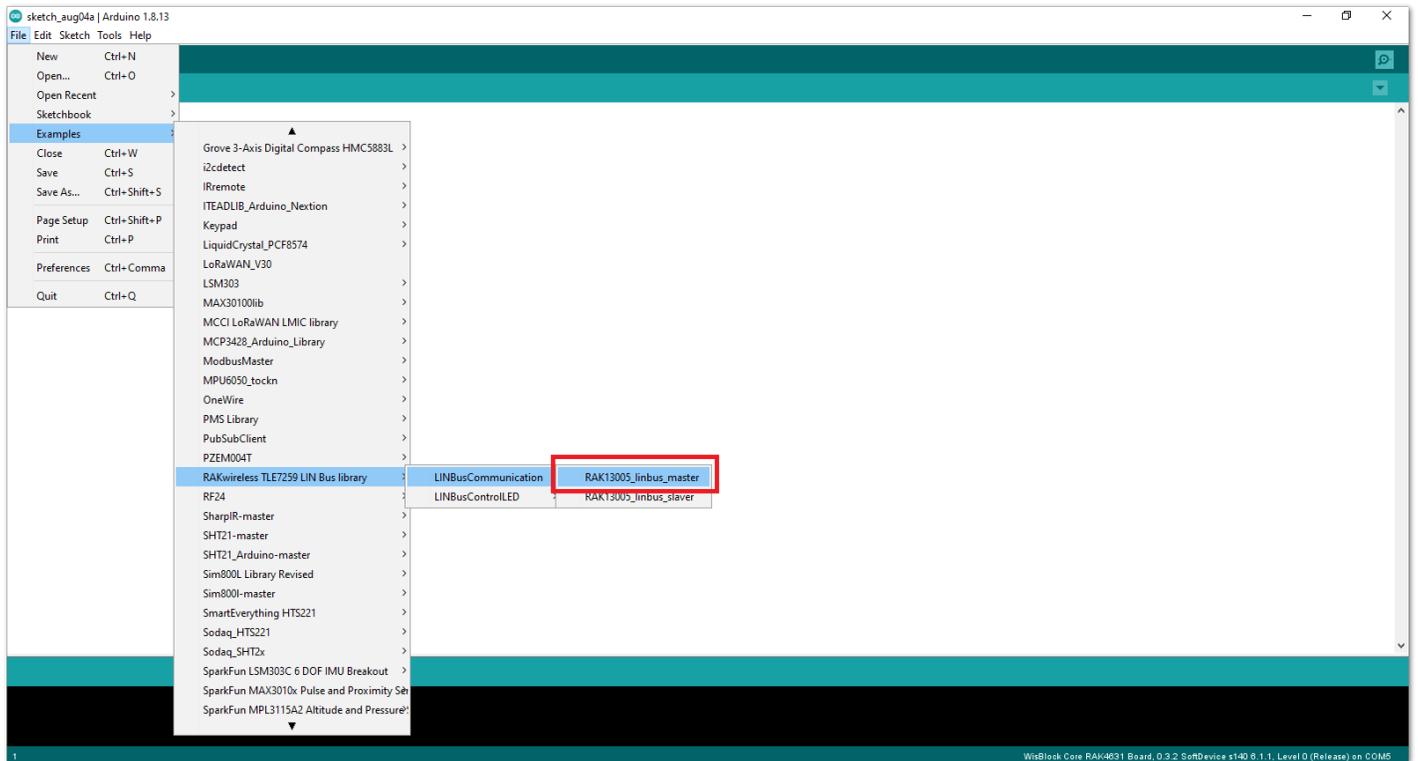


Figure 13: Open the code for the RAK13005 Controller

- Select the port where RAK4631 WisBlock Core is connected.

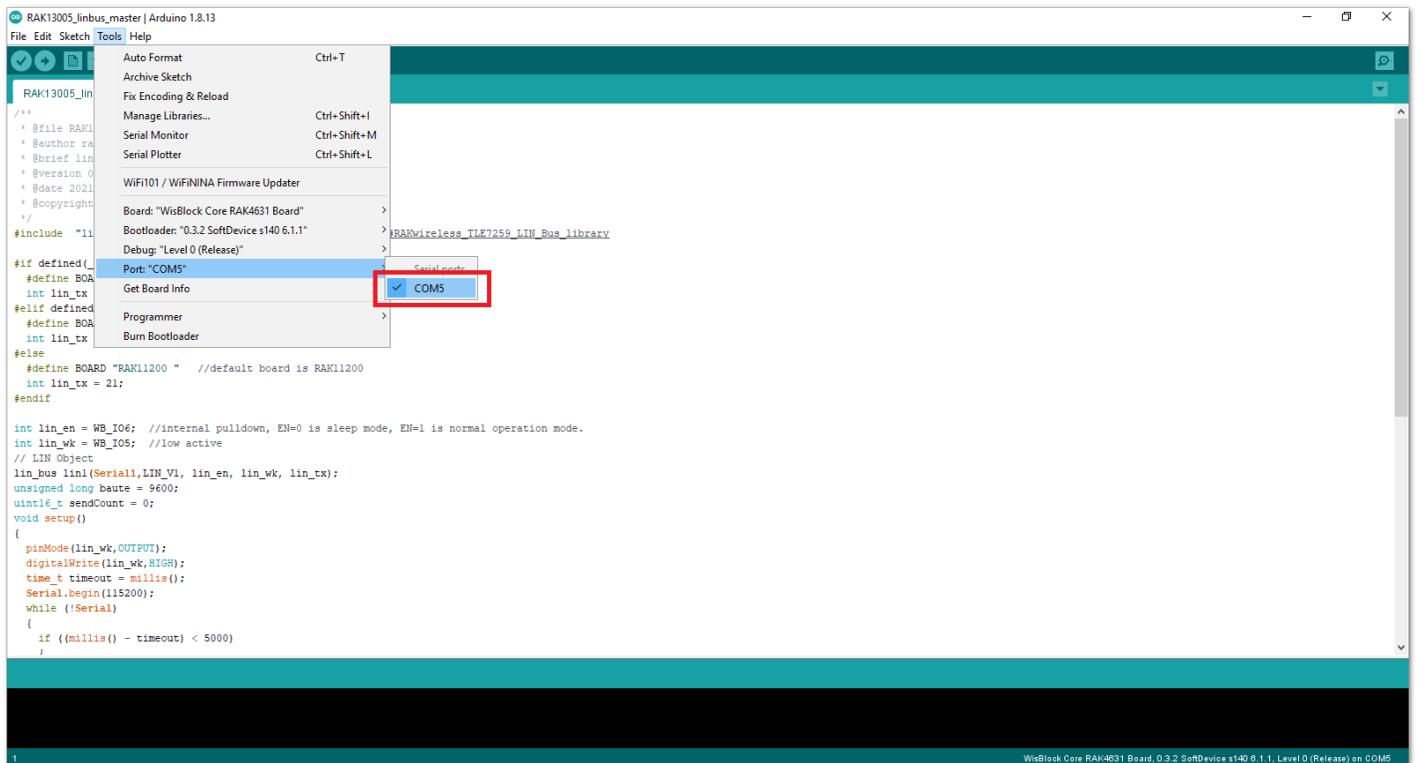


Figure 14: Select the Serial Port of RAK4631 for the RAK13005 LIN module in controller mode.

- Now, upload the `RAK13005_linbus_master` code to the WisBlock Core.

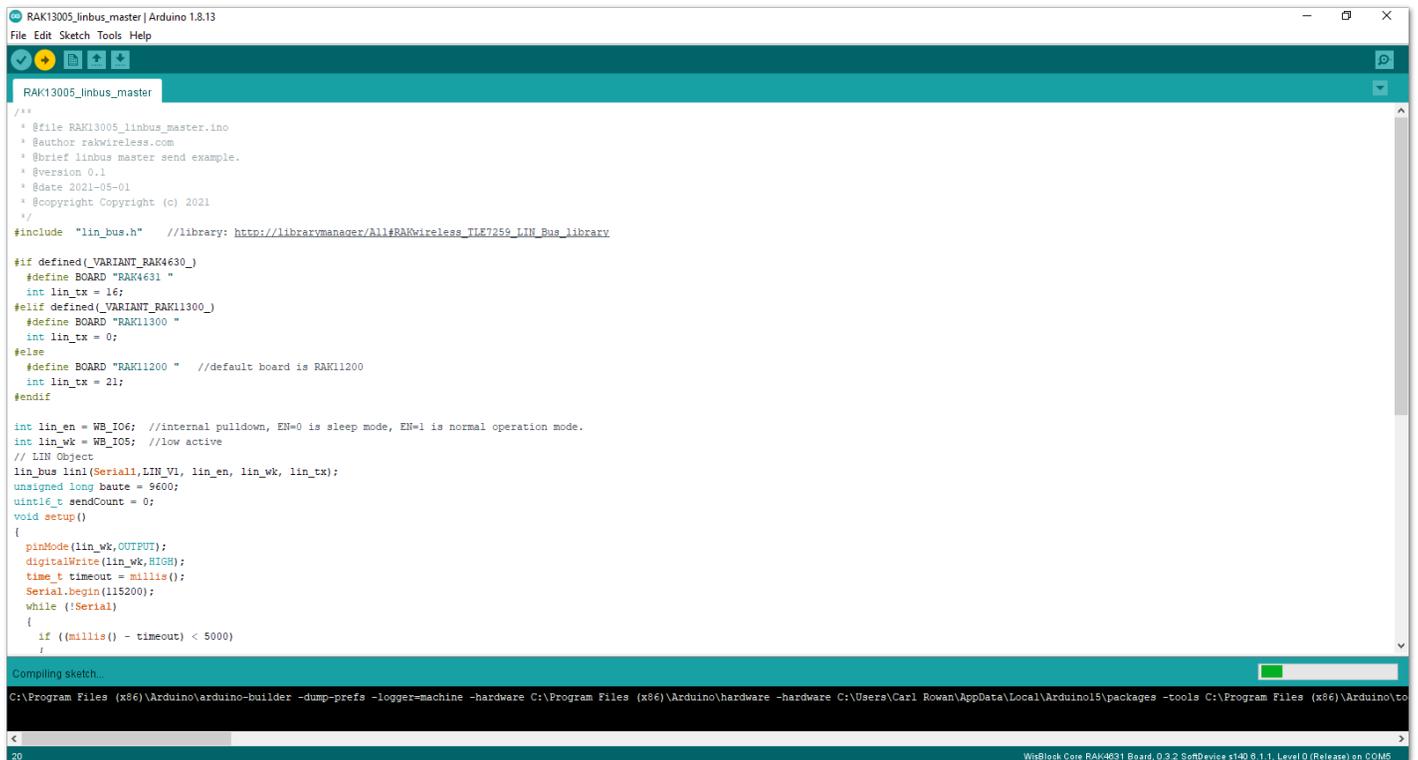


Figure 15: Uploading RAK13005_linbus_master code

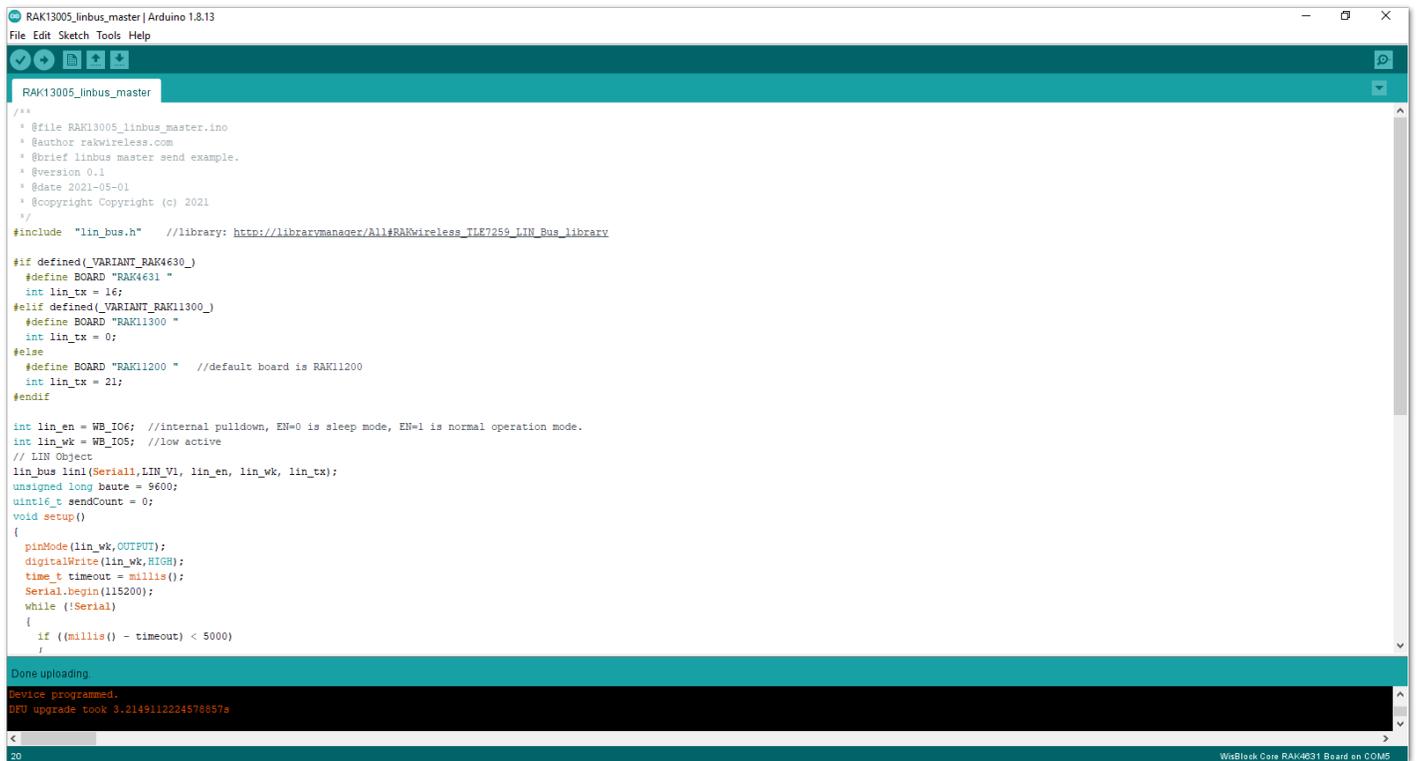


Figure 16: Successful code Upload

- After the successful code upload, you can now open the Serial Monitor and see the Serial output.

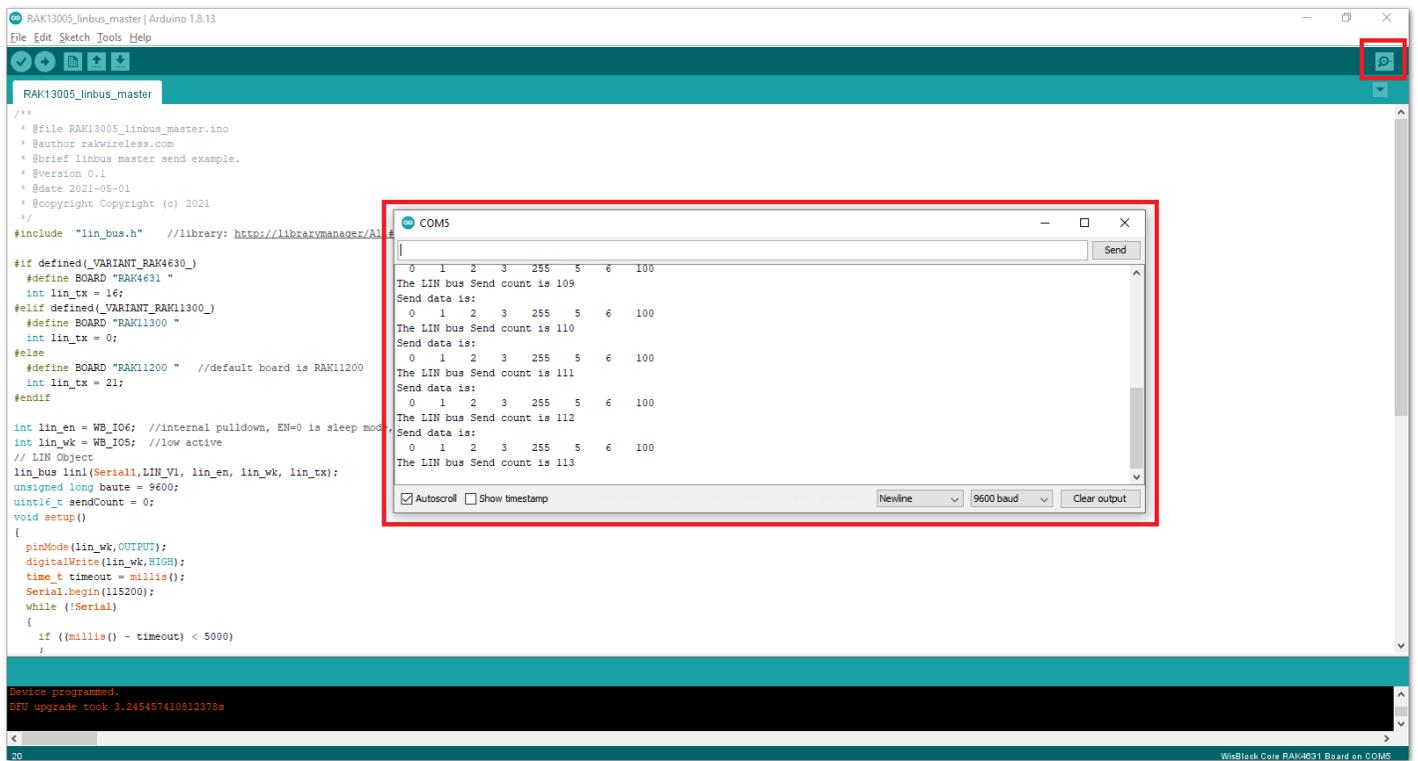


Figure 17: Serial Output of the RAK13005 Controller Mode

4. Upload the `RAK13005_linbus_slaver` Peripheral sketch.

- Connect the second WisBlock with the RAK13005 in Peripheral mode, then select `RAK13005_linbus_slaver`.

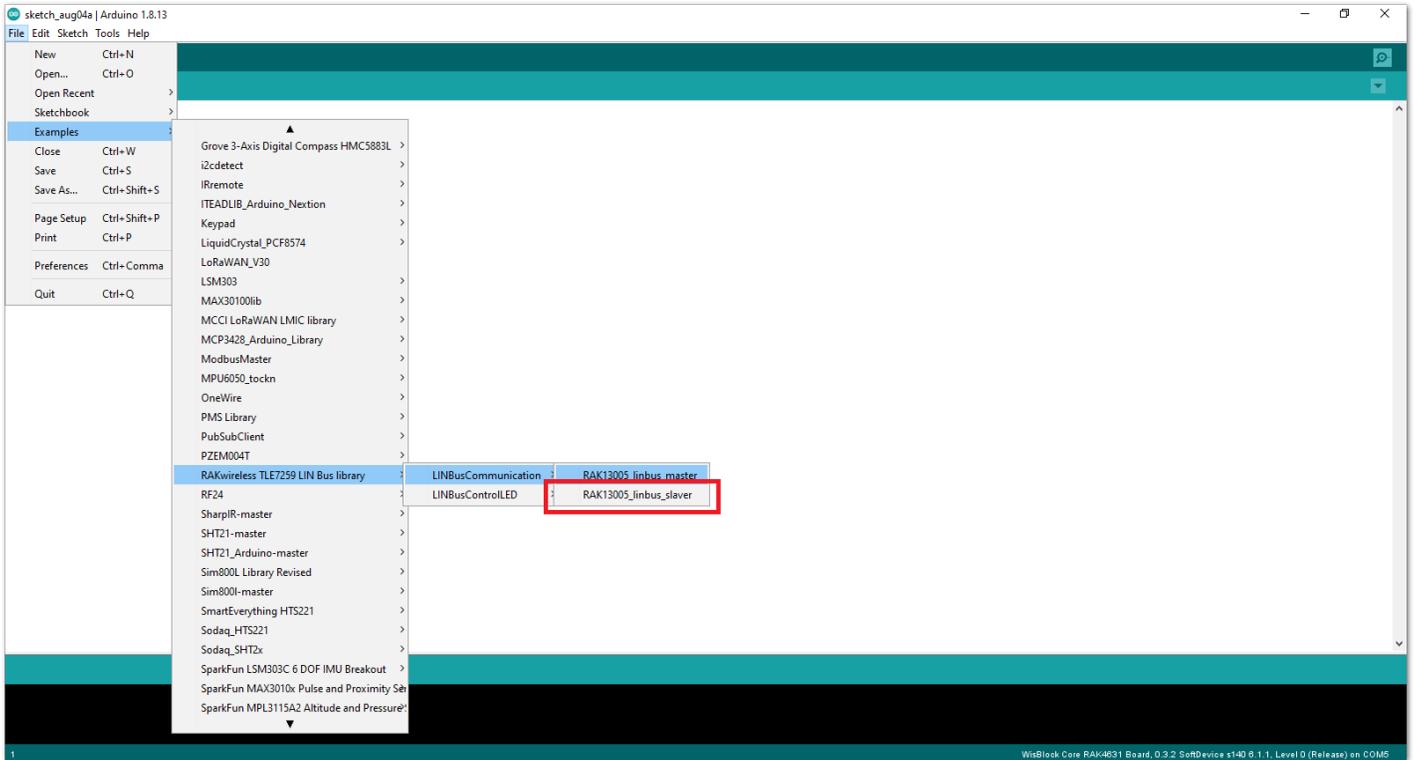


Figure 18: Open the code for the RAK13005 Peripheral

- Select the port, which is the additional port from the previous port for the controller. You should see two ports in your Arduino IDE.

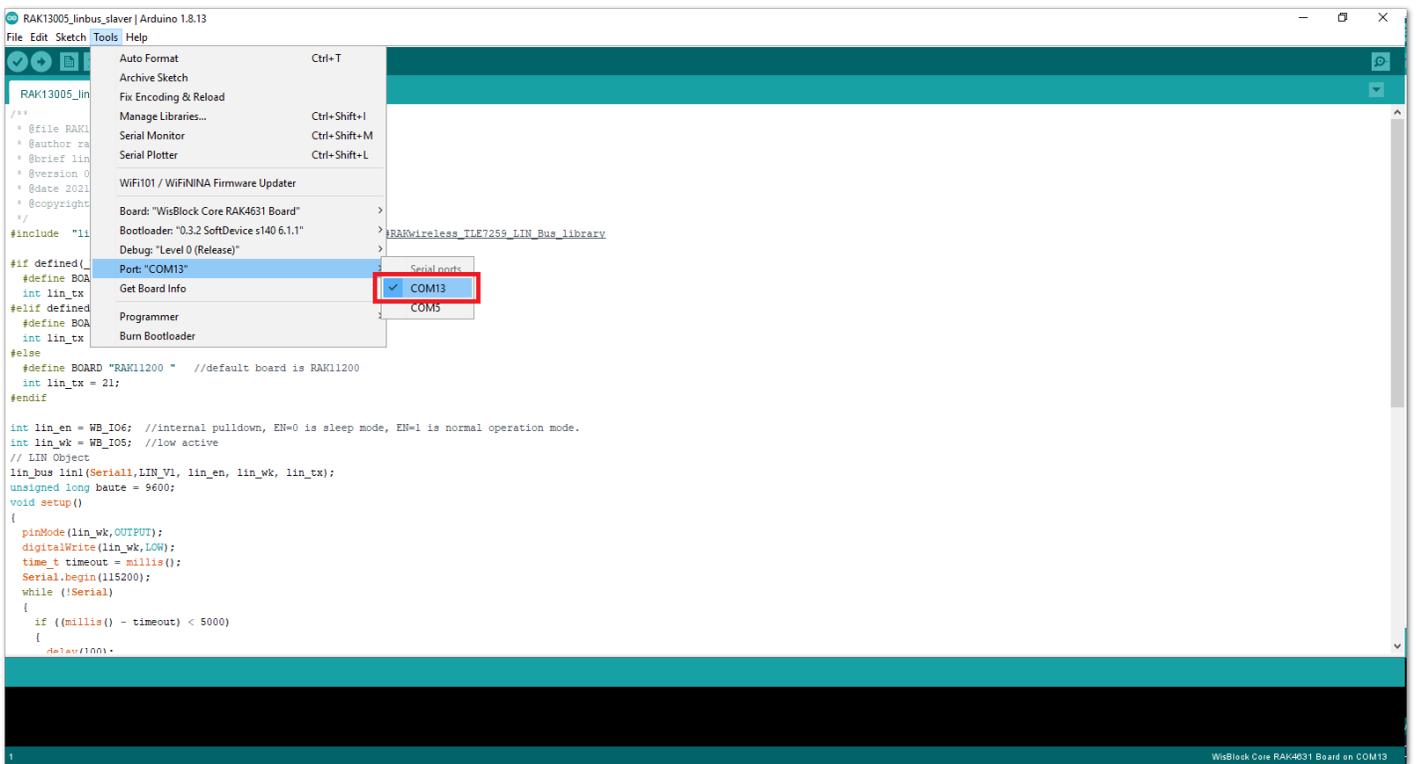


Figure 19: Select the Serial Port of RAK4631 for the RAK13005 LIN module in peripheral mode.

- After ensuring the port matching the RAK13005 LIN Peripheral, you can now upload the `RAK13005_linbus_slaver` code.

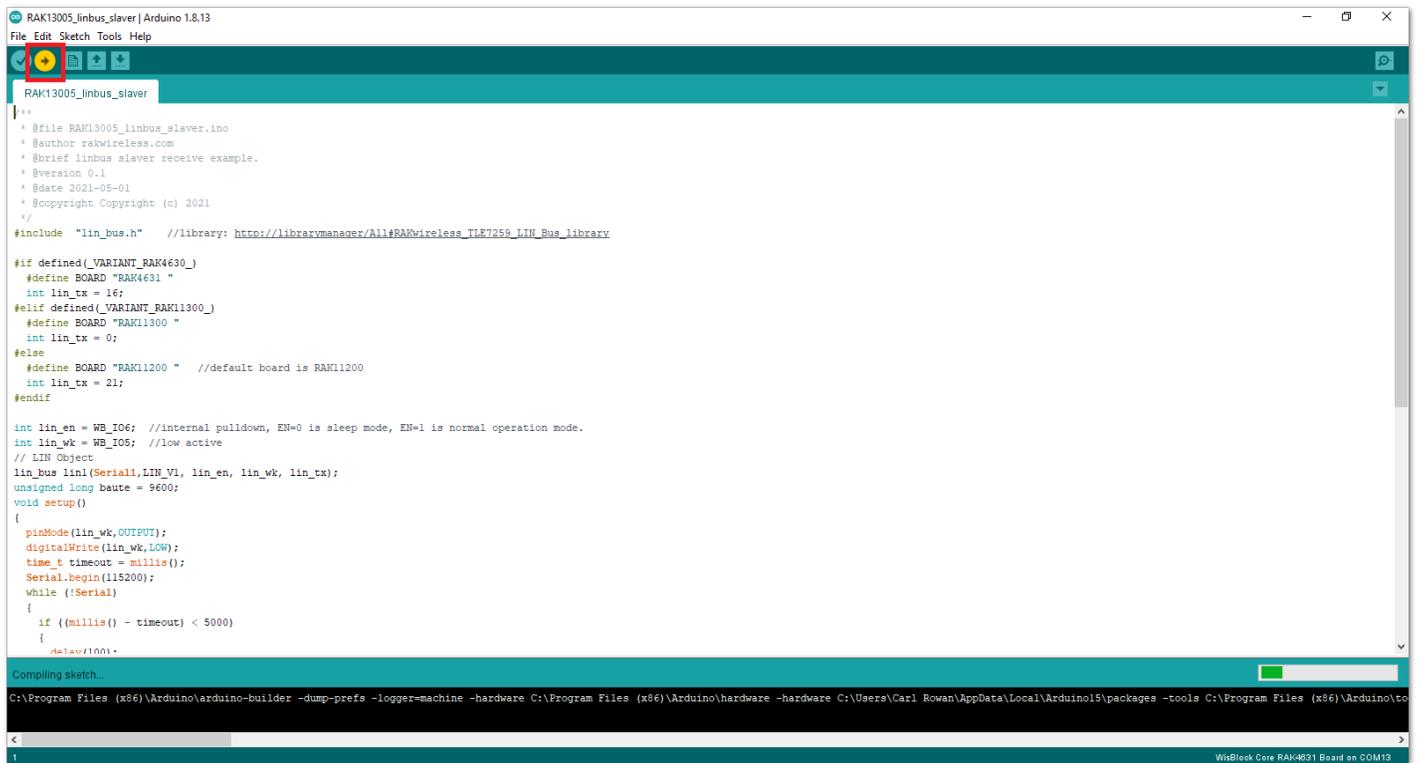


Figure 20: Uploading the RAK13005_linbus_slaver code

NOTE

If you experience any error in compiling an example sketch, check the updated code for the RAK13005 WisBlock Core Module that can be found on the [RAK13005 WisBlock Example Code Repository](#) .

5. Check Serial Monitor output.

- Check the Serial Monitor on the RAK13005 Peripheral device receiving the data coming from the RAK13005 **Controller** device. You must have the external power supply connected to have successful transmissions.

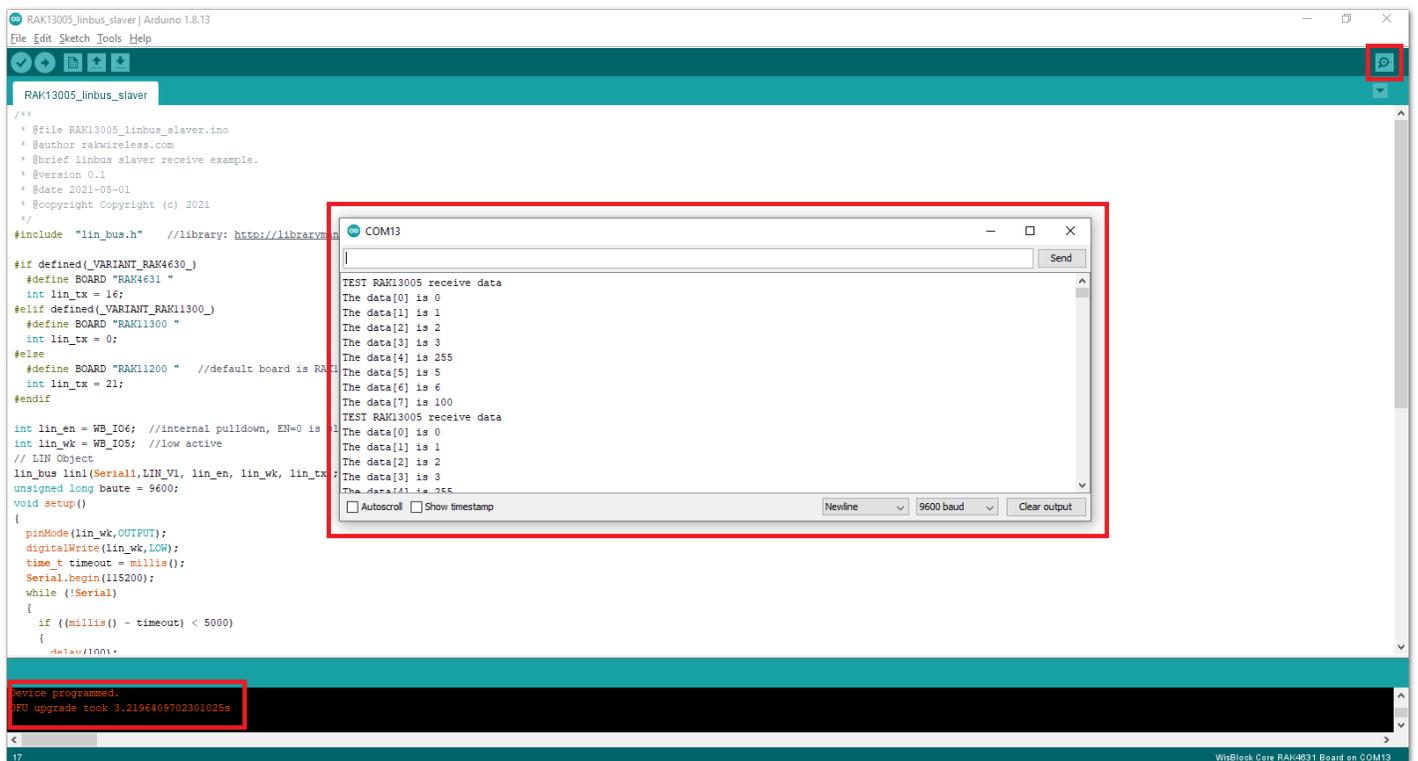


Figure 21: Serial Output of the RAK13005 Peripheral Mode

RAK13005 in RAK11200 WisBlock Core Guide

Arduino Setup

Figure 22 is an illustration on how to use two RAK13005 LIN modules for communication application. One RAK13005 is configured as **Controller** and the other RAK13005 is configured as **Peripheral**. The SMD resistors that set the mode are highlighted in a yellow box.

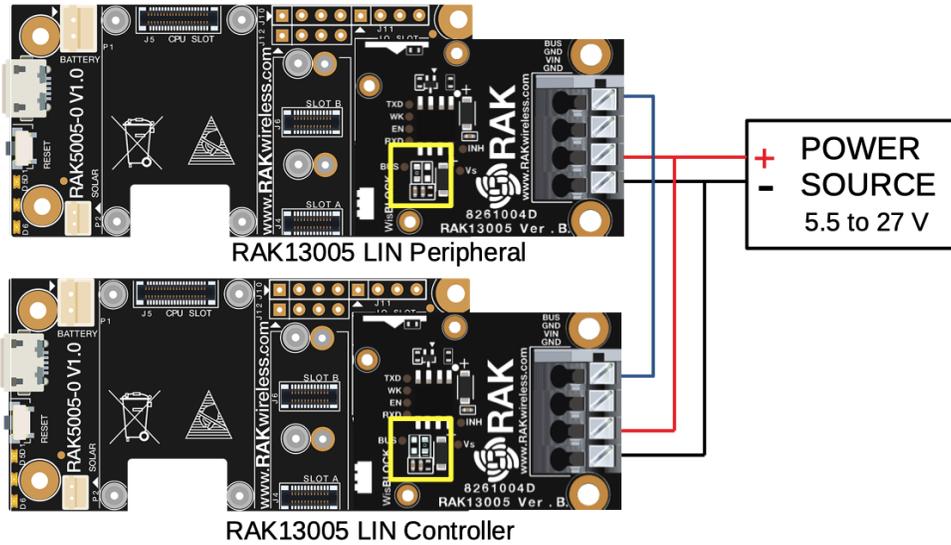


Figure 22: Two RAK13005 Interconnection for Controller and Peripheral mode

1. Select the RAK11200 WisBlock Core.

- Install [RAKwireless Arduino BSP](#) to find the RAK11300 in the Arduino Boards Manager.

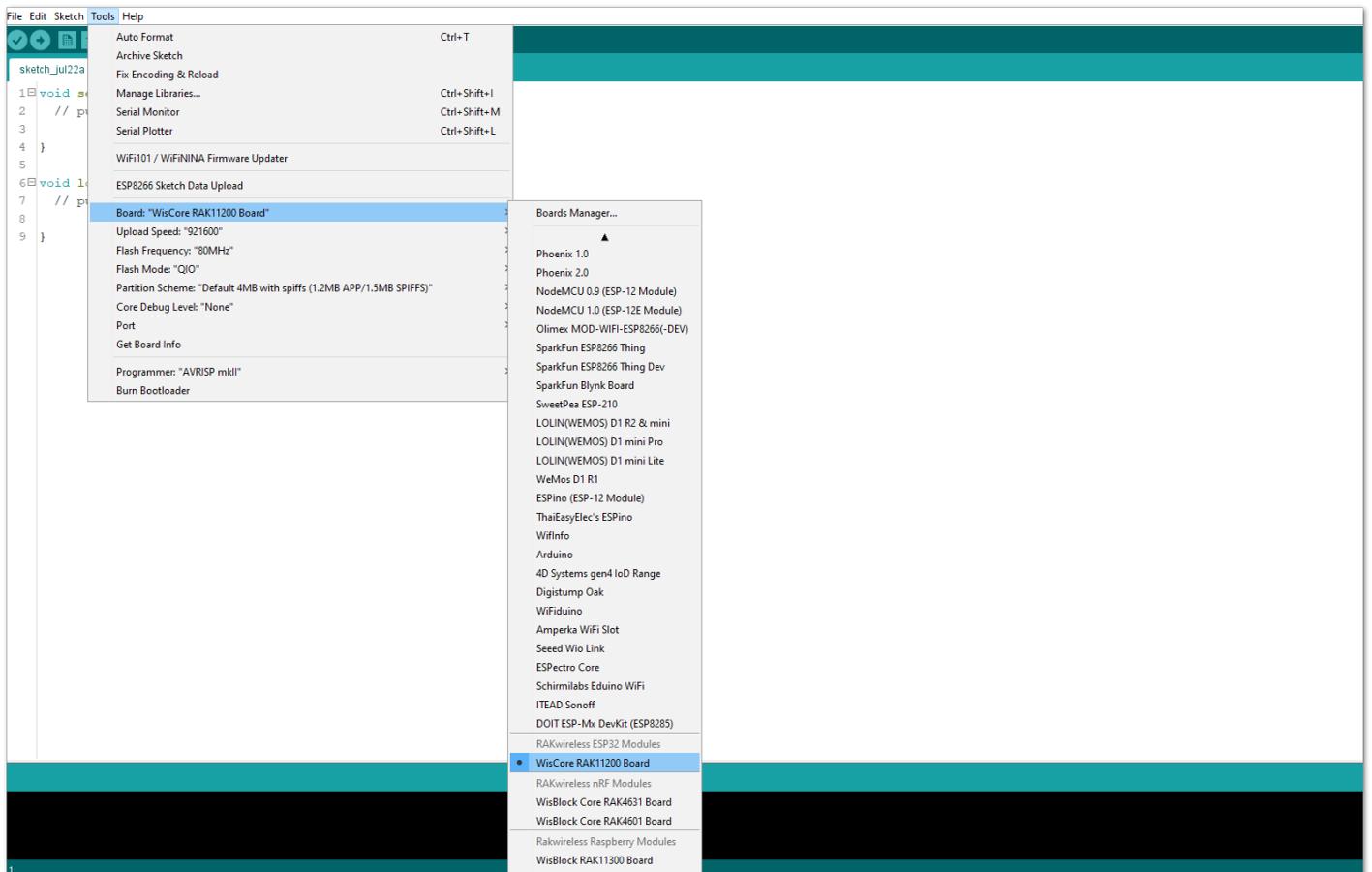


Figure 23: Selecting RAK11200 as WisBlock Core

2. Next, install the **RAKwireless TLE7259** library using the Arduino Library manager.

- Select `Sketch` followed by `Include Library` then `Manage Libraries`.

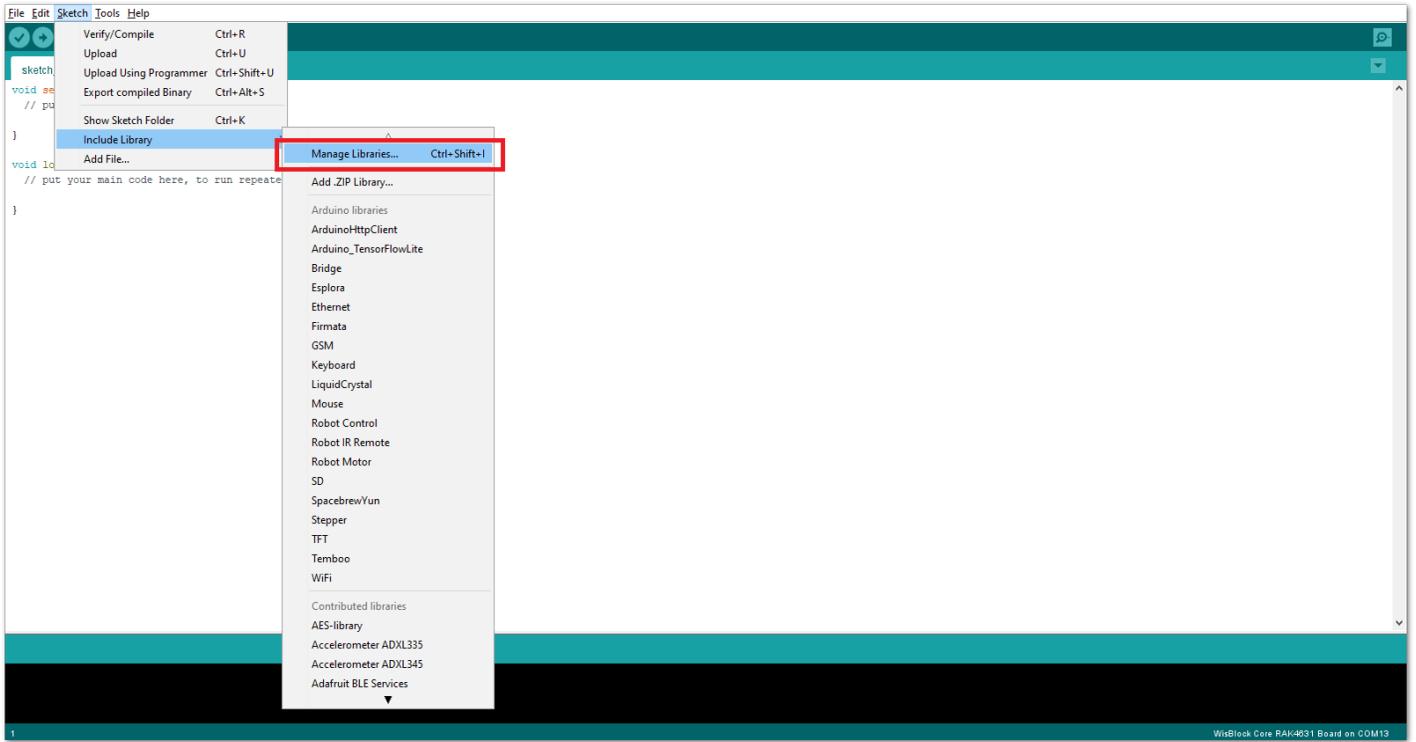


Figure 24: Open Arduino Library Manager

- Search for RAKwireless TLE7259 on Library Manager text box.
- Select the latest version then click **Install** button.

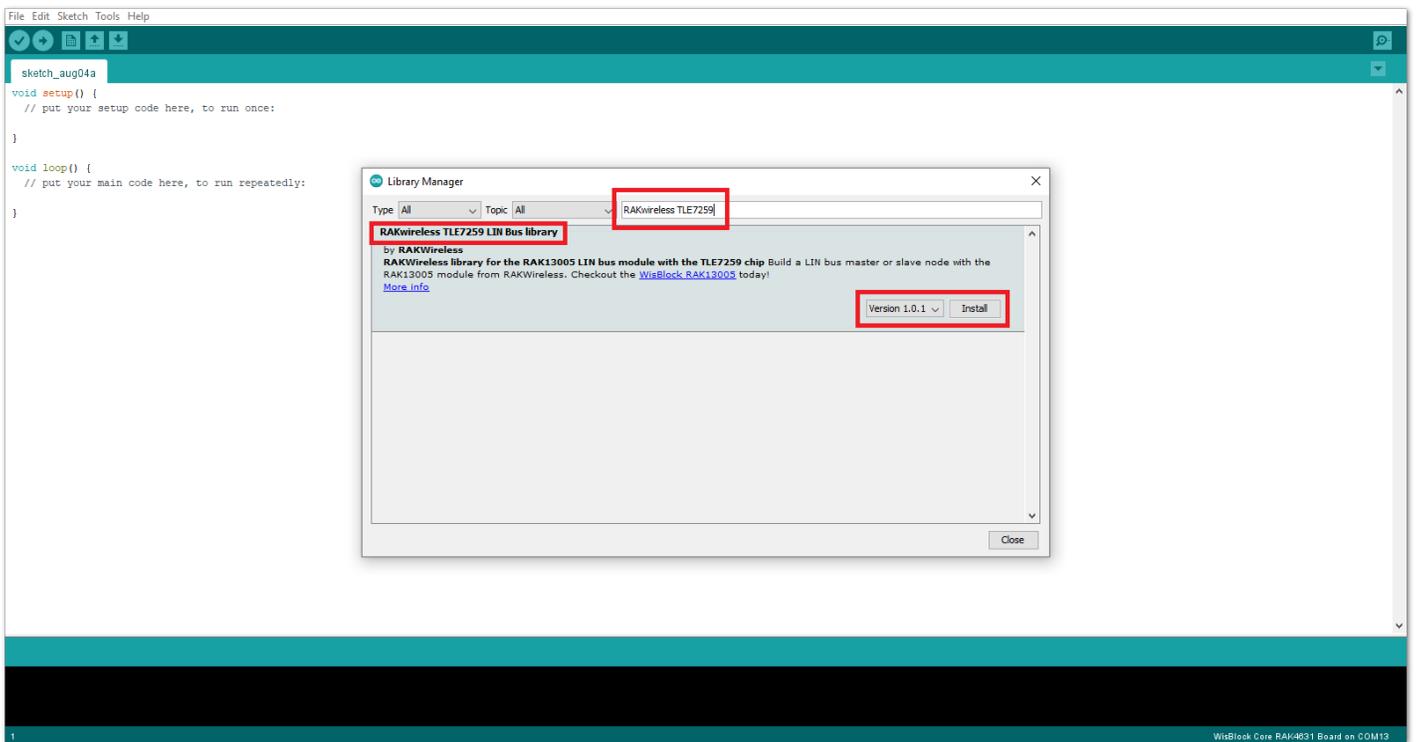


Figure 25: Look for RAKwireless TLE7259 LIN Bus Library

- After successful installation, close the Arduino Library window.

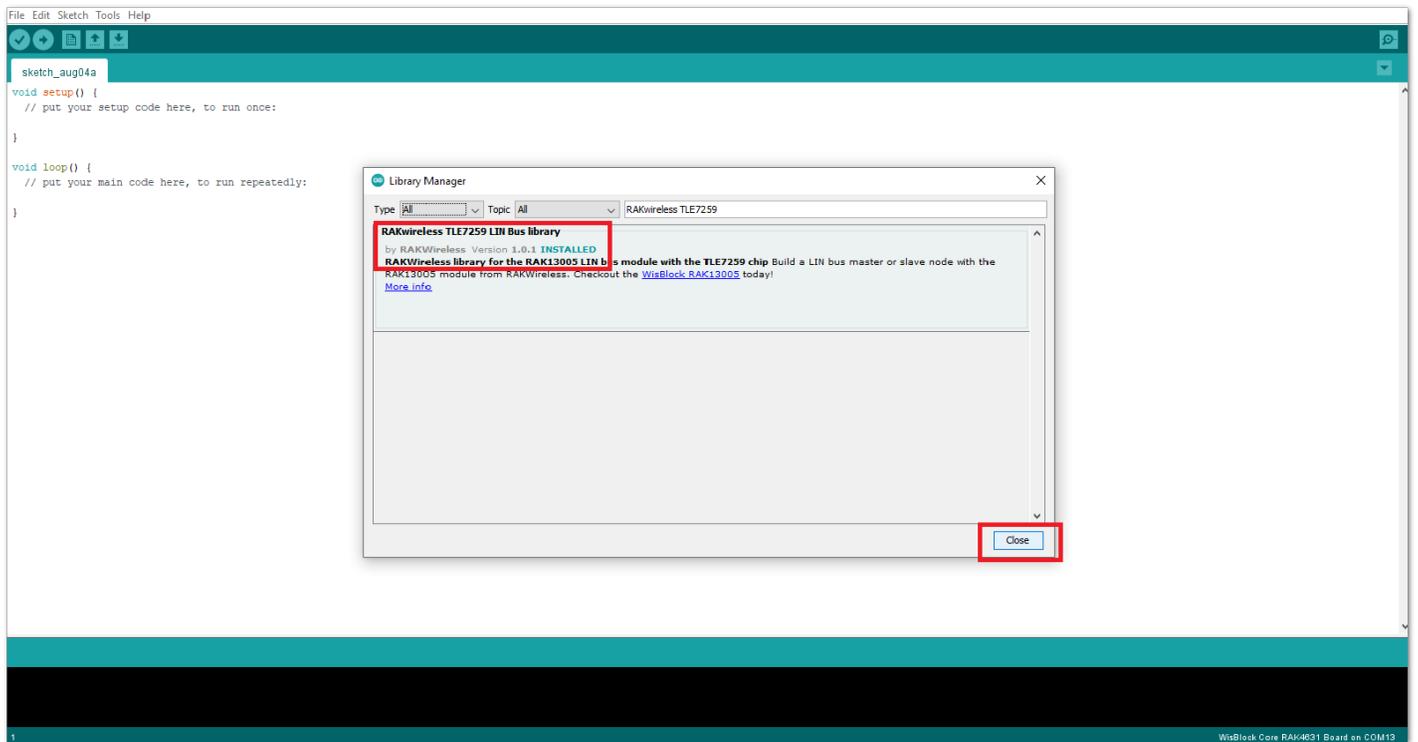


Figure 26: RAKwireless TLE7259 LIN Bus Library Successfully Installed

3. Upload the `RAK13005_linbus_master` **Controller** sketch.

- Open the `RAK13005_linbus_master` **Controller** sketch.
- Connect the first WisBlock with the RAK13005 module in **Controller** mode and select the `RAK13005_linbus_master`.

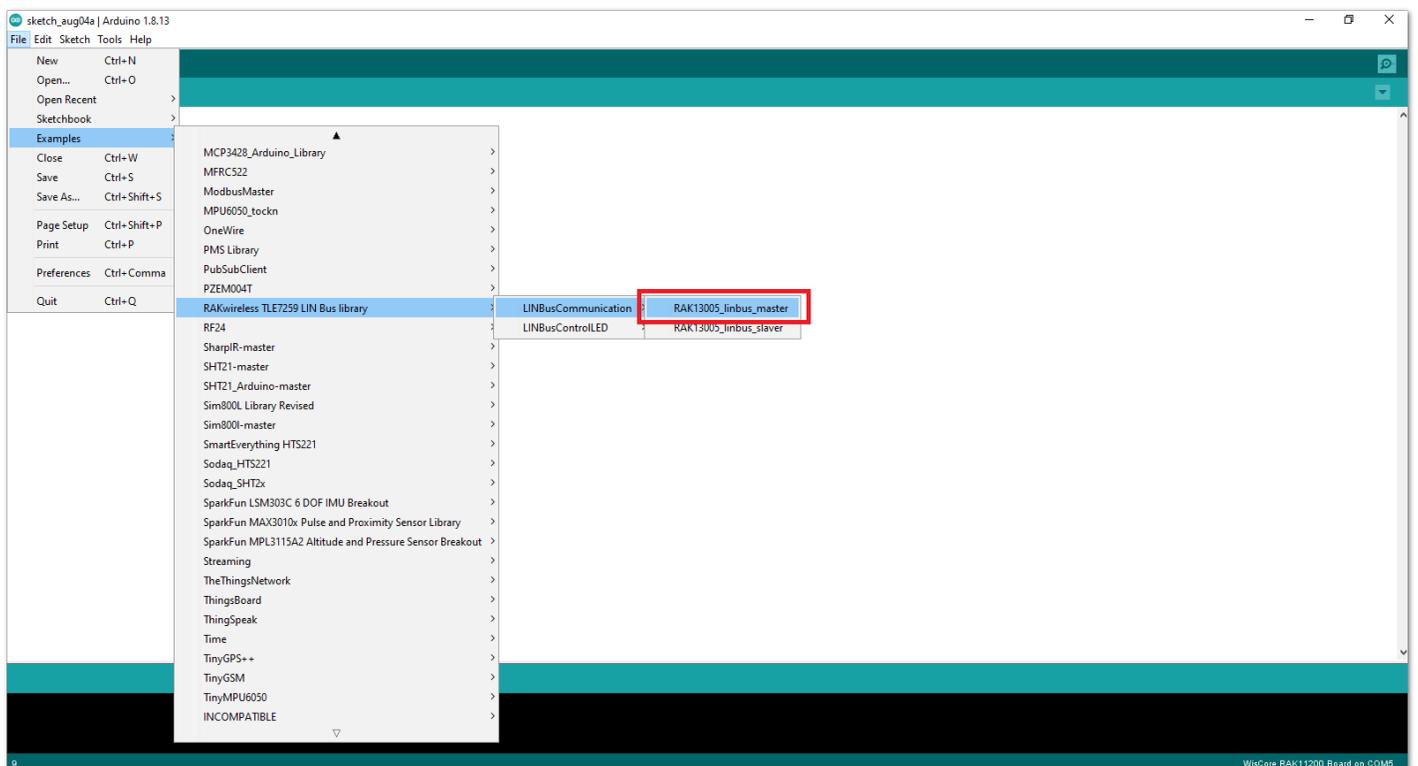


Figure 27: Open the code for the RAK13005 Controller

- Select the port where RAK11200 WisBlock Core is connected.

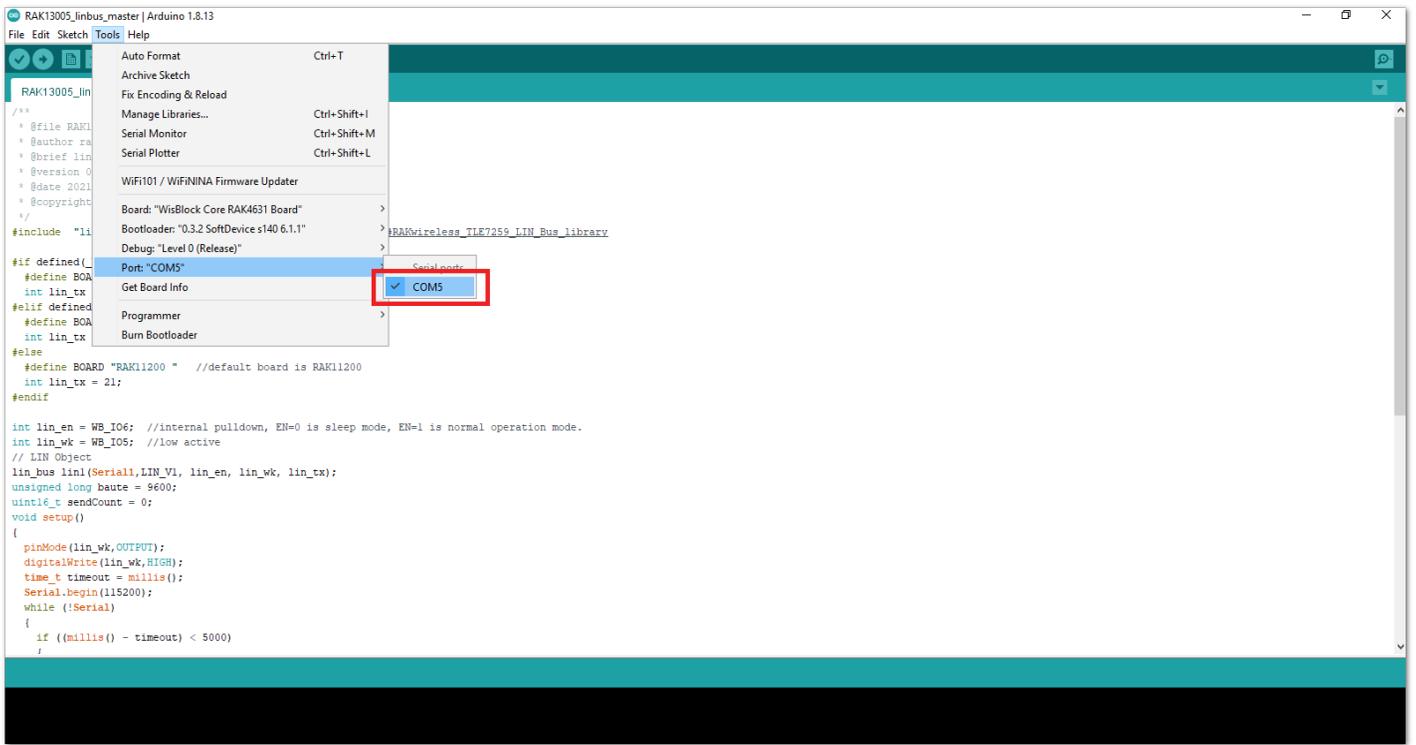


Figure 28: Select the Serial Port of RAK11200 for the RAK13005 LIN module in controller mode.

- Now, upload the `RAK13005_linbus_master` code to the WisBlock Core.

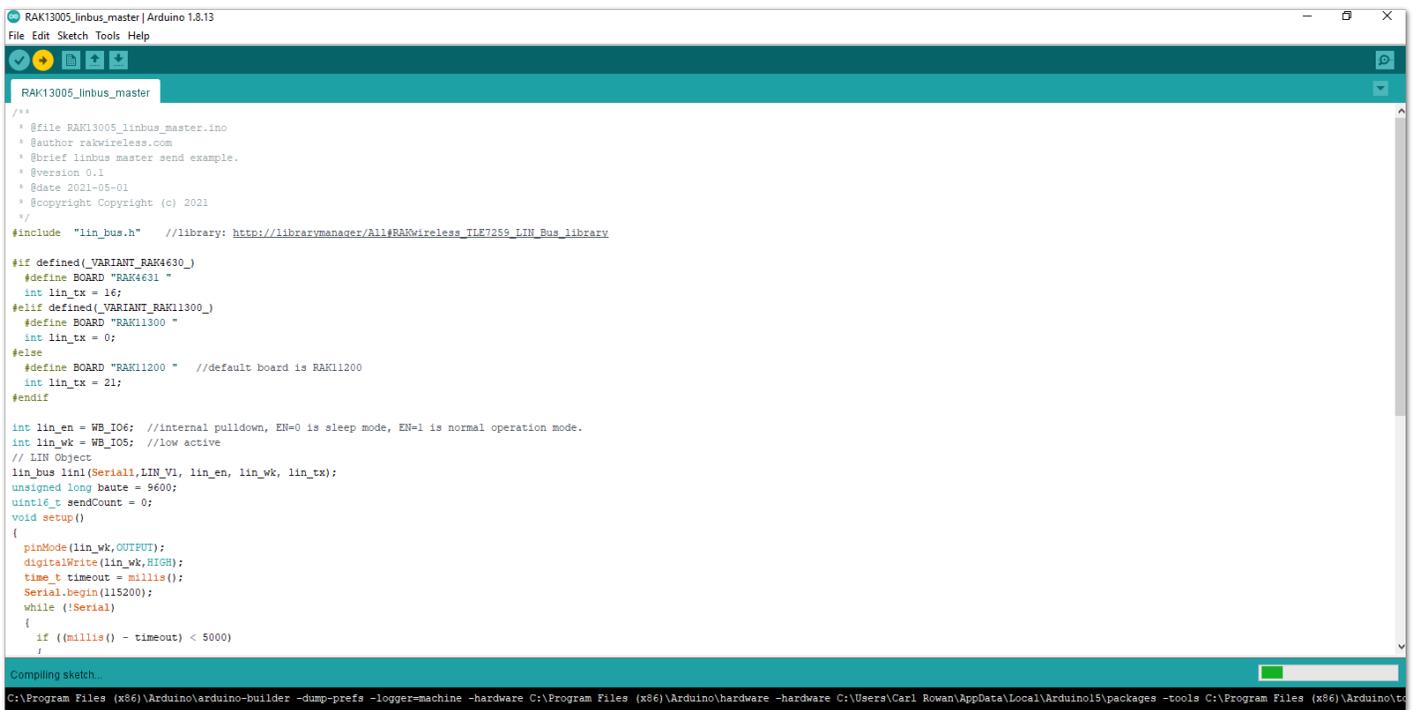


Figure 29: Uploading RAK13005_linbus_master code

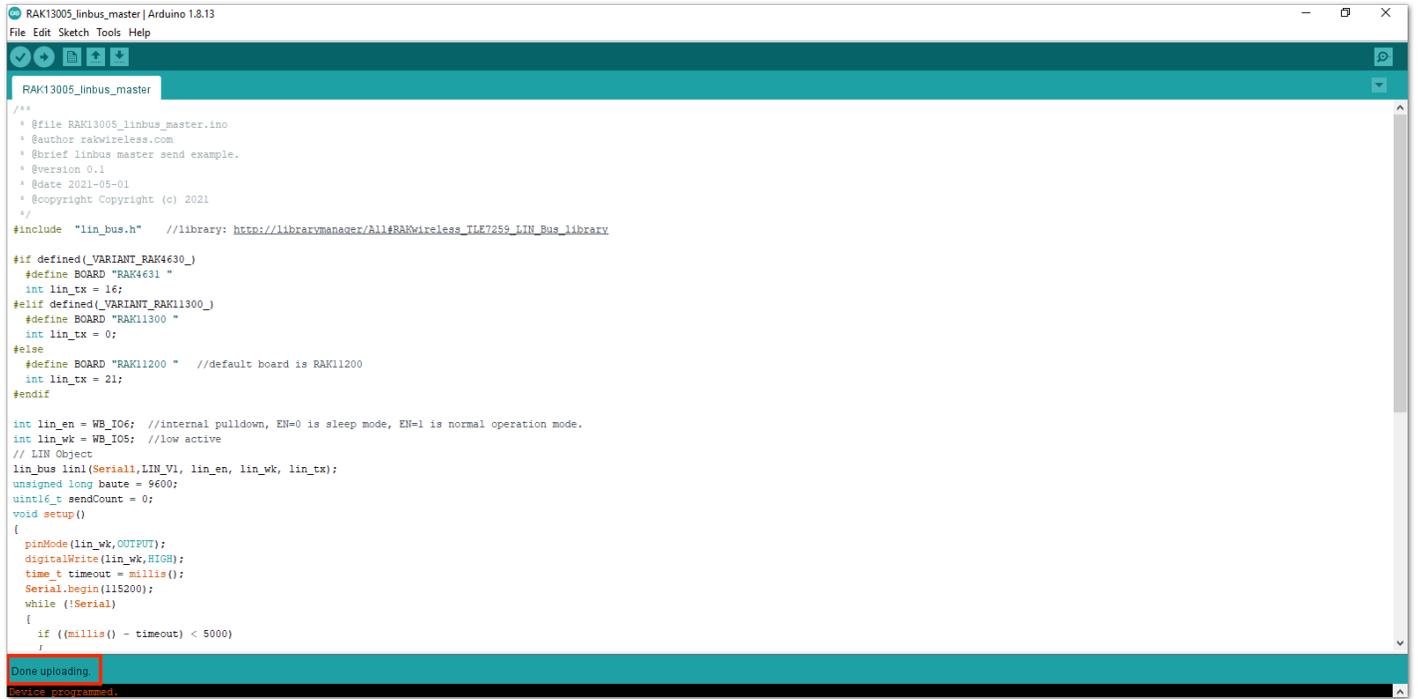


Figure 30: Successful code Upload

- After the successful code upload, you can now open the Serial Monitor and check the Serial output.

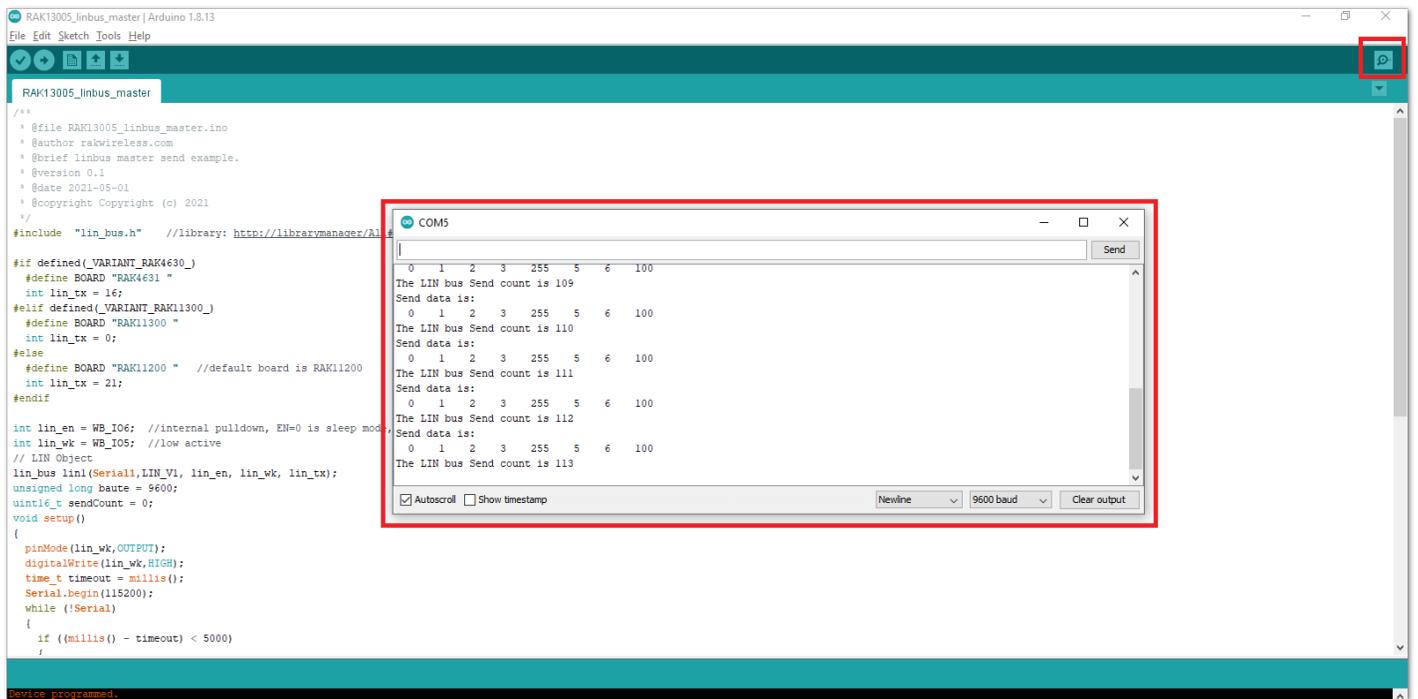


Figure 31: Serial Output of the RAK13005 Controller Mode

4. Upload the `RAK13005_linbus_slaver` Peripheral sketch.

- Connect the second WisBlock with the RAK13005 in Peripheral mode then select `RAK13005_linbus_slaver`.

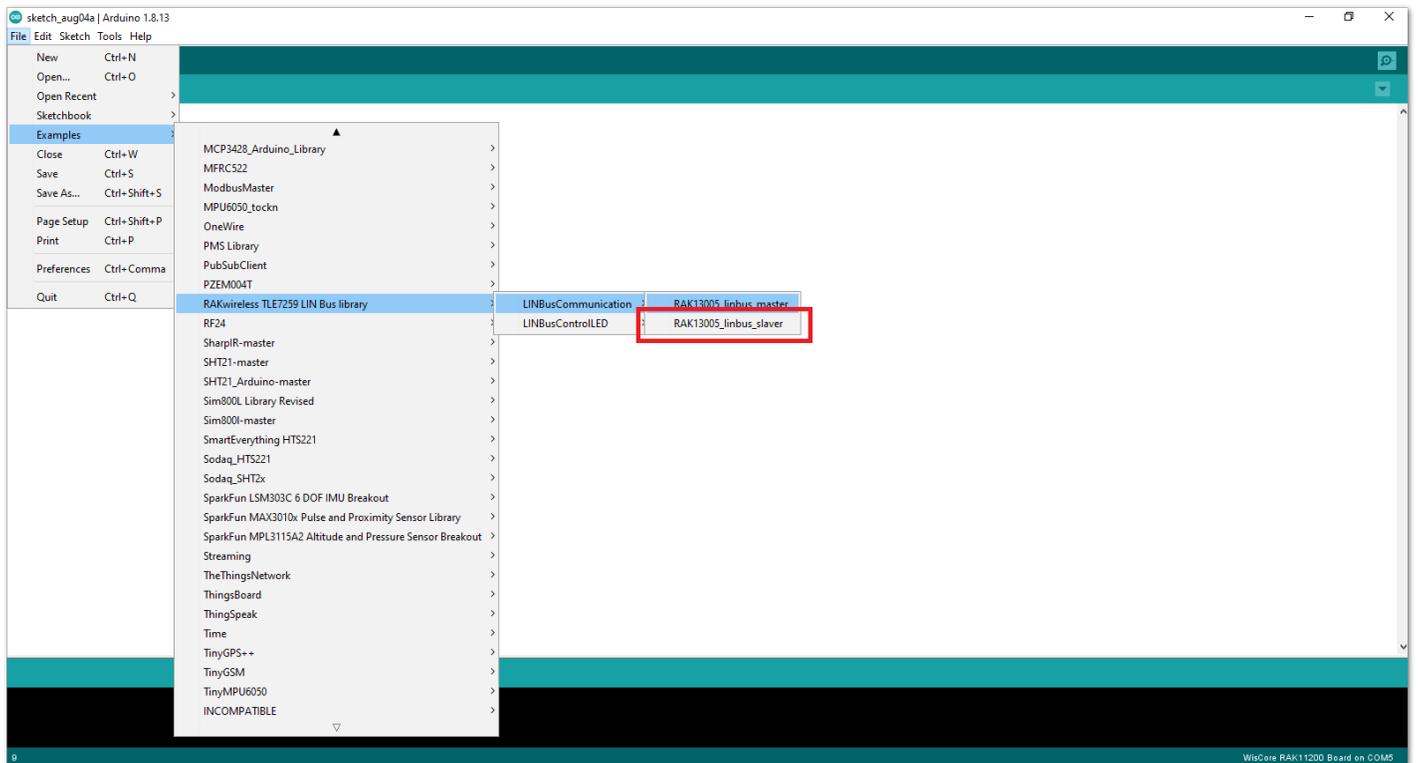


Figure 32: Open the code for the RAK13005 Peripheral

- Select the port, which is the additional port from the previous port for the controller. You should see two ports in your Arduino IDE.

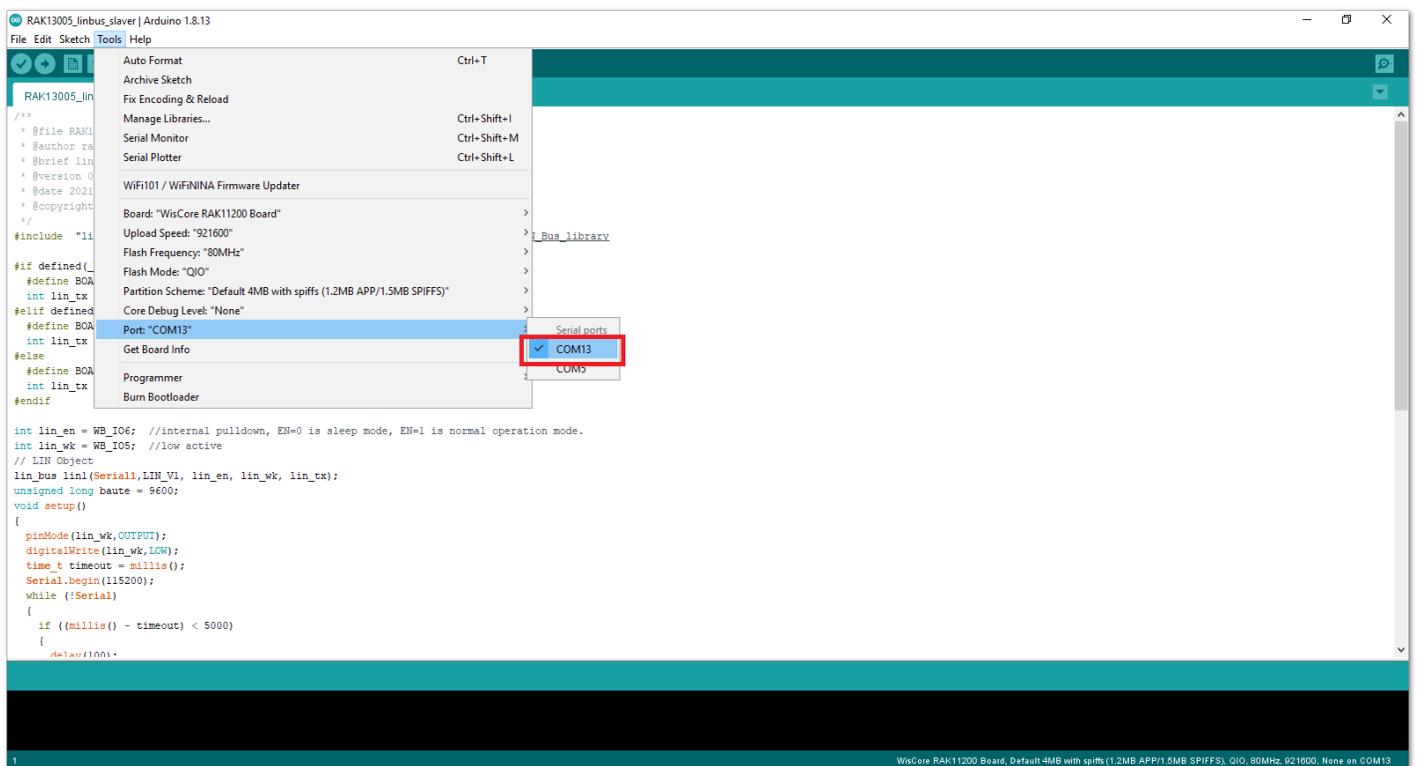


Figure 33: Select the Serial Port of RAK11200 for the RAK13005 LIN module in Peripheral mode.

NOTE:

RAK11200 requires the BOOT0 pin to be configured properly before uploading. If not done properly, uploading the source code to RAK11200 will fail. Check the full details on the [RAK11200 Quick Start Guide](#).

- After ensuring the port matching the RAK13005 LIN Peripheral, you can now upload the `RAK13005_linbus_slaver` code.

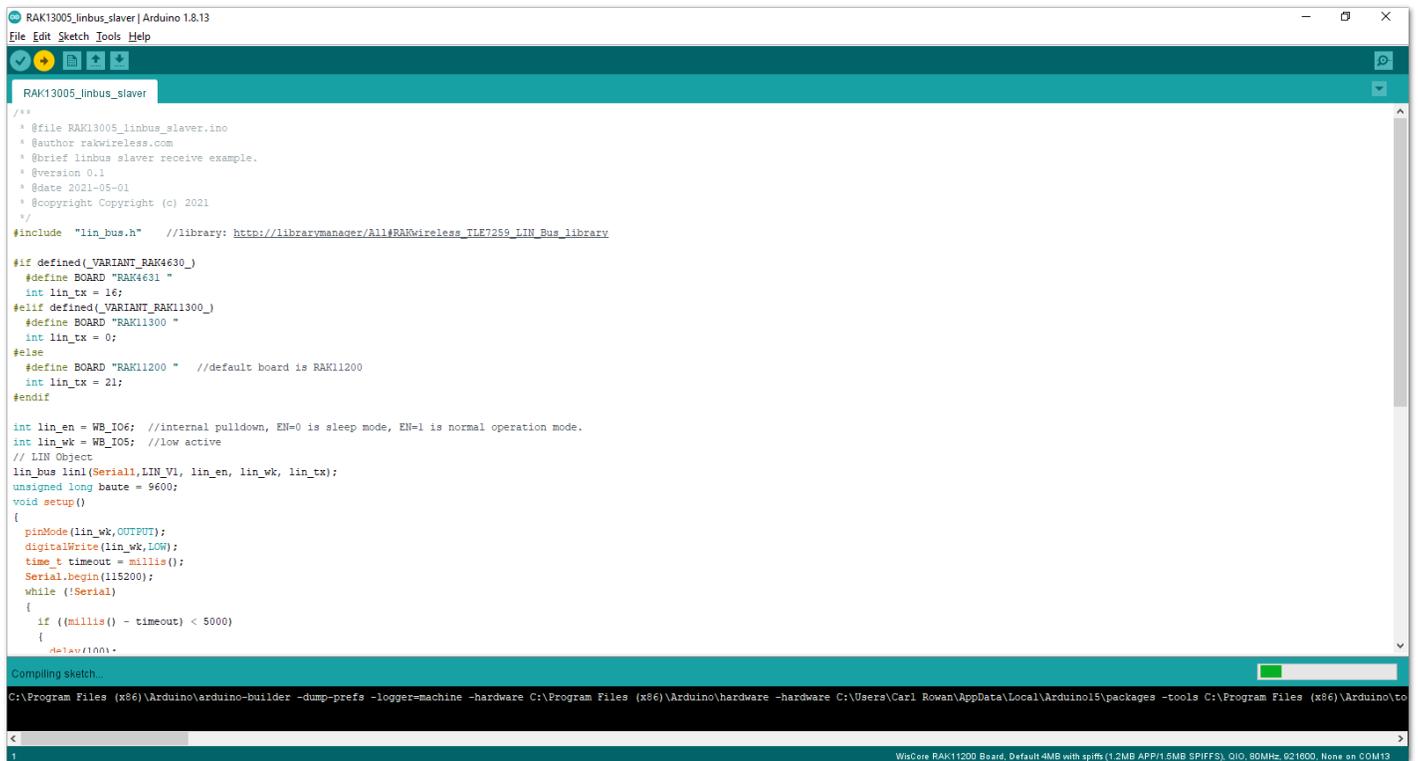


Figure 34: Uploading the RAK13005_linbus_slaver code

NOTE

If you experience any error in compiling an example sketch, check the updated code for the RAK13005 WisBlock Core Module that can be found on the [RAK13005 WisBlock Example Code Repository](#) .

5. Check Serial Monitor output.

- Check the Serial Monitor on the RAK13005 Peripheral device receiving the data coming from the RAK13005 **Controller** device. You must have the external power supply connected to have successful transmissions.

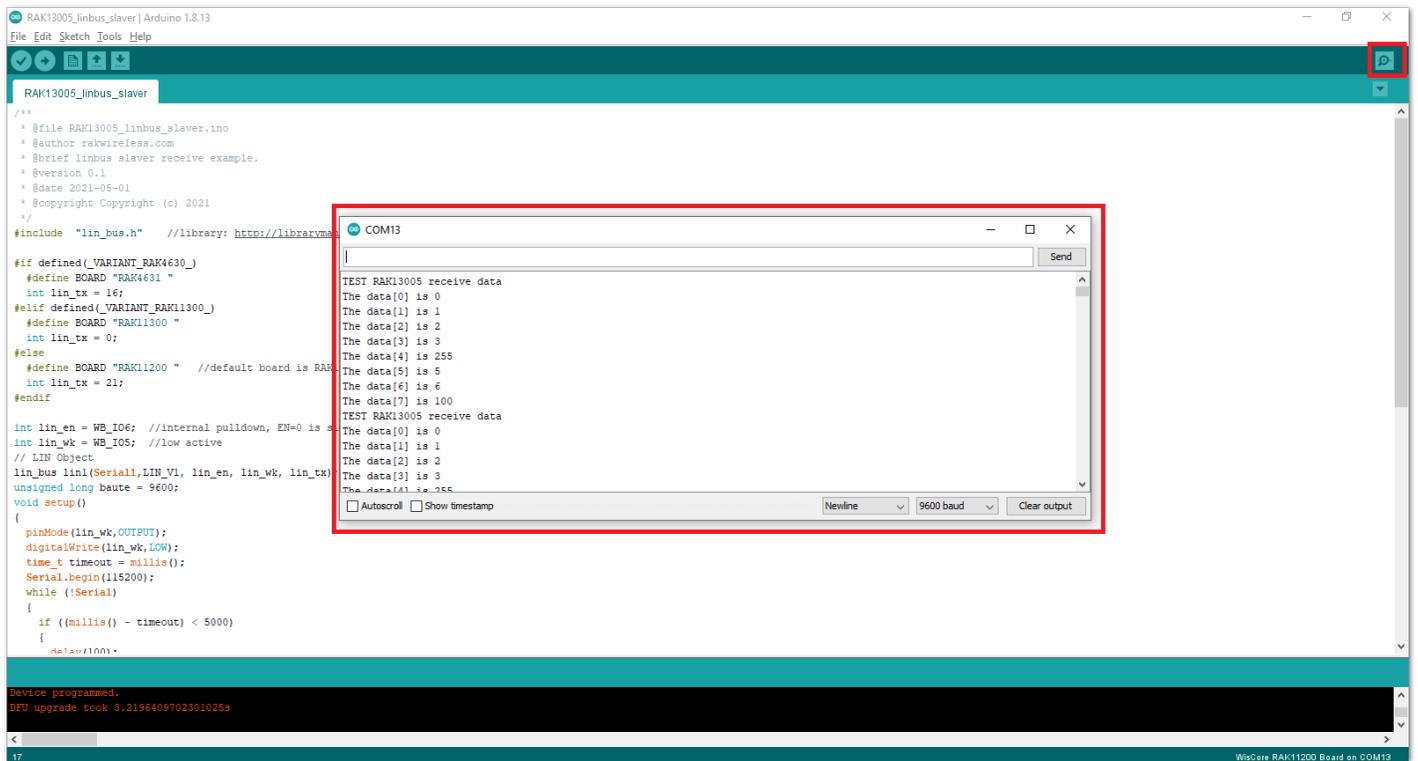


Figure 35: Serial Output of the RAK13005 Peripheral Mode

RAK13005 in RAK11310 WisBlock Core Guide

Arduino Setup

Figure 36 is an illustration on how to use two RAK13005 LIN modules for communication application. One RAK13005 is configured as **Controller** and the other RAK13005 is configured as **Peripheral**. The SMD resistors that set the mode are highlighted in a yellow box.

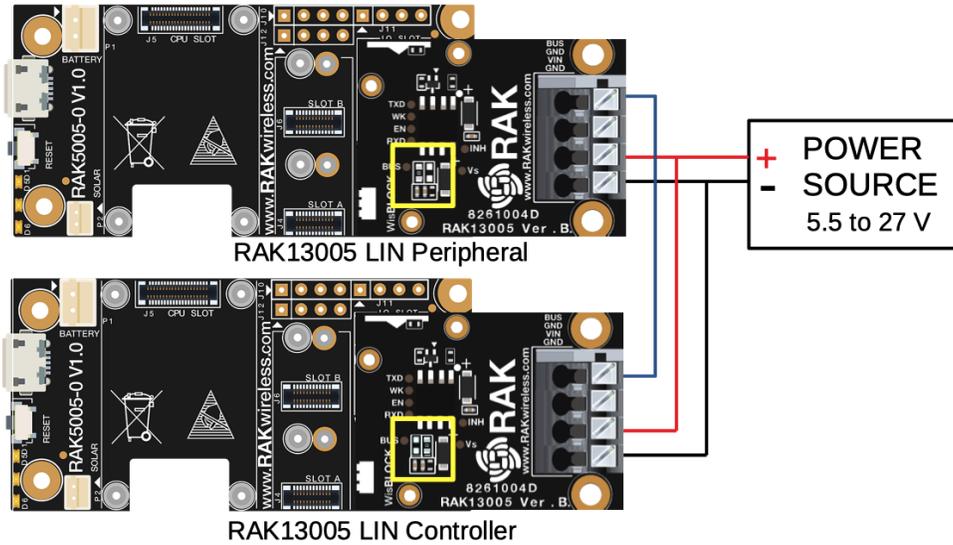


Figure 36: Two RAK13005 Interconnection for Controller and Peripheral mode

1. Select the RAK11300 WisBlock Core.

- Install the [RAKwireless Arduino BSP](#) to find the RAK11300 in the Arduino Boards Manager.

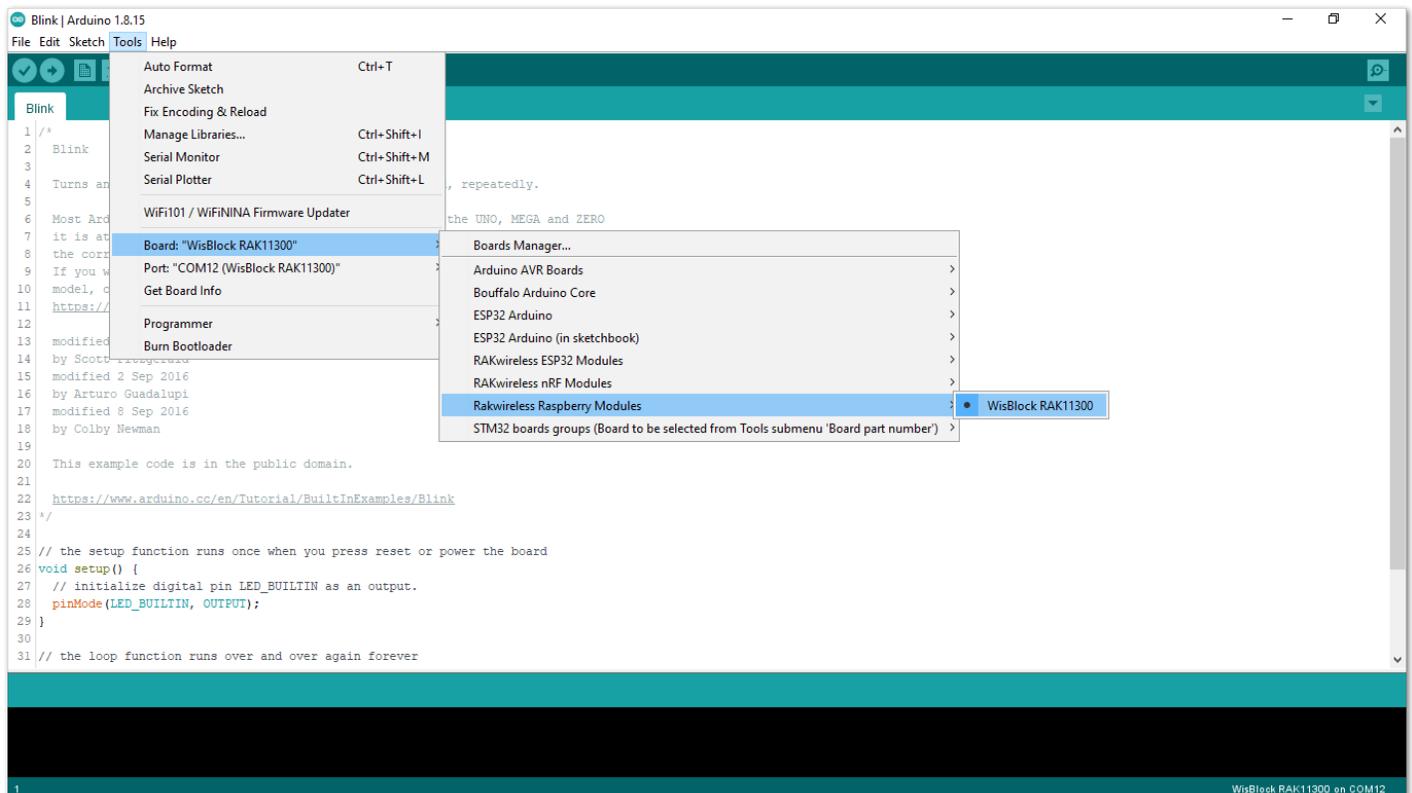


Figure 37: Selecting RAK11300 as WisBlock Core

2. Next, install the **RAKwireless TLE7259** library using Arduino Library manager.

- Select `sketch` followed by `Include Library` then `Manage Libraries`.

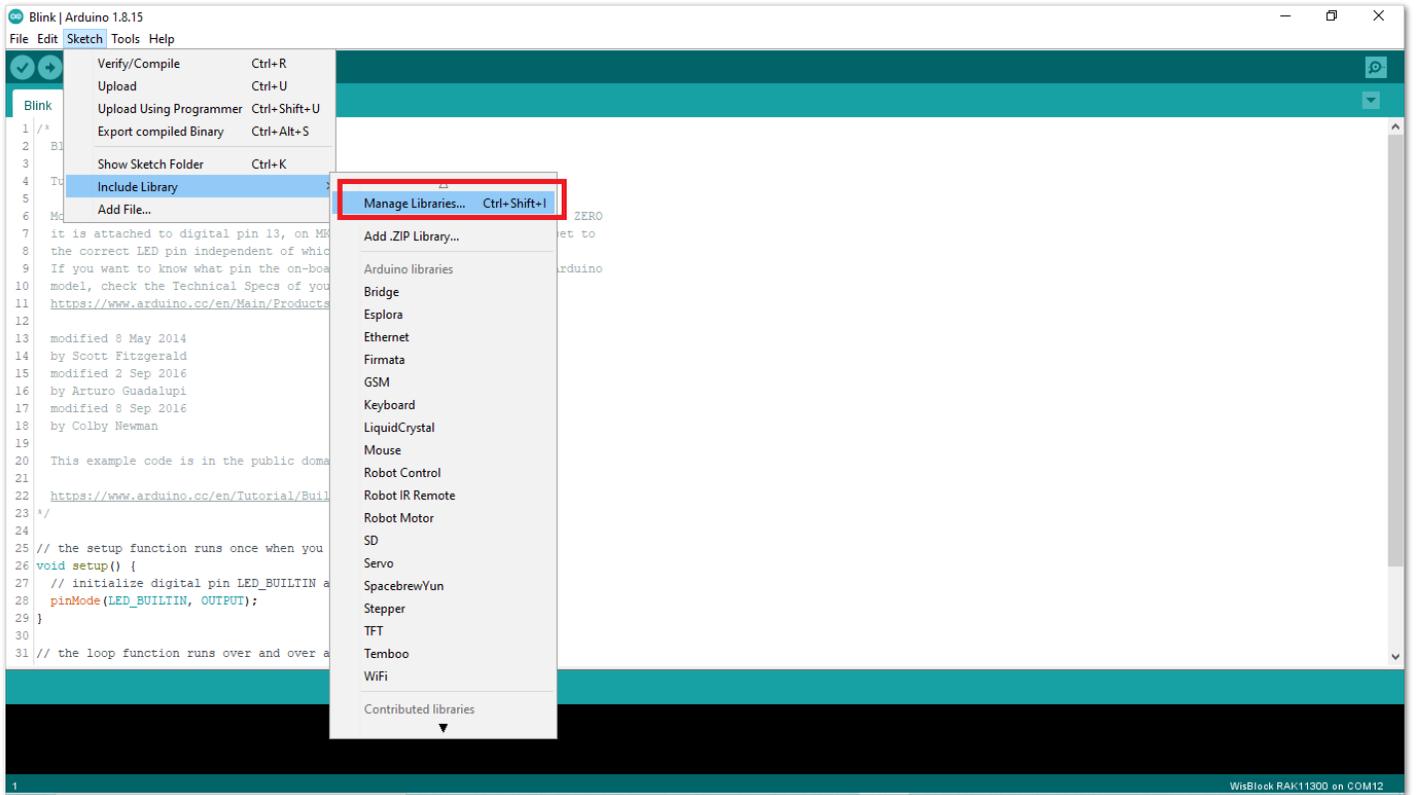


Figure 38: Open Arduino Library Manager

- Search for RAKwireless TLE7259 on Library Manager text box.
- Select the latest version of the library then click **Install** button.

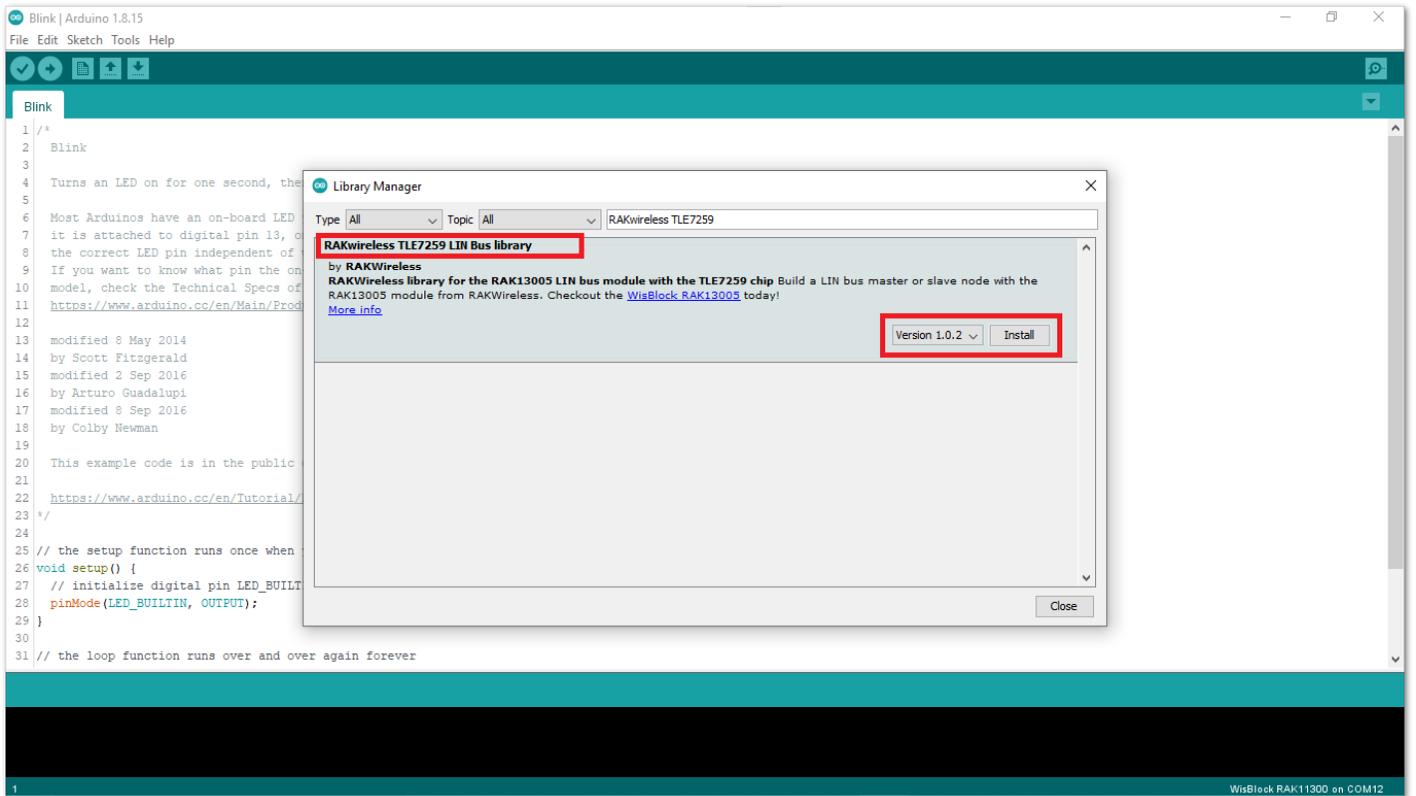


Figure 39: Look for RAKwireless TLE7259 LIN Bus Library

- After successful installation, close the Arduino Library window.

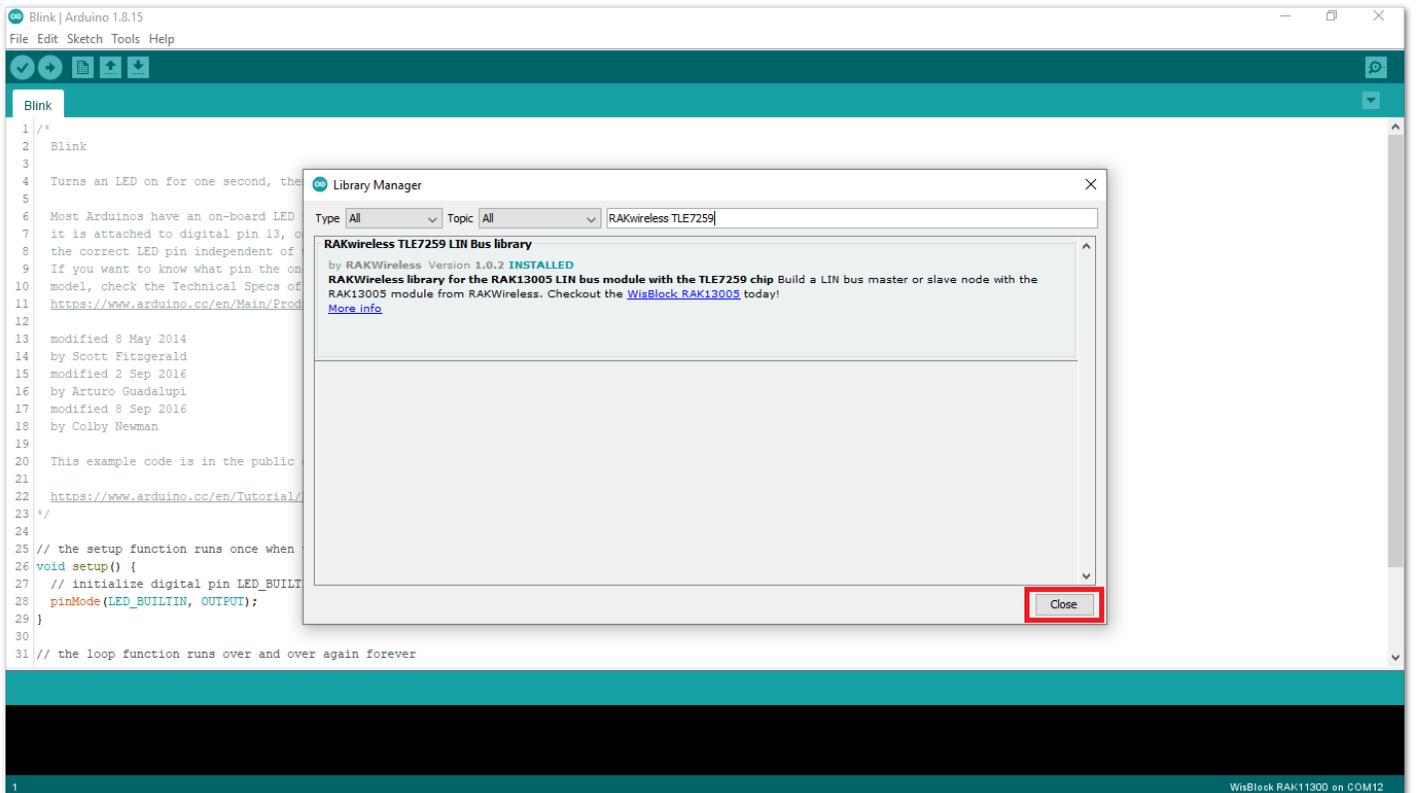


Figure 40: RAKwireless TLE7259 LIN Bus Library Successfully Installed

3. Upload the `RAK13005_linbus_master` **Controller** sketch.

- Connect the first WisBlock with the RAK13005 module in **Controller** mode and select the `RAK13005_linbus_master`.

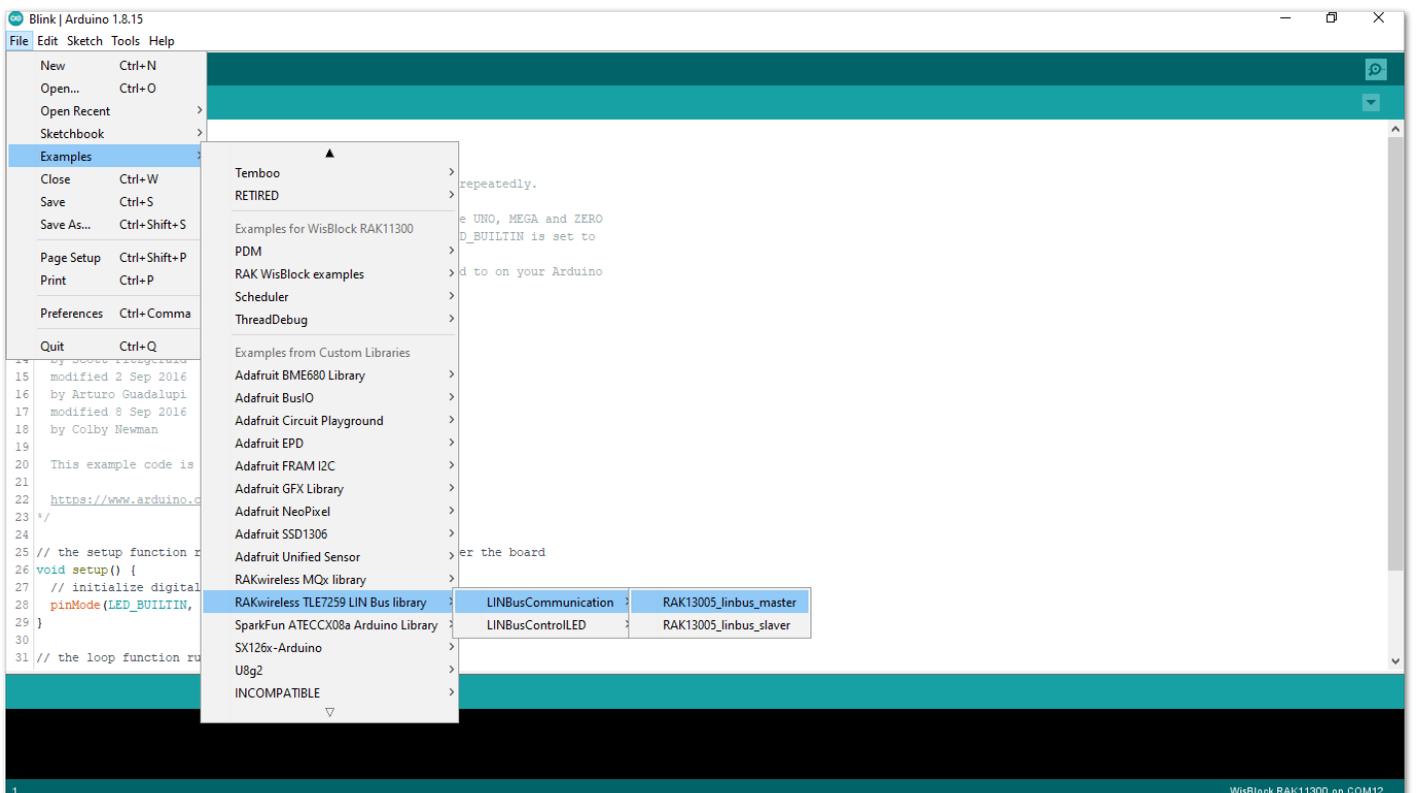


Figure 41: Open the code for the RAK13005 Controller

- Select the port where RAK11300 WisBlock Core is connected.

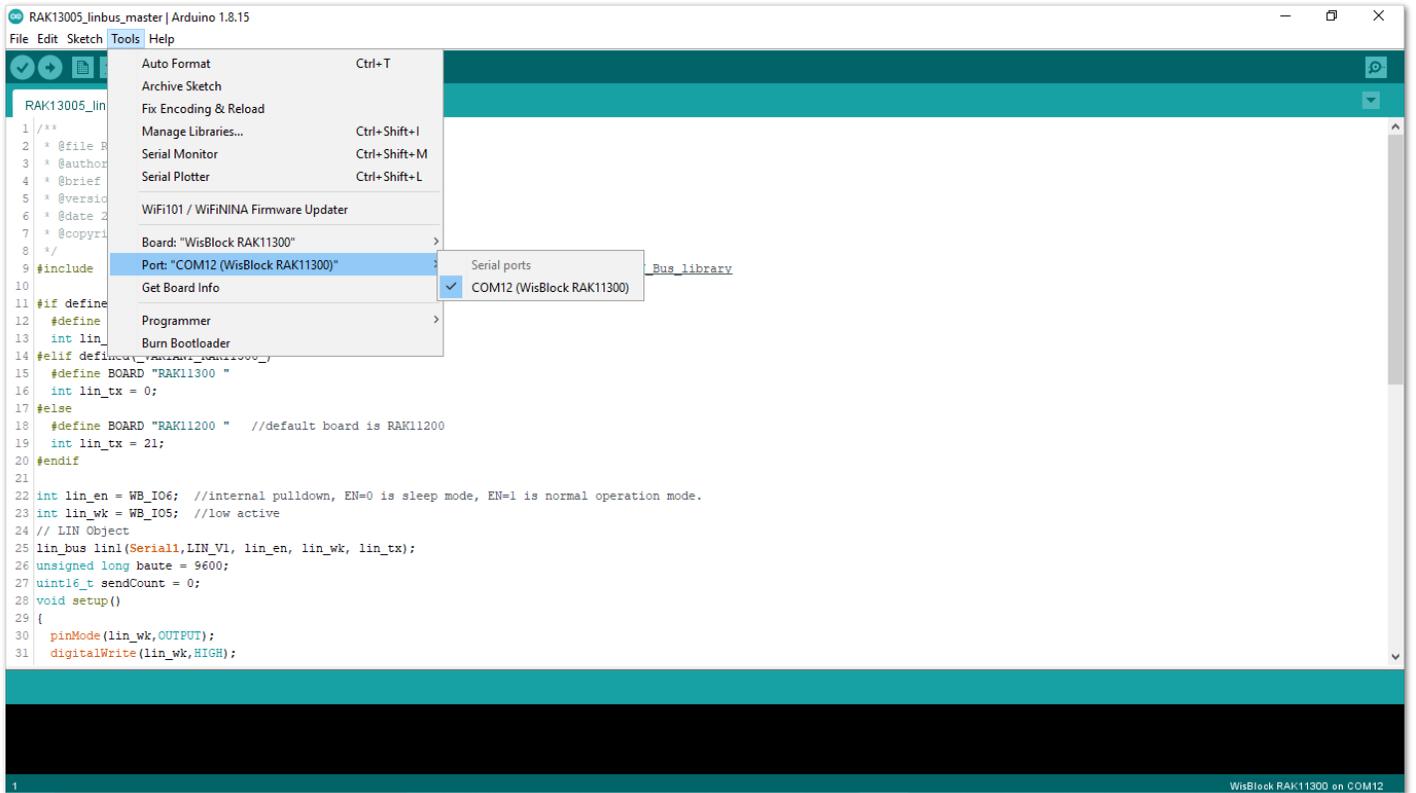


Figure 42: Select the Serial Port of RAK4631 for the RAK13005 LIN module in controller mode.

- Now, upload the `RAK13005_linbus_master` code to the WisBlock Core.

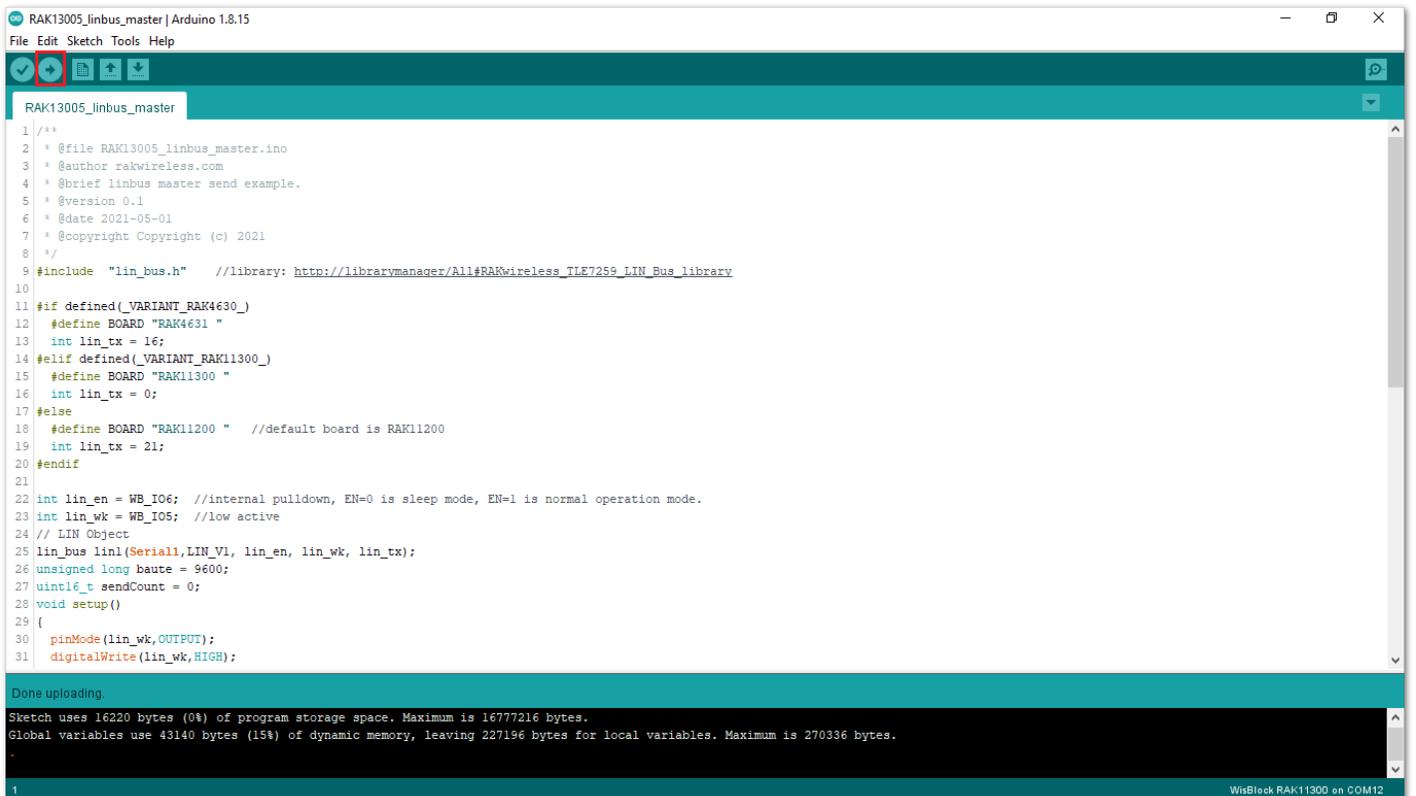


Figure 43: Successful code upload

- After the successful code upload, you can now open the Serial Monitor and see the Serial output.

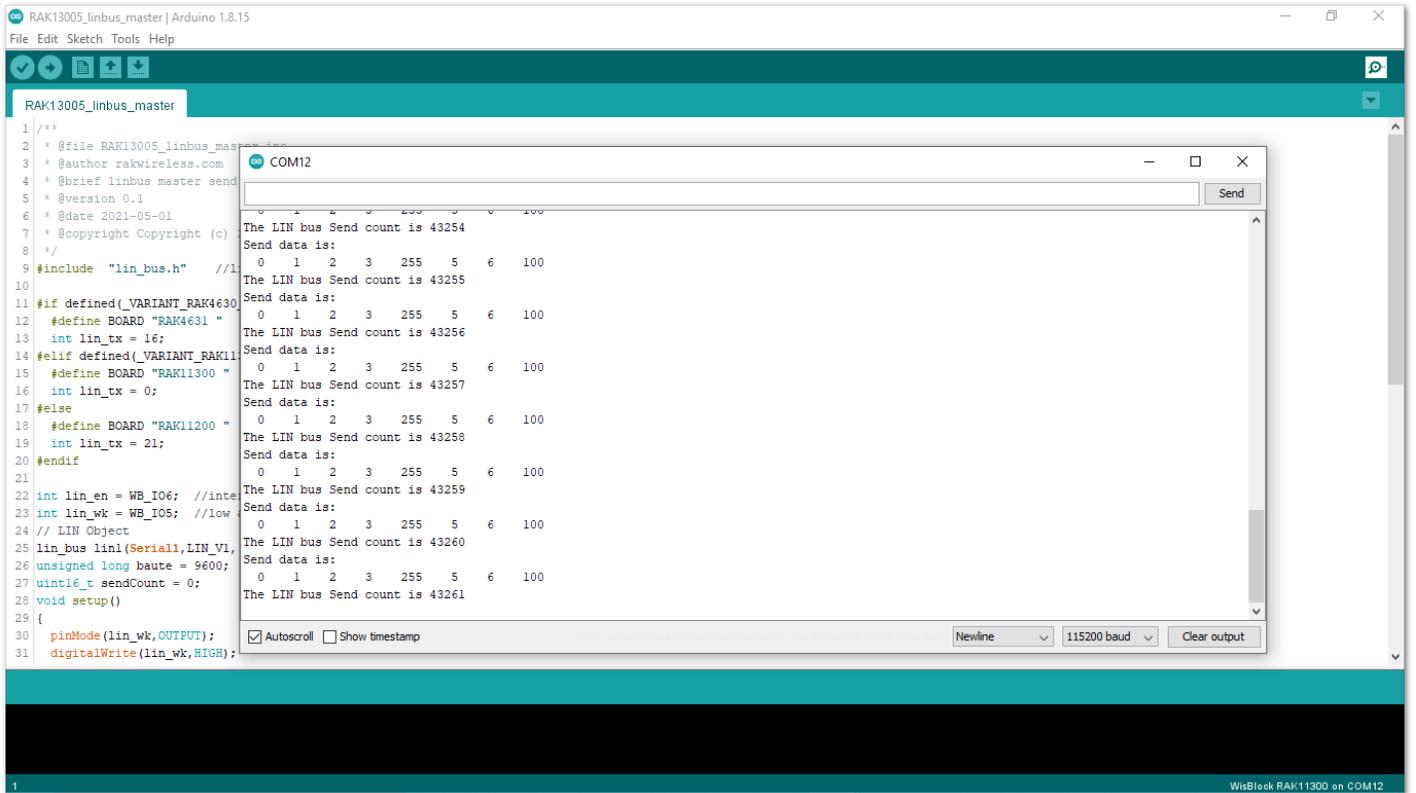


Figure 44: Serial Output of the RAK13005 Controller Mode

4. Upload the `RAK13005_linbus_slaver` Peripheral sketch.

- Connect the second WisBlock with the RAK13005 in Peripheral mode then select `RAK13005_linbus_slaver`.

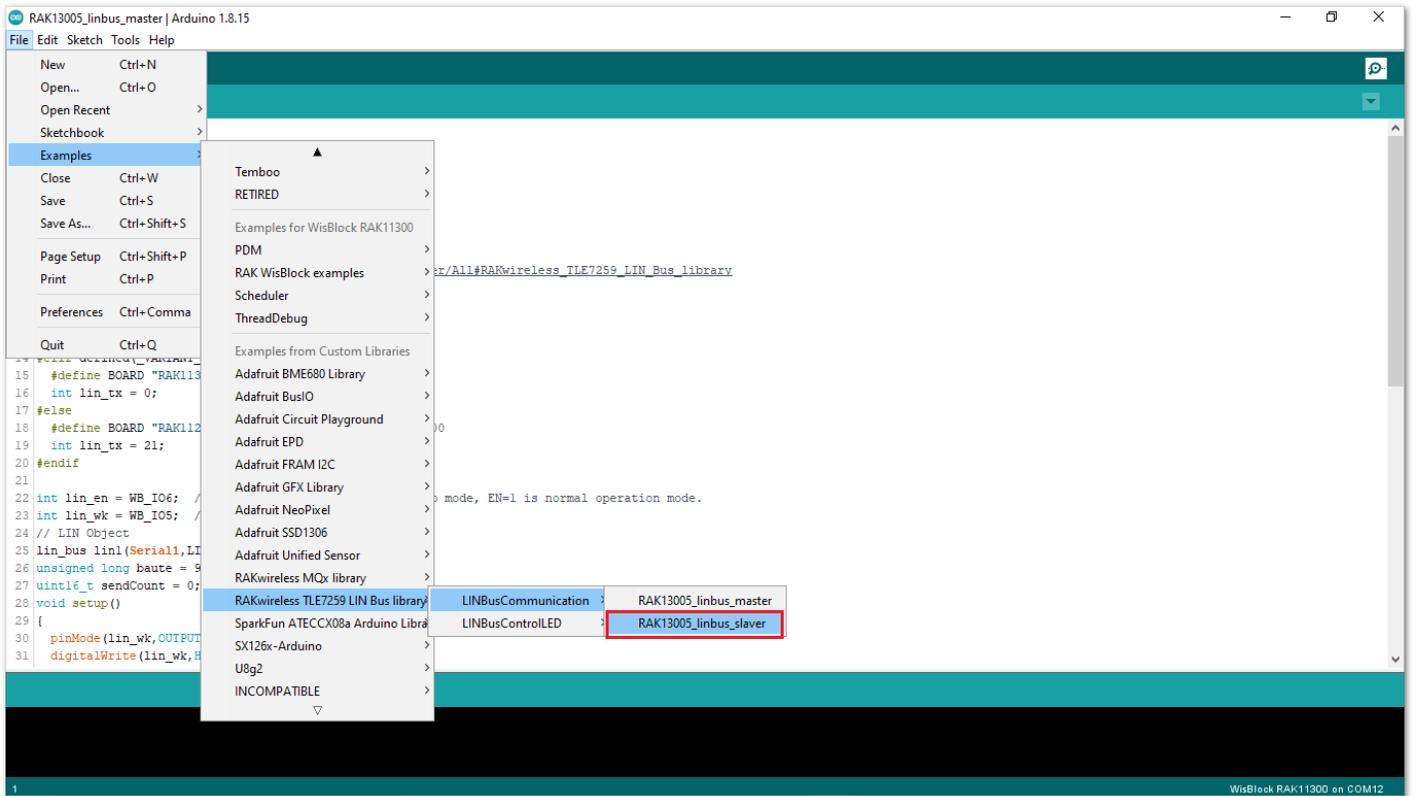


Figure 45: Open the code for the RAK13005 Peripheral

- Select the port, which is the additional port from the previous port for the controller. You should see two ports in your Arduino IDE.

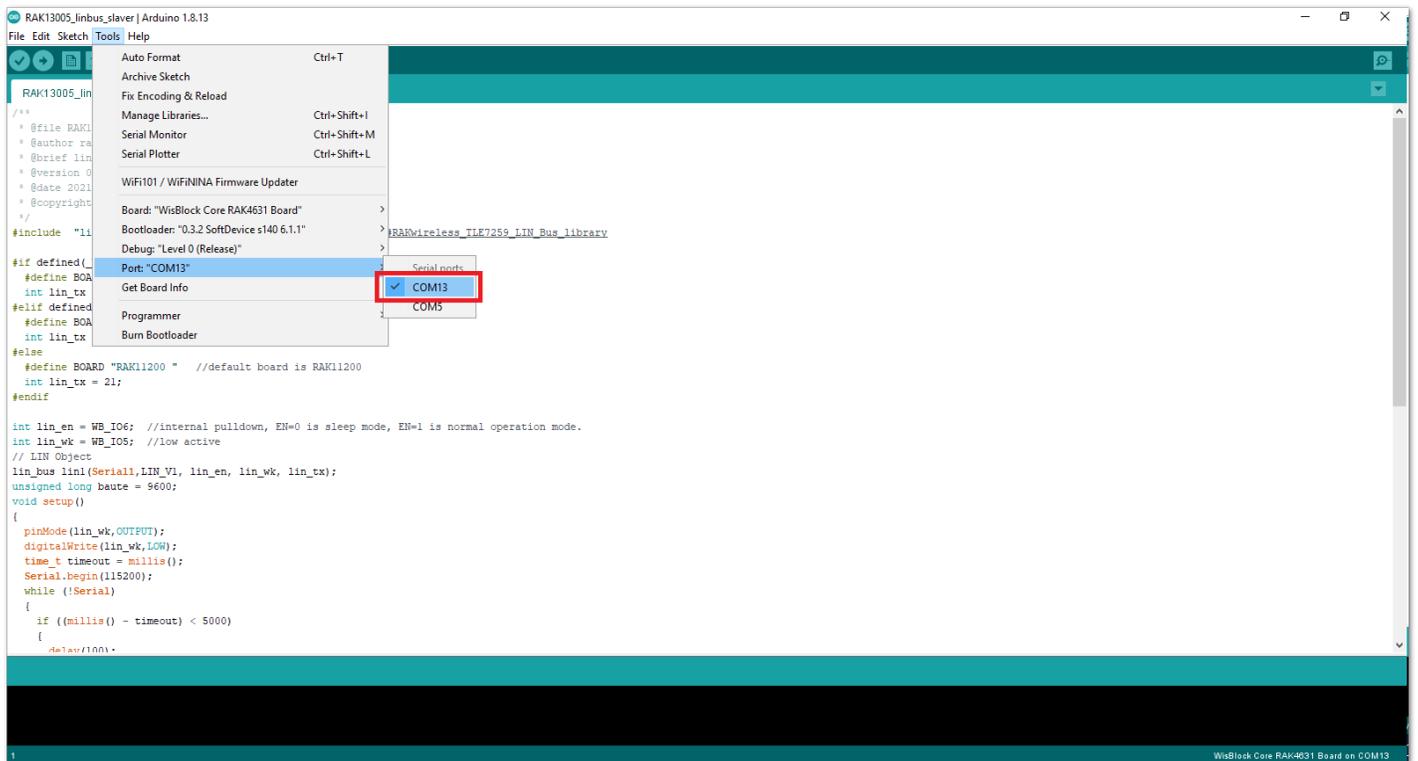


Figure 46: Select the Serial Port of RAK11300 for the RAK13005 LIN module in peripheral mode.

- After ensuring the port matching the RAK13005 LIN Peripheral, you can now upload the `RAK13005_linbus_slaver` code.

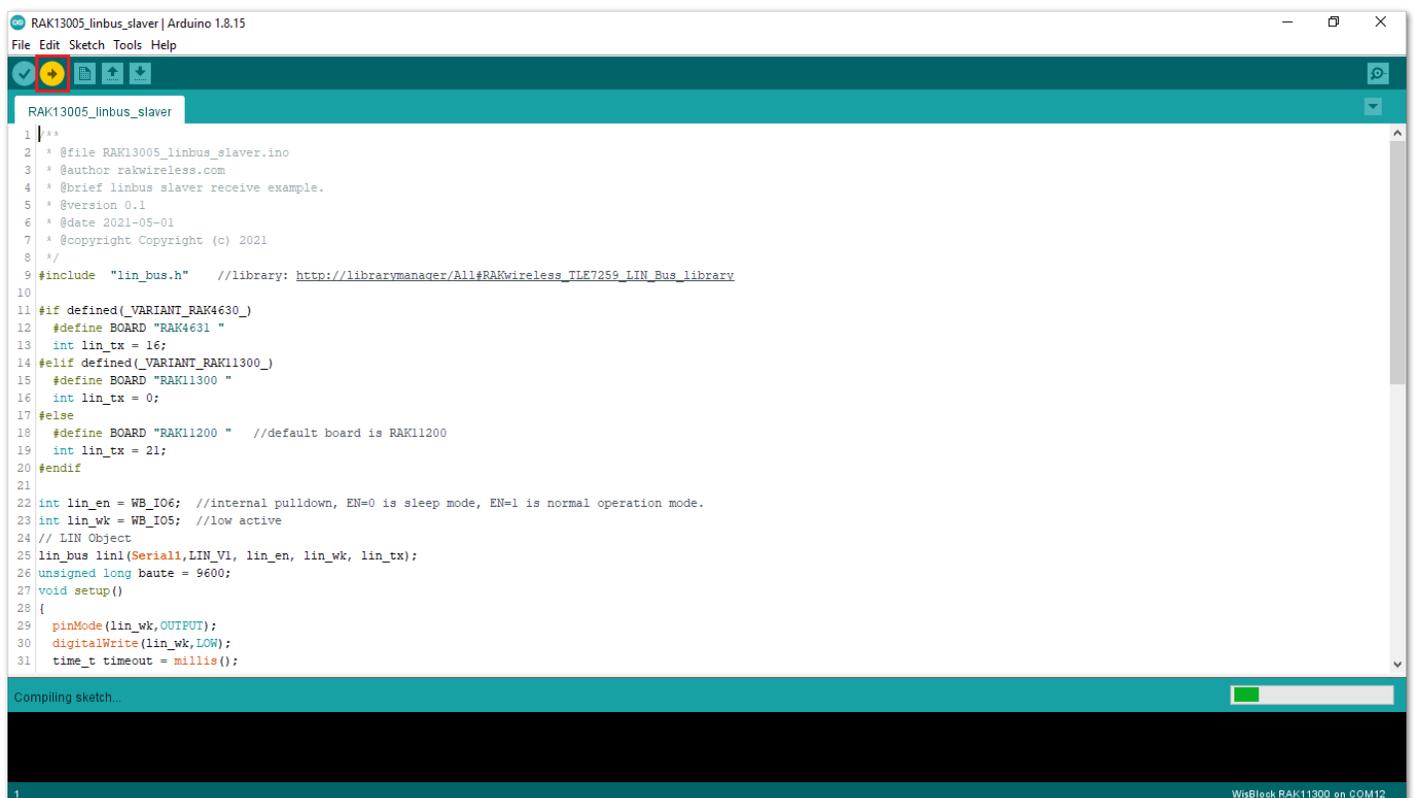


Figure 47: Uploading the RAK13005_linbus_slaver code

NOTE

If you experience any error in compiling an example sketch, check the updated code for the RAK13005 WisBlock Core Module that can be found on the [RAK13005 WisBlock Example Code Repository](#) .

5. Check Serial Monitor output.

- Check the Serial Monitor on the RAK13005 Peripheral device receiving the data coming from the RAK13005 **Controller** device. You must have the external power supply connected to have successful transmissions.

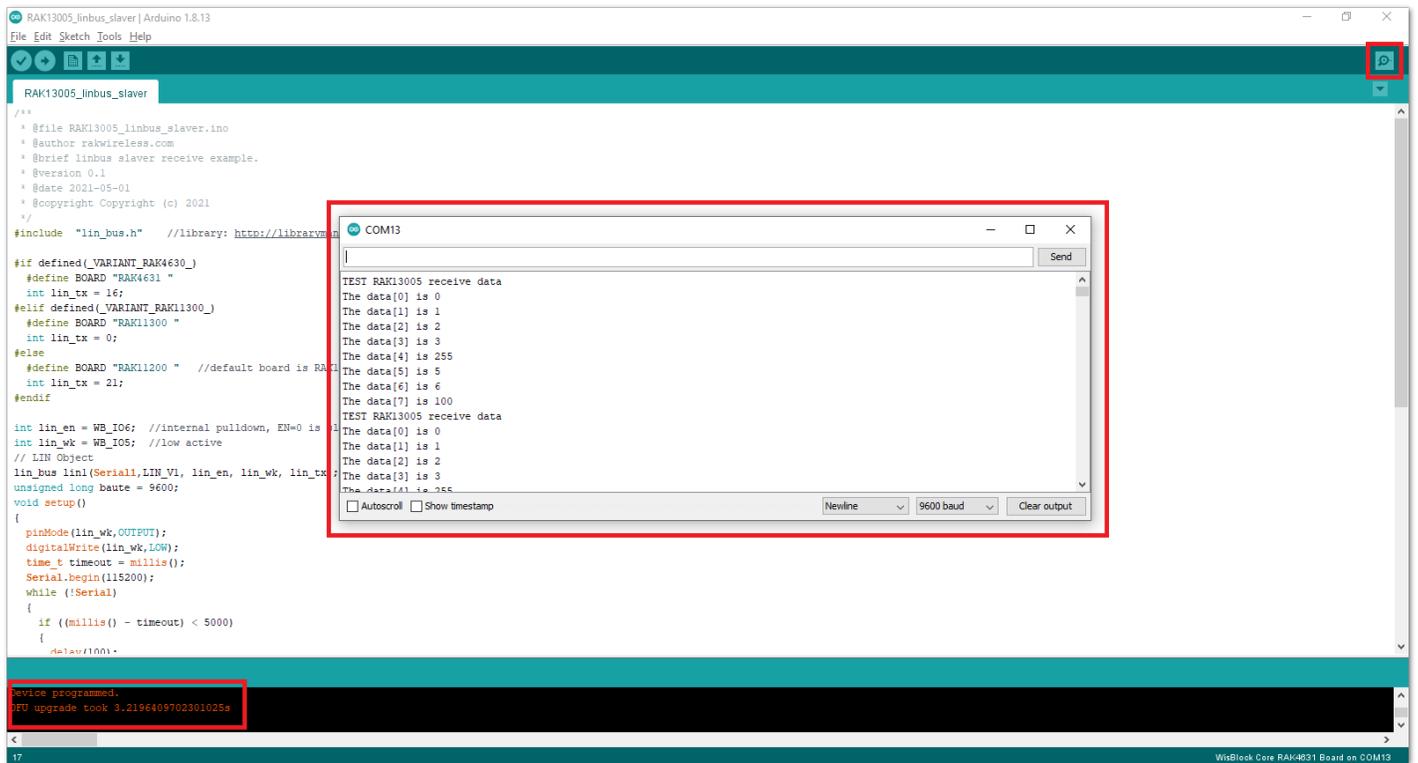


Figure 48: Serial Output of the RAK13005 Peripheral Mode

To extend the use of the RAKwireless TLE7259 LIN Bus library, check the [TLE7259 Library methods](#) .

RAK13005 WisBlock LIN Module Datasheet

Overview

Description

The RAK13005 is a **Local Interconnect Network (LIN)** transceiver module, used in automatic technologies that can be mounted on the IO slot of the WisBlock Base board. It is designed for in-vehicle networks using data transmission rates from 2.4 kBaud to 20 kBaud, and it uses the TLE7259-3 chip from Infineon.

This module offers safe communication over up to 40 m distance between the LIN bus nodes. Besides the use in an automotive environment, it can be implemented in home appliances and industrial automation. The LIN bus technology consists of Peripheral (Slave) and Controller (Master) Nodes which are both supported by RAK13005.

Features

- **Module specifications**
 - Single-wire LIN transceiver for transmission rates up to 20 kBaud
 - Supports both Controller(Master) and Peripheral(Slave) modes
 - Compliant to ISO 17987-4 and LIN Specification 2.2A
 - Very low current consumption in sleep mode with wake-up functions
 - Support 12 V and 24 V LIN bus power supply
 - Digital I/O levels compatible with 3.3 V and 5 V microcontrollers
 - Chipset: Infineon TLE7259-3
- **Size**
 - 25 x 35 mm

Specifications

Overview

Mounting

The RAK13005 module can be mounted on the IO Slot of a WisBlock Base board. Figure 1 shows the mounting mechanism of the RAK13005 on a WisBlock Base board, such as the RAK5005-O.

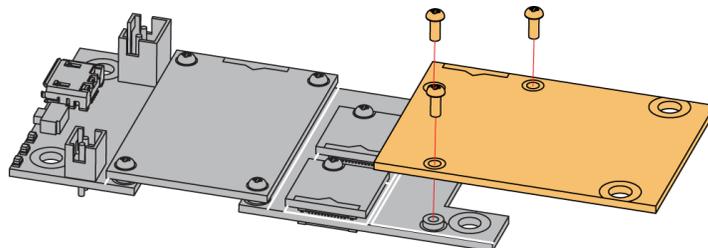


Figure 2: RAK13005 WisBlock LIN Module mounting

Hardware

The hardware specification is categorized into five parts. It shows the chipset of the module and the pinouts and its corresponding functions and diagrams. It also presents the parameters and their standard values in terms of electrical and mechanical.

Chipset

Vendor	Part number
Infineon	TLE7259-3

Pin Definition

The RAK13005 WisBlock LIN module module comprises a standard 40-pin WisConnector. The WisConnector allows the RAK13005 module to be mounted on a WisBlock Base board, such as RAK5005-O. The pin order of the connector and the pinout definition is shown in Figure 2.

NOTE:

- The UART related pins, 3V3, and GND are connected to this module.
- The IO6 pin is connected to LIN Enable input pin (EN).
- The IO5 pin is connected to MCU_WK pin.

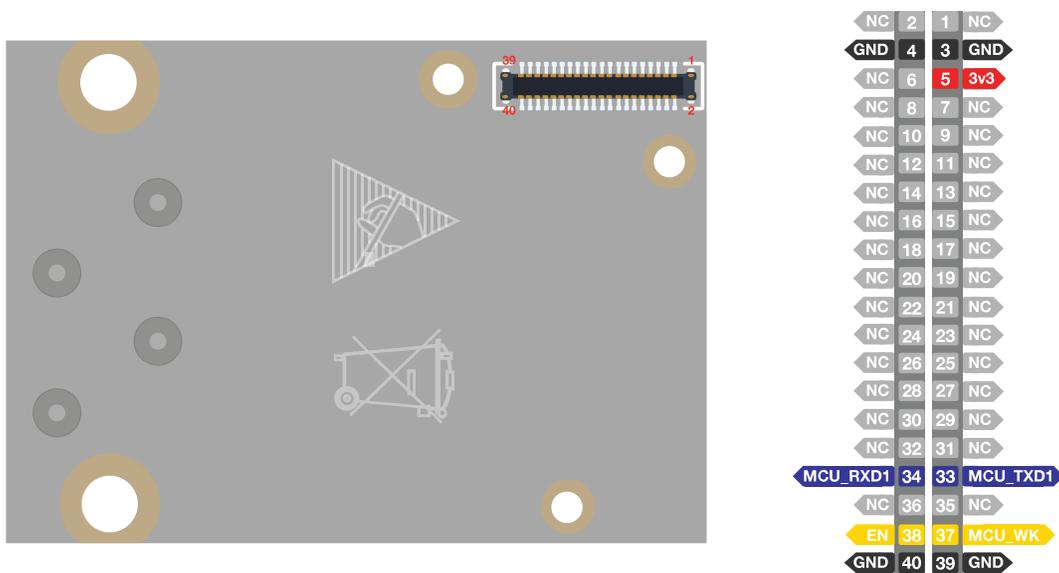


Figure 3: RAK13005 WisBlock LIN Module Pinout Diagram

Electrical Characteristics

Recommended Operating Conditions

Symbol	Description	Min.	Nom.	Max.	Unit
VS	Supply Voltage Range for Normal Operation	5.5	-	27	V
Tj	Junction Temperature	-40	-	85	°C
I _{sleep}	Current Consumption at VS in Sleep Mode	-	5	12	uA

Mechanical Characteristic

Board Dimensions

Figure 3 shows the dimensions and the mechanic drawing of the RAK13005 module.

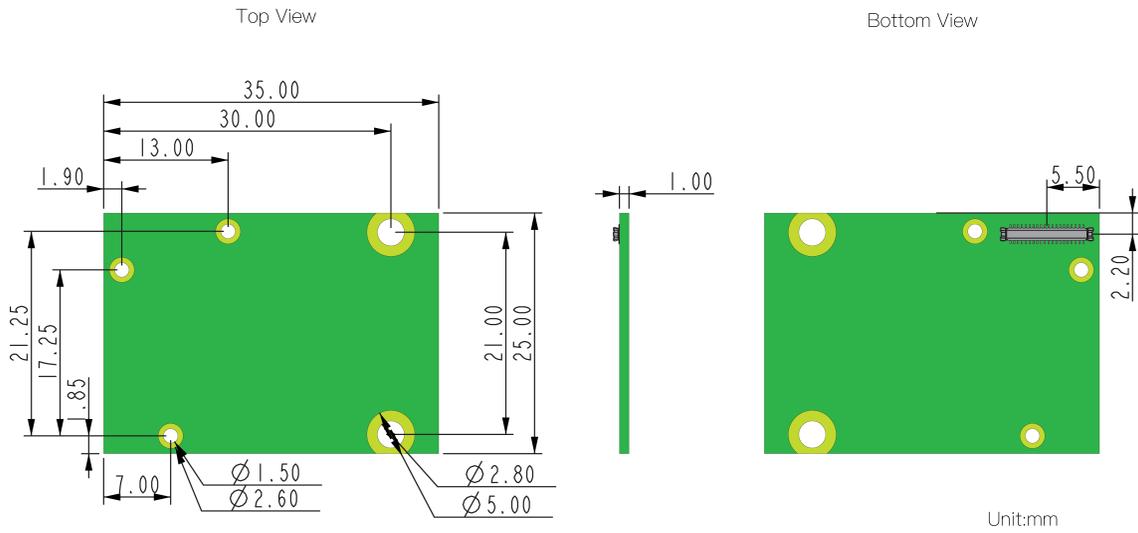


Figure 4: RAK13005 WisBlock LIN Module Mechanic Drawing

WisConnector PCB Layout

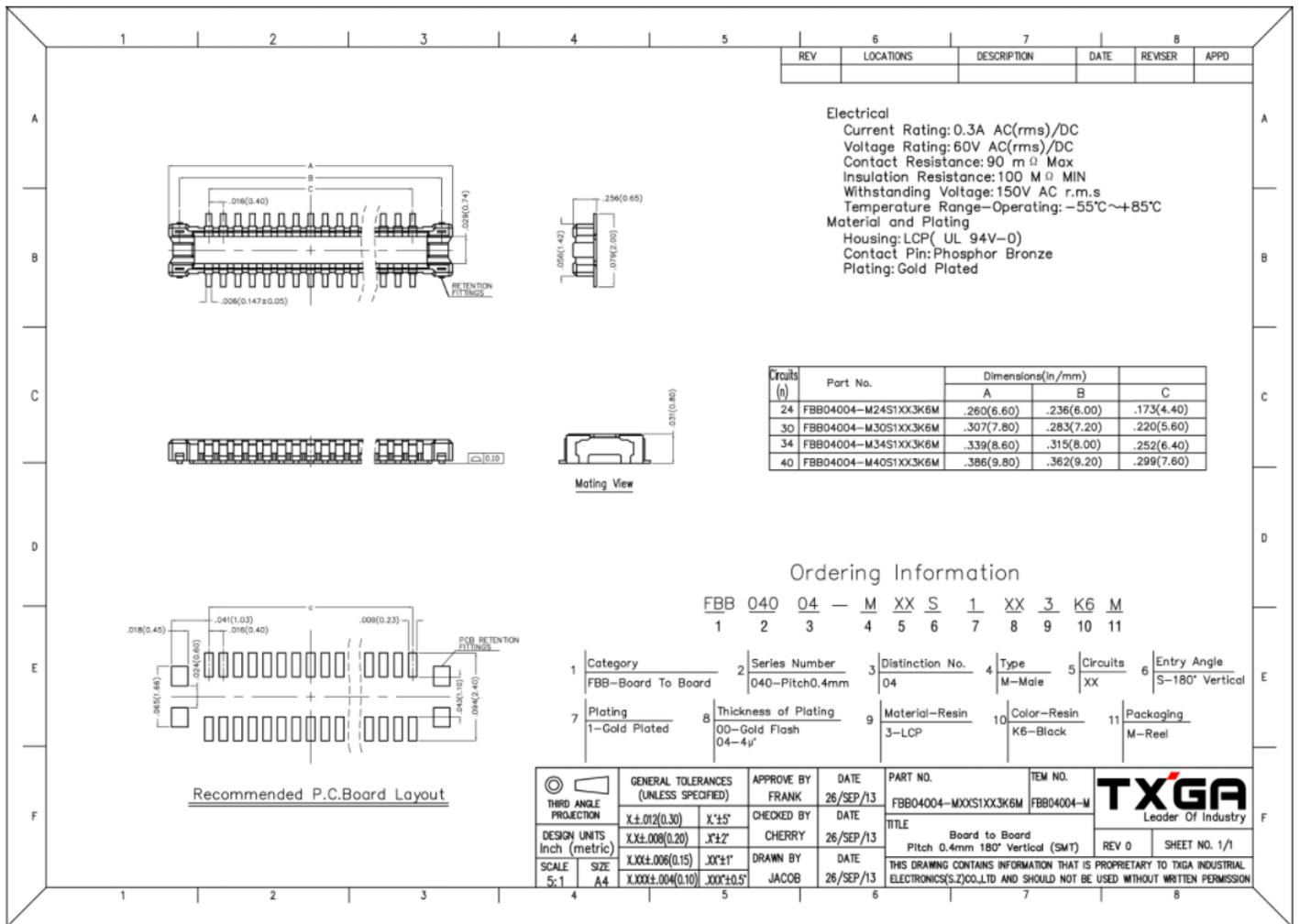


Figure 5: WisConnector PCB Footprint and Recommendations

Schematic Diagram

Figure 5 shows the RAK13005 schematic.

- **J2** is the LIN bus connector.
- **J1** is the 40-pin WisConnector.
- **VS** is the LIN bus power supply pin.
- **EN** is the Enable input IO6 which is an active-high pin.
- **WK** is the Wake input which is an active-low pin.
- **VIN** range is 5.5 to 27 V.

NOTE:

The **MCU_WK** pin (IO5) is connected to the **Q1** transistor, and the **Q1** collector is connected to the **WK** pin. **Q1** works as an inverter, thus in normal operation, set **MCU_WK** to the high level.

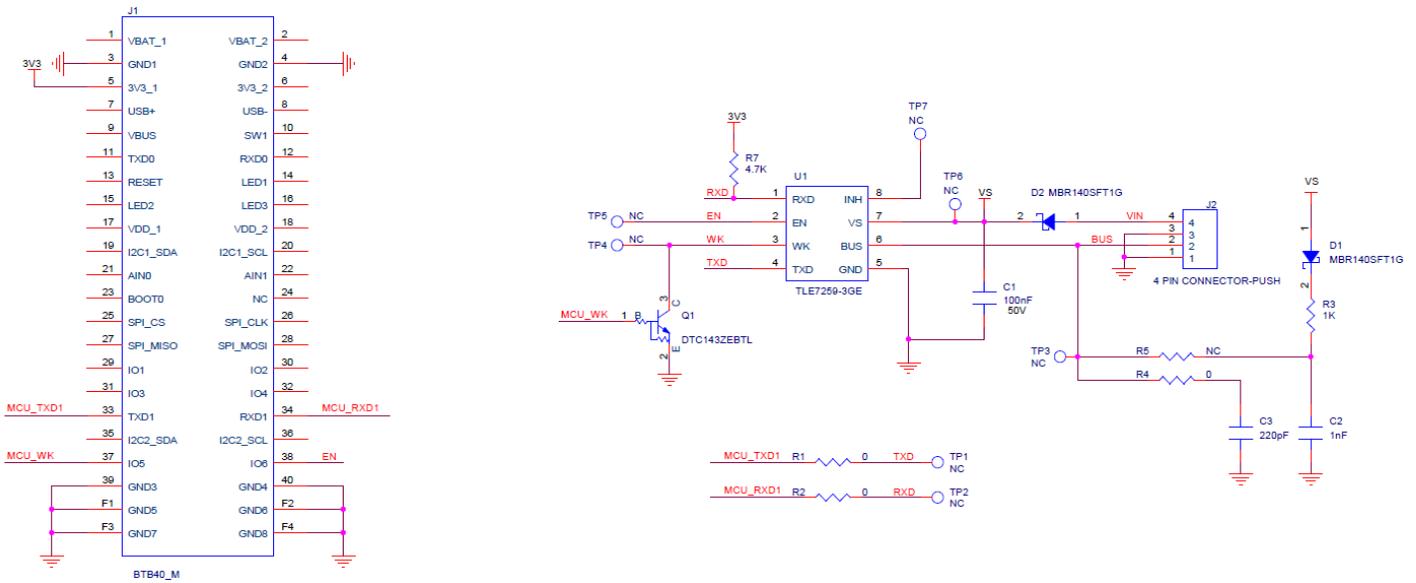


Figure 6: RAK13005 Schematic Diagram

NOTE:

- With **R5** soldered, the RAK13005 works as a LIN controller(master).
- With **R4** soldered, the RAK13005 works as a LIN peripheral(slave).

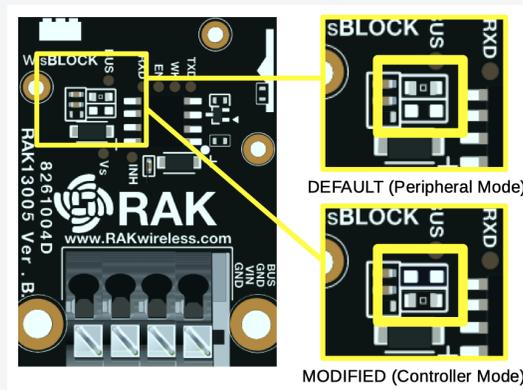


Figure 1: RAK13005 LIN Mode Configuration