LORAWAN® NETWORK
BASED ON IOT VEGA SERIES EQUIPMENT AND SOFTWARE

DEPLOYMENT AND CUSTOMIZATION MANUAL

In this Manual the LoRaWAN® network deployment and customization are described which includes initial setting up of the server, gateway connection, end devices connection to the network with using the server administration program

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INTRODUCTION

This Manual is designated for an equipment and software manufactured by Vega-Absolute OOO and determines the order of deployment of the LoRaWAN® network using these products.

The Manual is targeted at specialists having experience in Linux area, network connections and minimal experience of networks administration.

While network deployment and customization there are may occur extra situations which unforeseen in this manual so that for guarantied result the network deployment must be carried out by the qualified specialists

1 GENERAL NETWORK DESCRIPTION

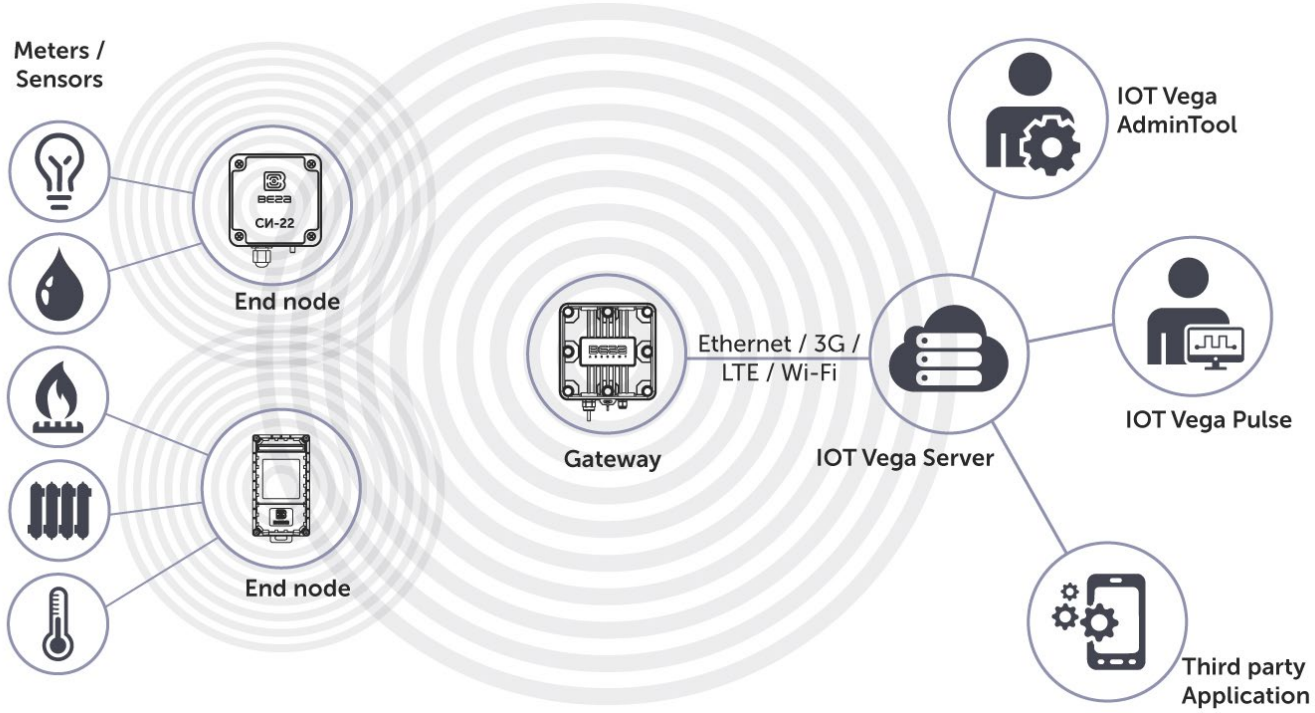
LoRaWAN® network is a radio network. The server communicates with end devices through radio repeaters which are Vega BS gateways.

Gateways registered on the server and linked to the server.

End devices also registered on the server and linked to the server.

There are no links between gateways and end devices. Gateway transmits server messages to the network and all end devices which are placed in the spread signal radius receives those messages. Vice versa is the same, the end device transmits messages everywhere and all gateways in range receive those messages and transmit on the server to which they are linked.

Messages contain identificational data, so the server does not proceed the messages from devices which are not registered on the server and likewise the end device does not proceed messages which are intended for another end device.



Thus, the network deployment begins from the server organization on the appropriate equipment. The server must work round the clock to provide the network operation.

Further you need to provide the connection between gateway and the server after what you may start to connect the end devices.

2 MINIMUM NECESSARY FOR BUILDING A NETWORK

Software

IOT Vega Server
IOT Vega AdminTool
IOT Vega Configurator
COM-port driver
USB driver
PuTTy or another terminal application for work through SSH
LoRa Scaner (optional)

Equipment

Gateway
Antenna
POE-adapter
Computer with USB and Internet available (Desktop / Laptop / Tablet)
Network equipment
End devices (selectively)

Documentation

User Manual for IOT Vega Server
User Manual for Vega LoRaWAN Configurator
Gateway User Manual
User Manuals for End devices (selectively)

Other

mini-USB cable for connection the gateway to the computer
micro-USB cable for connection some end devices (if necessary)
FSK-dongle for connection some end devices (if necessary)

Software and documentation are on en.iotvega.com website.

PuTTy – free software which may be found on the developer website.

3 NETWORK DEPLOYMENT PROCESS

Network deployment need a several steps.

1. Installing and customizing of the server.
2. Gateway connection to the server.
3. End devices connection to the server.
4. Mounting the equipment of the work placement.

The first step is carried out with the computer which will become the server and will work round the clock.

The second and third steps you may do at any comfortable place with computer connected to the Internet.

The fourth step is carried out at the placements of mounting the specific devices.

STEP 1 - IOT VEGA SERVER

After downloading the archive with the necessary server version, you should unzip the archive, go to the folder, and open the **settings.conf** file with any text editor. This file contains server settings. The contents of the file are shown below. The lines in which changes should be made are highlighted in red, the comments of the file are displayed in blue, and the comments of this manual are green.

```
# Host connection settings
[host]
# IP-address for UDP connection (gateway connection)
ip=127.0.0.1 – here you need to specify IP address of the computer where the server is located
# Port for UDP connection (gateway connection)
udpPort=8001 – this port is used for gateway connection to the server
# Port for TCP (WebSocket) connection
tcpPort=8002 – this port is used by the external applications and for connection to the server through IOT Vega AdminTool
# "path" part of webSocket address
webSocketPath=/
# Flag of using SSL encryption for WebSocket
useSSL=0
# SSL certificate filename (certificate must be in server's directory)
certFileName=cert.crt
# SSL key filename (key must be in server's directory)
keyFileName=key.key

# LoRaWAN network settings
[lora]
# LoRaWAN network identifier (should be random between 1 and 127)
networkID=1 – network ID is must be changed in case of more than one network is deployed nearly; at other cases it is not necessary
```

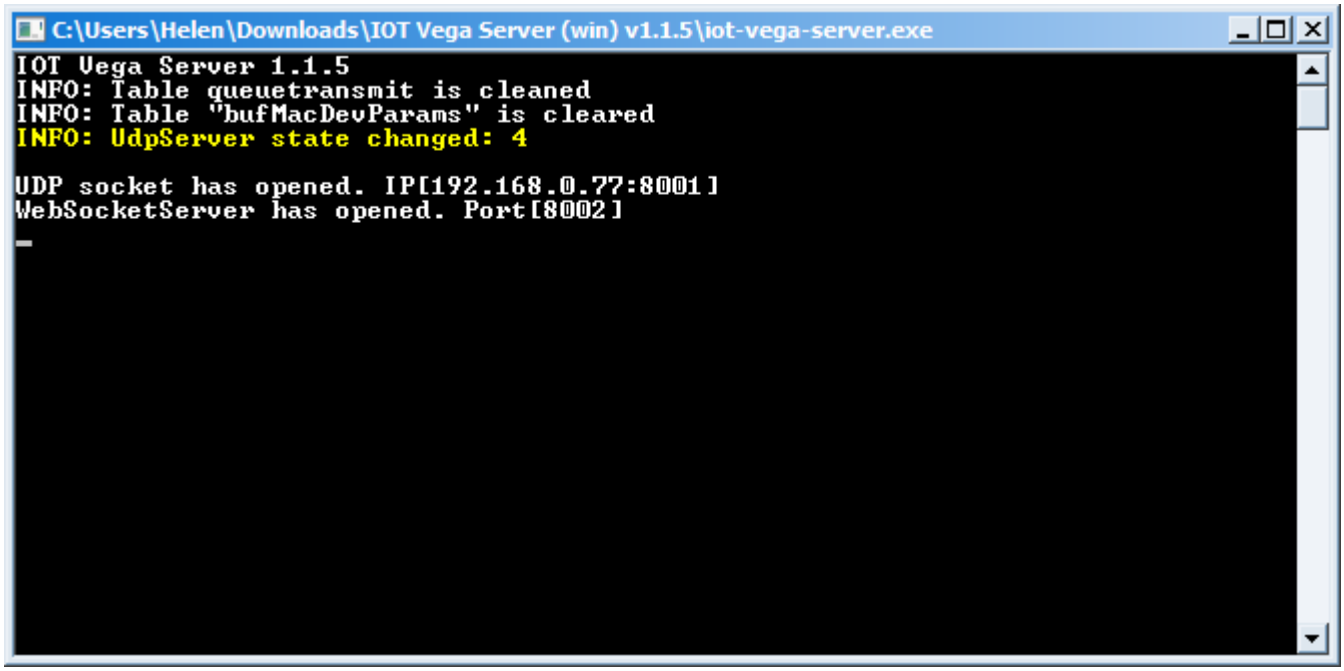
```
	# Flag for using Plug-and-Play gateways function.
	# If this value is 1, server would automatically append all gateways which connected to one
	usePnPGateway=1

	# Super user options
	[root] in that part you may specify login and password for super user; this data will be used when accessing the server through the application IOT Vega AdminTool
	# Login for super user
	root=root
	# Password for super user (recommendation: change this password to your own)
	password=123

	# Console settings (volume of debug information)
	[console]
	# Maximum level of console messages that will be shown (levels of messages represented below)
	maxMsgLevel=20
	# Maximum level of console messages that will be saved into LOG file (levels of messages represented below)
	maxLogMsgLevel=0 during the initial work with the network, it is better to change this value to 20 so that as much information as possible is output to the log file for further calls to the support service; when the network is stable and the number of devices increases too much, it makes sense to lower the level of information content of the log file for easier file search
	#    Console message levels:
	# errors   = 0
	# uplink   = 1
	# downlink = 2
	# warning  = 3
	# info          = 4
	# debug    = 20

	# External DataBase settings
	[external_db] in this section, you should make changes only if you want to configure work with an external database; by default, the external database is disabled, and the server works with its own database
	# Flag of using external DB
	useExternalDb=0
	# Type of external DB. Supported only next types:
	#    MYSQL
	#    SQLITE
	typeExternalDb=MYSQL
	# Name of external DB (schema's name for MYSQL)
	nameExternalDb=server
	# IP and port of DB's server ("localhost" is supported)
	ipExternalDb=127.0.0.1
	portExternalDb=5505
	# User login and password (user should have maximum level of privileges)
```

```
userExternalDb=admin
passwordExternalDb=admin
```

After making the necessary changes, the settings file should be saved and closed.

For correct server operation you need to install drivers **openSSL** and **msvc c++ 2013**, folder with which are located at the server root folder.

After that you can launch the file **iot-vega-server.exe** and make sure that the server works.



The lines *UDP socket has opened* and *WebSocketServer has opened* show the correct server operation, and absent of any error messages.

You must not close the server; it is need for network operation.

STEP 2 - GATEWAY

After starting the server, you can begin to connect and configure the gateway. To connect the gateway to the computer, you will need to install the driver for the COM port (it can be downloaded on the iotvega.com website from the gateway page).

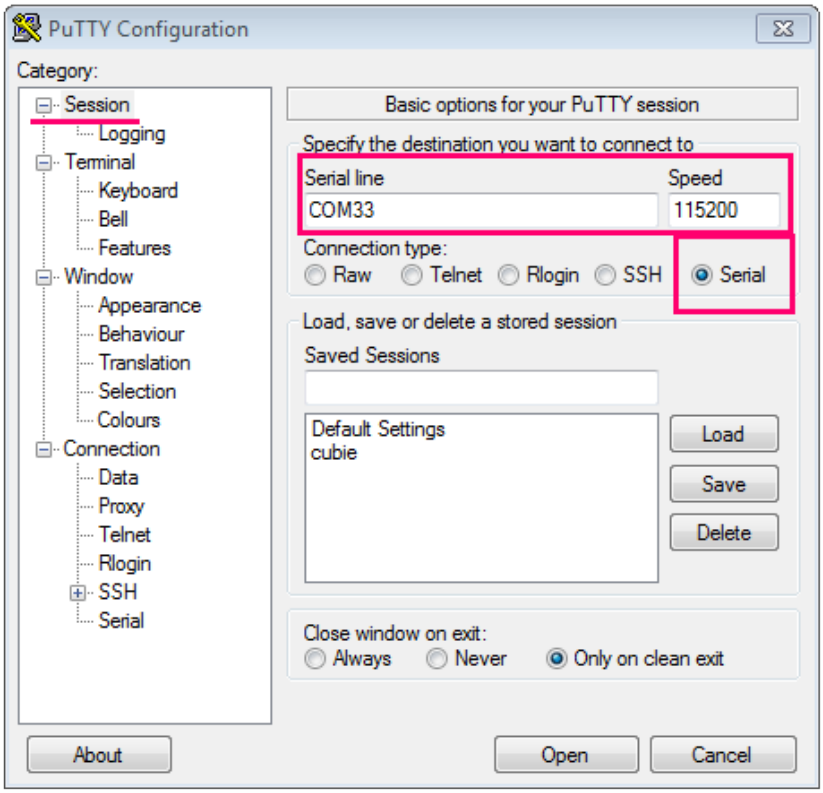
Please note that the website contains two types of drivers for different types of MCP2200 and CP210x chips responsible for the operation of the COM port. If you cannot determine the type of chip used in the gateway, just install both drivers.

You also need a PuTTY terminal program or any other terminal program that supports SSH connection.

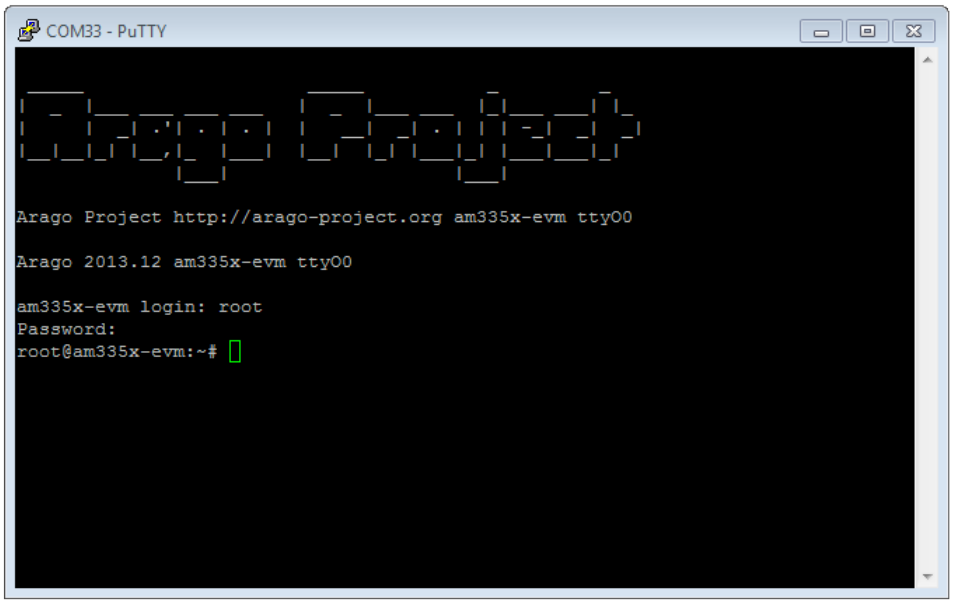
For Vega BS-1.2 and Vega BS-2.2 gateways, there is an additional setting option via the pre-installed Web-interface, the description of which can be found in the Gateway User Manual (part 4). The following describes the configuration method through the terminal program, available for all models of gateways manufactured by Vega-Absolute.

Connection is carried out in the following order:

1. Connect the gateway to POE-adapter.
2. Connect POE-adapter to the LAN connector of the network equipment and to the power network.
3. Connect the gateway to the computer through USB.
4. Install the COM-port driver. Make sure that in the device manager in the "Ports" part the COM-port of the connected gateway appears and remember its number.
5. Open the PuTTY program, make connection through serial port as described in User Manual on the gateway.
6. After that open the PuTTY program, choose **Serial** connection way and enter the virtual COM-port number of the gateway and speed (115200) at the correspond fields.
7. Press **Open**.



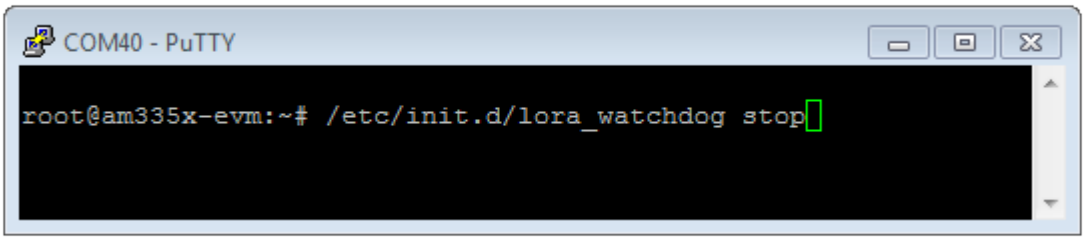
After connecting to the gateway, a PuTTY terminal window will appear, where you need to enter your login and password. By default, the **root** login and password **temppwd** are used to connect to the gateway (no characters will be displayed when entering the password). When connecting for the first time, it is recommended to change the password for individual access.



8. Now you can configure the gateway.

Packet forwarder application starts automatically when system starts. Before the gateway configuring you need to stop Packet forwarder process by the command:

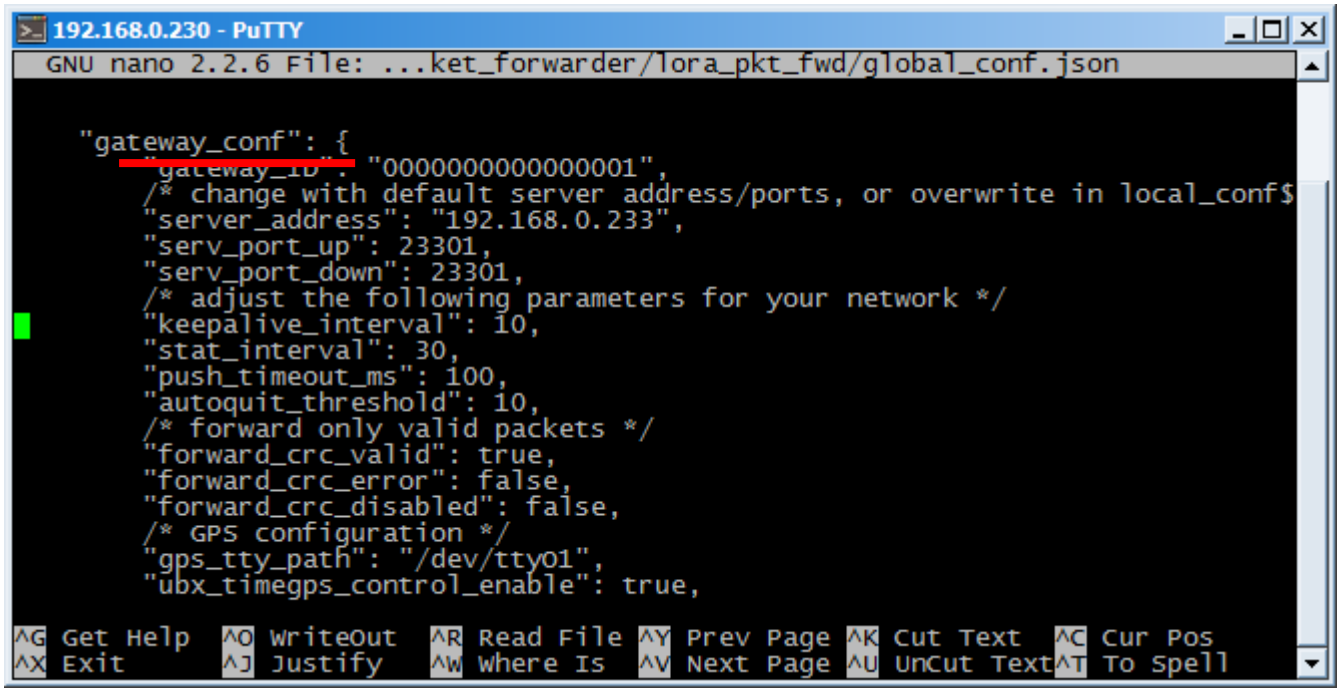
/etc/init.d/lora_watchdog stop



For settings changing you need to enter the command:

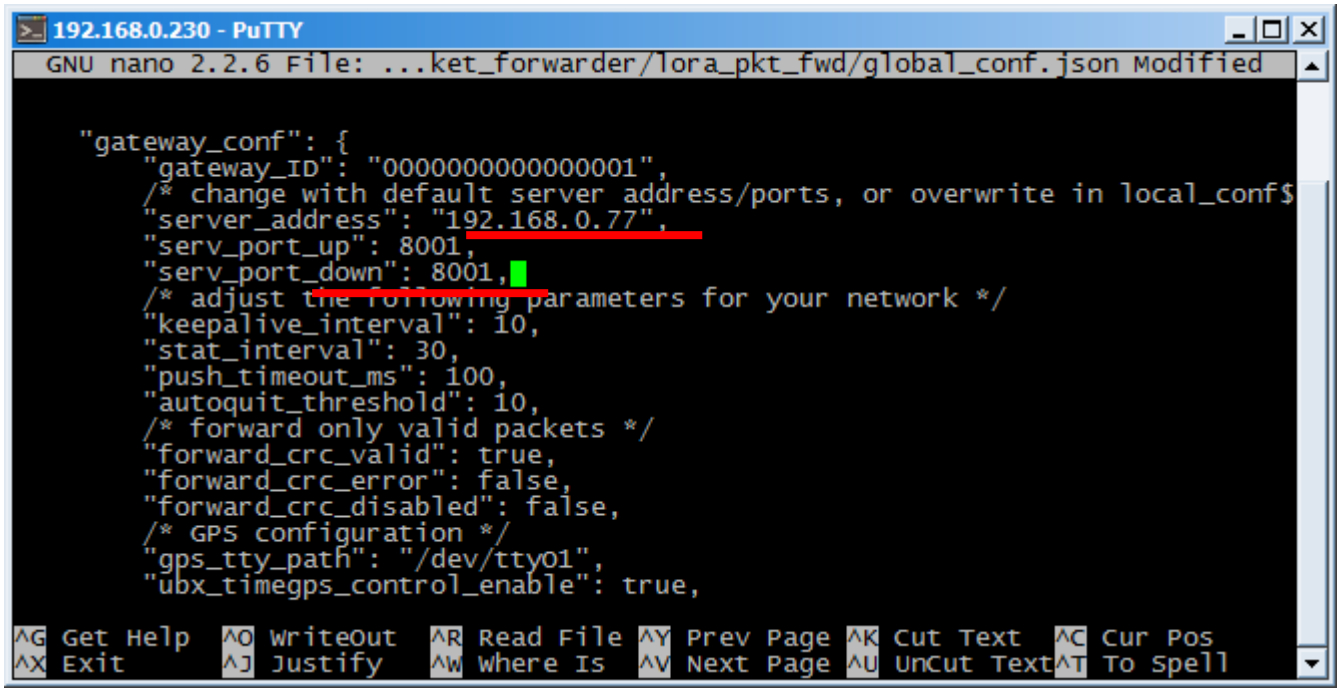
nano LoRa/packet_forwarder/lora_pkt_fwd/global_conf.json

Scroll configure file down to line gateway_conf.



In that part you need to specify IP address and UDP port of the server which are specified in the server configure file **settings.conf**.

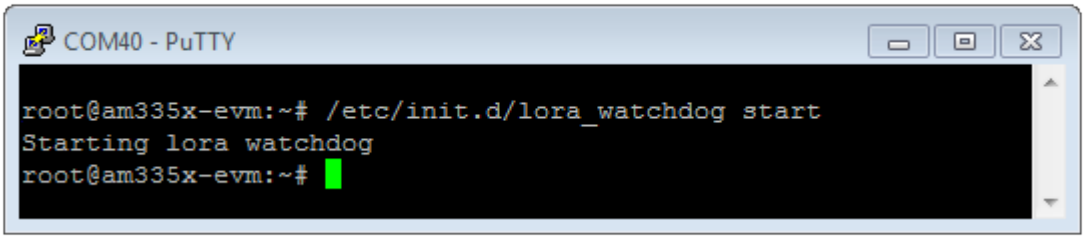
Specify the same port at the lines **serv_port_up** and **serv_port_down**.



After making changes, press ctrl+X - exit the file. To the proposed question about saving changes, press the Y key. Confirm with the Enter key.

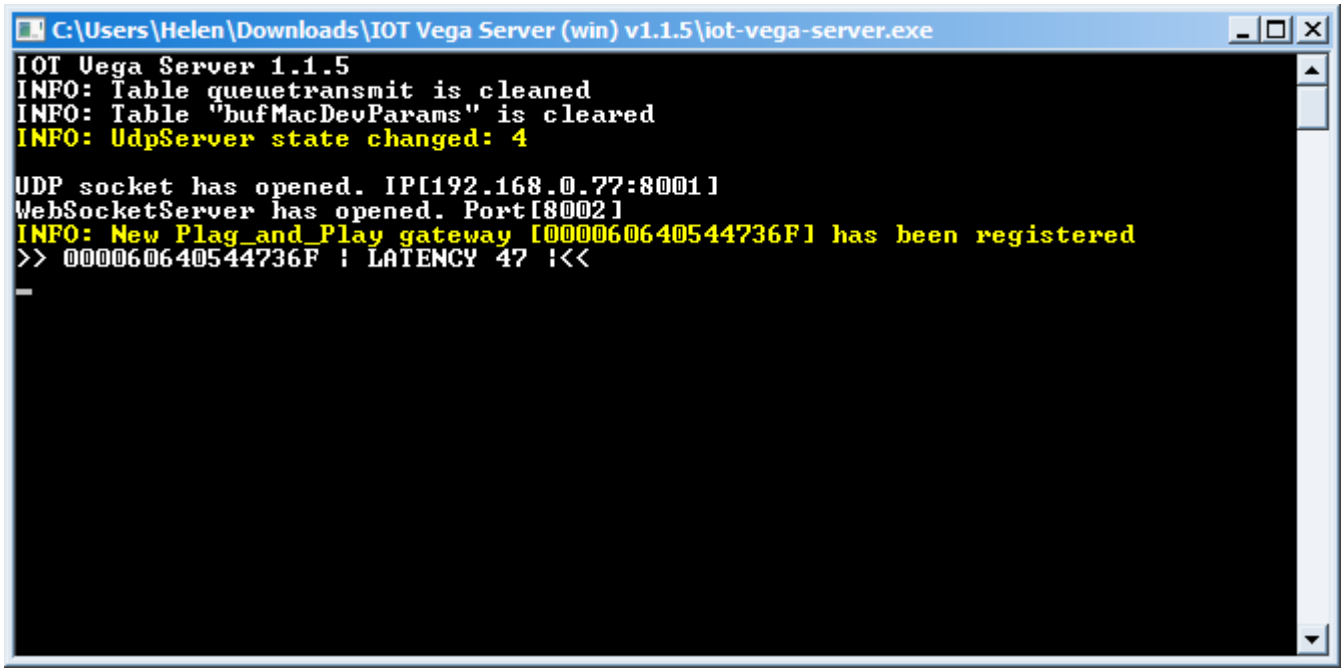
After changing the settings of the gateway, you must start the process again:

/etc/init.d/lora_watchdog start



After which the Packet forwarder process will be launched with the new settings.

A record of the connected gateway will appear in the server window. Pay attention to the response value (LATENCY parameter), it can vary depending on the quality of communication from 0 to 100 over Ethernet and from 100 to 500 over 3G in the normal range.



The server and the gateway see each other, now you can close PuTTY. Server must be stay open.

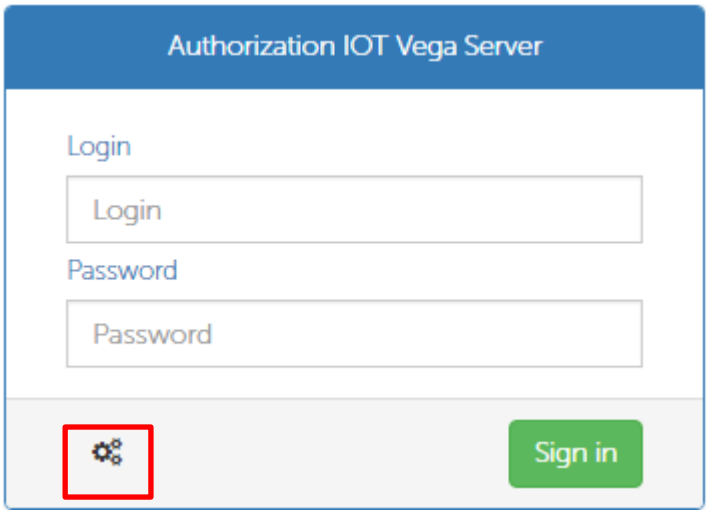
IOT VEGA ADMINTOOL

Open the folder with application, find **config.js** file and open with any text editor. The file contains the setting for web interface AdminTool. The contents of the file are shown below. The lines in which changes should be made are highlighted in red, the comments of the file are displayed in blue, and the comments of this manual are green.

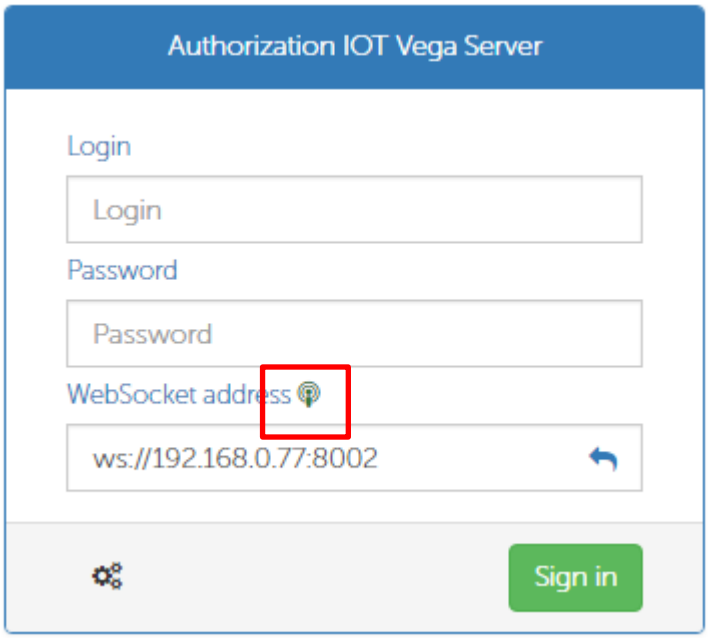
```
const address_ws = 'ws://192.168.0.1:8002'; - websocket Iot Vega Server address

const demo_user = false; - the parameter enables and disables the display of the user's demo button on the authorization panel. Valid values are true - show, false - hide.

A demo user is a user with login "demo" and password "demo". The demo user is not on the server by default, you need to register it.

const select_server = false; - the parameter enables and disables the display of the websocket server selection button on the authorization panel (the button looks like gears). Valid values are true - show, false - hide.

//const stock_address_ws = ['ws://192.168.0.1:8002','ws://127.0.0.1:8002']; - a set of addresses of websocket servers for quick change of connections, by default the line is commented out, but if you want to activate this option, then commenting should be removed. A quick address change is carried out on the authorization page by double-clicking on the connection indicator (in the form of an antenna).

const map_tiles_leaflet = { - map source, default is OpenStreetMap

    url: "https://{s}.tile.openstreetmap.org/{z}/{x}/{y}.png",

    options: {

        attribution: '&copy; <a href="https://www.openstreetmap.org/copyright">OpenStreetMap</a> contributors'

    }

}
```

You should change IP address and port number in corresponding with specified in the server configure file settings.conf, but this time use the TCP port. After that save and close the file.

Launch the index.html file with any browser. Web page will open with entering fields for login and password. Firstly, press the gear button.



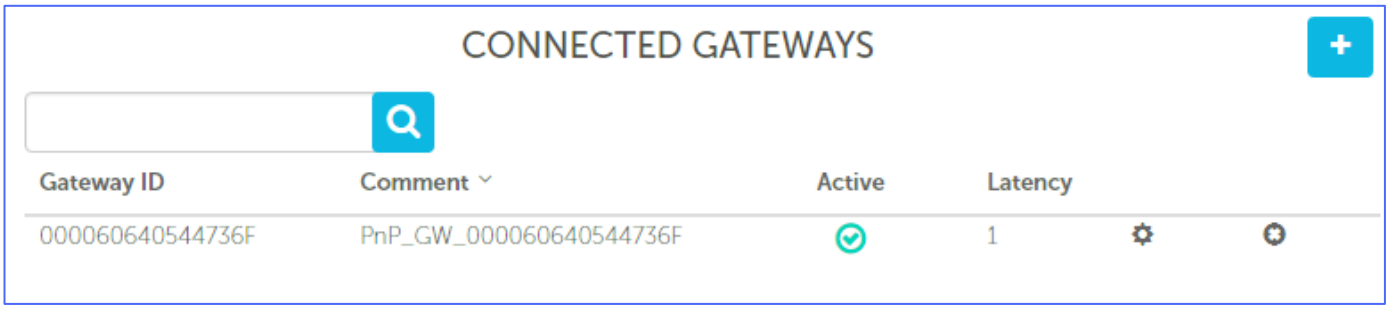
A line appears with the address and port of the server specified in the **config.js** settings file, as well as the icon of connecting status to the server. A green icon means a successful connection.



In the Login and Password fields you must enter ones specified in the **settings.conf** file. Press **Sign in**.

IOT Vega AdminTool started.

In the **Gateways** tab, you can see the connected gateway.



The **Active** column displays the status of the gateway, a green checkmark means that the gateway is transmitting data to the server.

STEP 3 – CONNECTION OF THE END DEVICES

Before connecting the device to the computer for the first time, you must install the driver for the COM port **stsw-stm32102**, which can be downloaded from iotvega.com. After running the executable file **VCP_V1.4.0_Setup.exe**, the installer window will appear.

In this window, you need to click **Next**, then **Install**, and then the installation will begin. When the installation is completed successfully, the following screen appears.

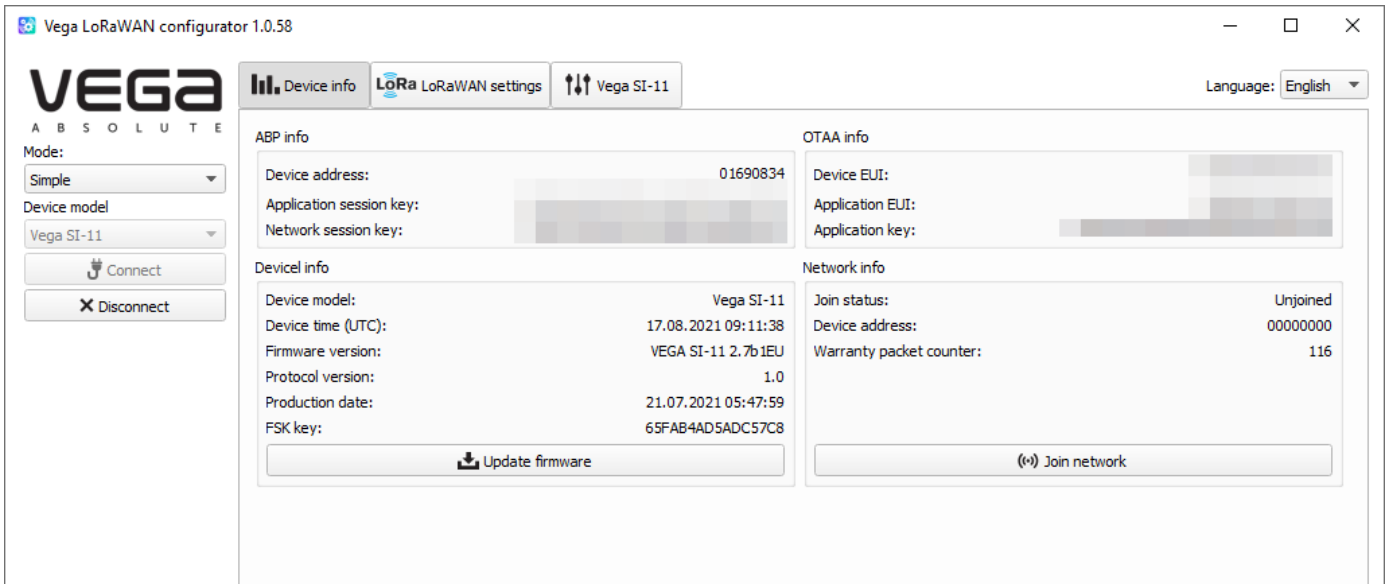
After pressing **Finish** the driver is ready for operation, - it is possible to connect the end devices via USB. If you have problems installing the driver, see Appendix 1.

All end devices are adjust using the “Vega LoRaWAN Configurator” application while USB connecting. For a detailed acquaintance with the program, see the User Manual for the program.

For the connection to the device, perform the following steps:

1. Connect the USB cable to the device.
2. Start the "Vega LoRaWAN Configurator" application.
3. Click the "Connect" button in the menu on the left.

The application automatically recognizes the device model, and the device selection menu becomes inactive.

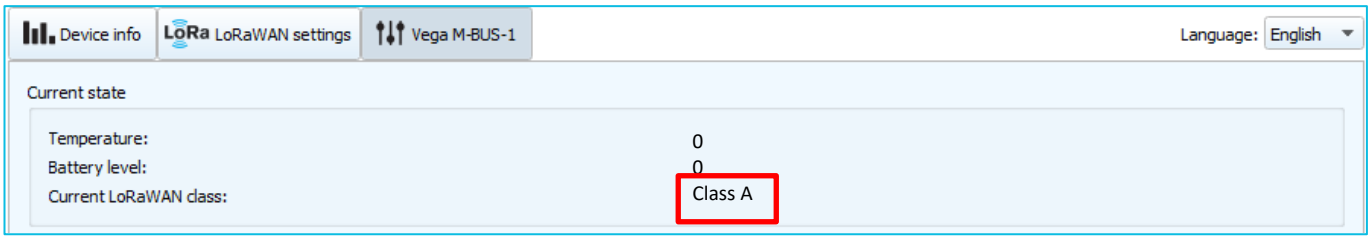


All you need for device connection to the network is in the “Device info” tab: ABP info and OTAA info.

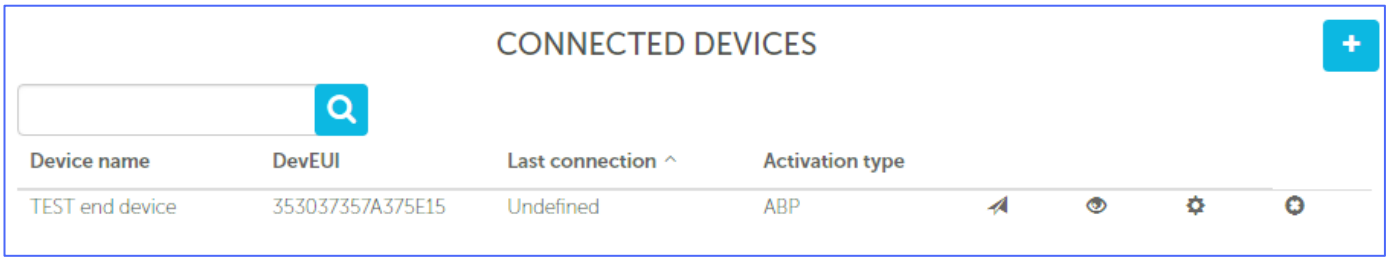
ABP info - displays the data necessary to register the device in the LoRaWAN network with ABP method (Activation By Personalization).

OTAA info - the data required to register the device in the LoRaWAN network with OTAA method (Over The Air Activation) is displayed).

You may find out the device class on the web site or through the «Vega LoRaWAN Configurator» in the device tab.



After filling in all the fields, click the "Save" button. The device will appear in the connected devices list.



In the "Vega LoRaWAN Configurator" program, click the "Join Network" button. Make sure that the packet came to the server, information in the column **Last connection** will appear with the date and time of the last packet.

Now you can configure the device in the "Vega LoRaWAN Configurator" program in accordance with the User Manual for the specific device. Then disconnect the device from the computer.

Thus, you can connect any end-node devices to the LoRaWAN network.

STEP 4 – EQUIPMENT MOUNTING

Now that the LoRaWAN network has been built and is functioning successfully, you need to place the gateway and end devices where they will operate continuously.

The operation of the network largely depends on the correct relative position of the gateway antenna and end-node devices. You can check the signal quality using the LoRaWAN network tester. The order of work depends on the specific purposes for which the network is being built, and the order of placement of devices and antennas is selected in accordance with them.

The basic recommendations for the placement of the antenna are given in the User Manual for the gateway. General rule - the antenna should be located at a high point, in open space, so that nothing would interfere with the signal propagation. The more powerful the antenna, the further the signal travels, so it is recommended to use an antenna with a gain of at least 10 dBi. With such an antenna, the coverage area of the gateway can reach 5 km in the city, and 15 km outside the city. Thus, it is not necessary to place the antenna with the gateway in the same building where the end devices will be located. If it is required to provide data collection from two buildings located at 7 km from each other, then the gateway can be placed approximately between these buildings. So, the gateway will be at 3.5 km from each building and will confidently collect data from the end devices.

The gateway connects to the antenna with the wire, so it can be located anywhere convenient for connecting to an Ethernet or 3G network.

After installing the gateway and the antenna and checking the correct operation of the gateway through IOT Vega AdminTool, you can proceed with the installation of the end devices.

Using a network tester, you can verify the signal quality at the installation point of the end device. Next, connect the device according to the scheme which shown in User Manual for a specific device. And press the activation button.

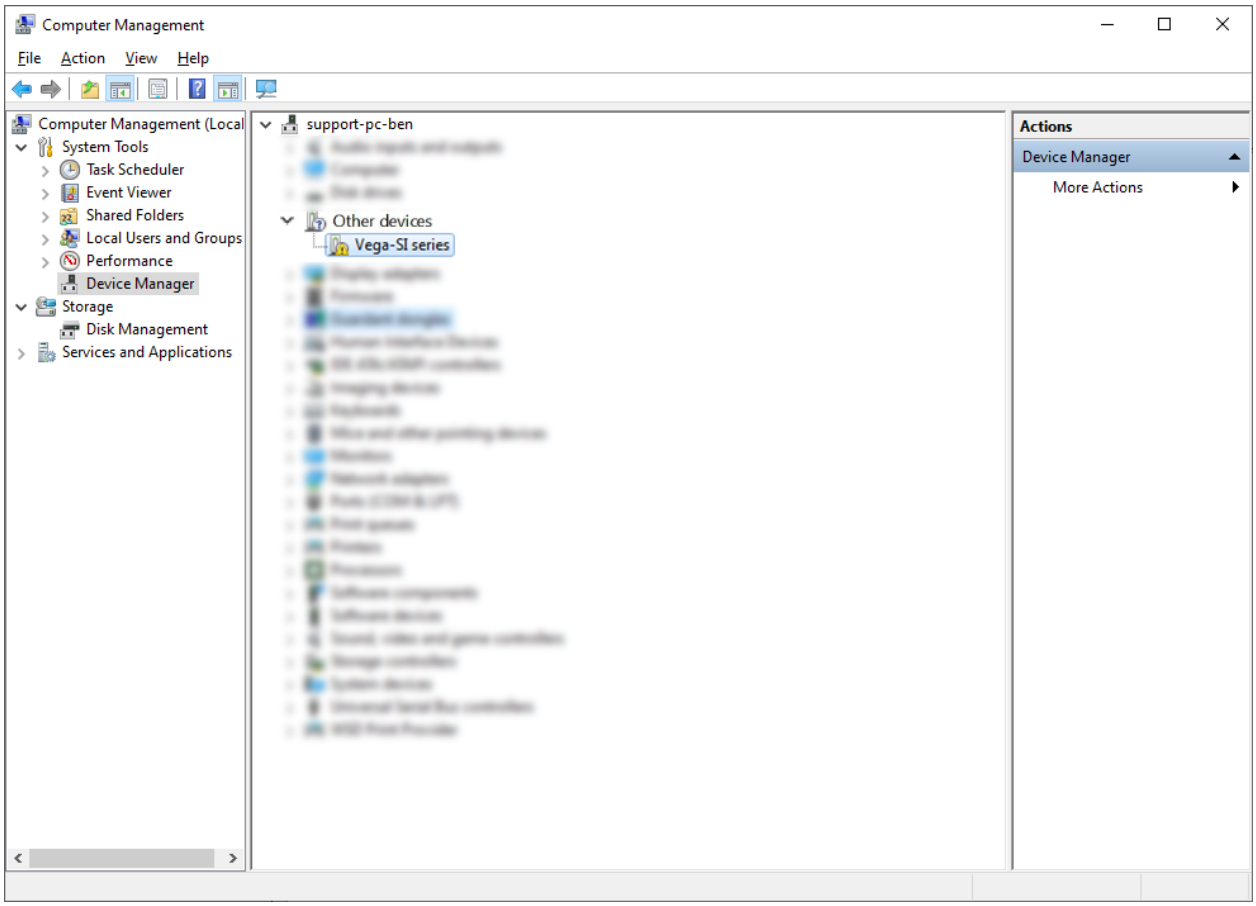
Devices with pulse inputs, when external meters are connected to them, can accumulate random pulses. After completing the mounting of such a device, it is necessary to reset these readings by holding the activation button for 5 seconds, and then turn on the device again.

The correct operation of the end devices can also be checked through IOT Vega AdminTool.

Network building is complete.

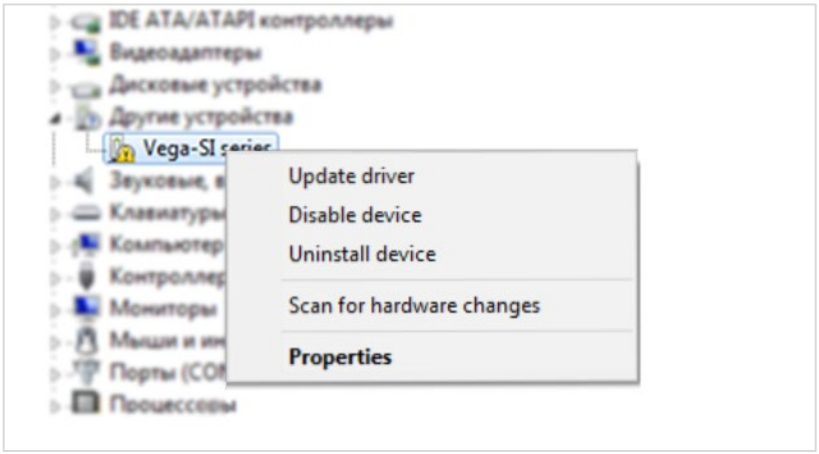
APPENDIX 1 – TROUBLESHOOTING FOR DRIVER STSW-STM32102 INSTALLATION

One of the frequently occurring problems when installing the stsw-stm32102 COM port driver is that after installing and connecting the target device via USB, the device is not detected as a device with a virtual COM port.

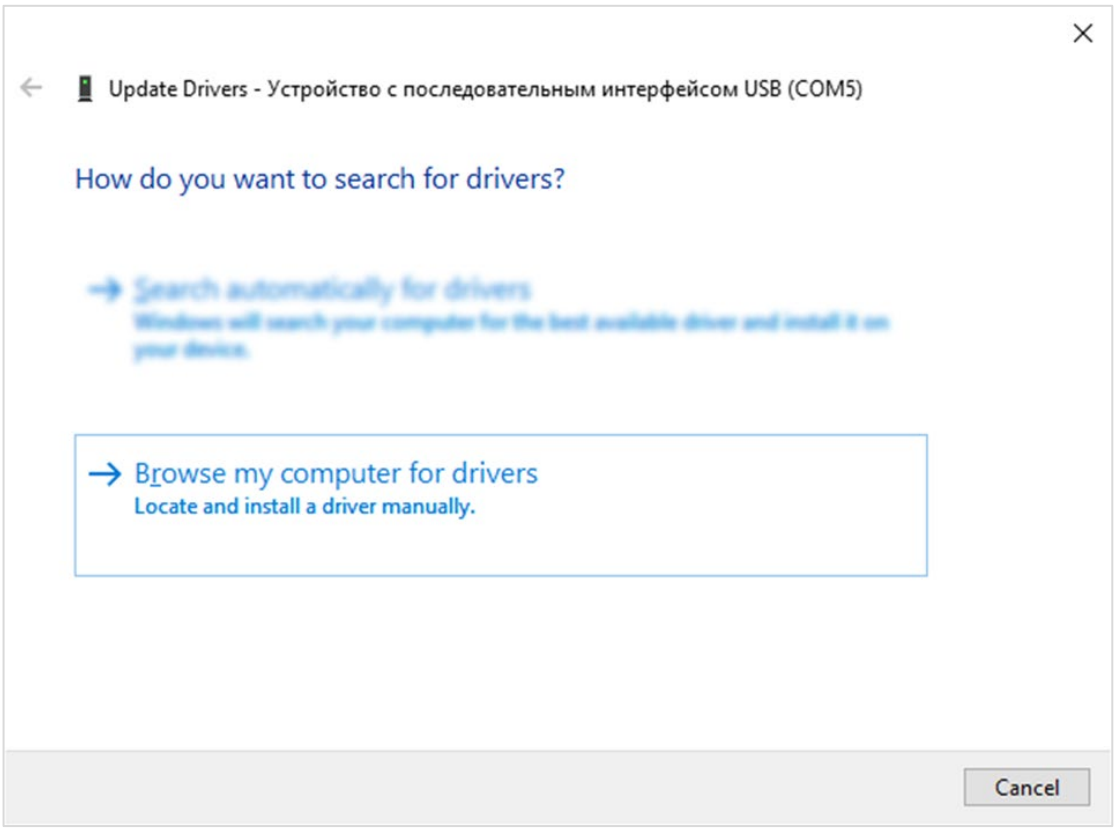


To resolve this issue, we recommend that you do the following:

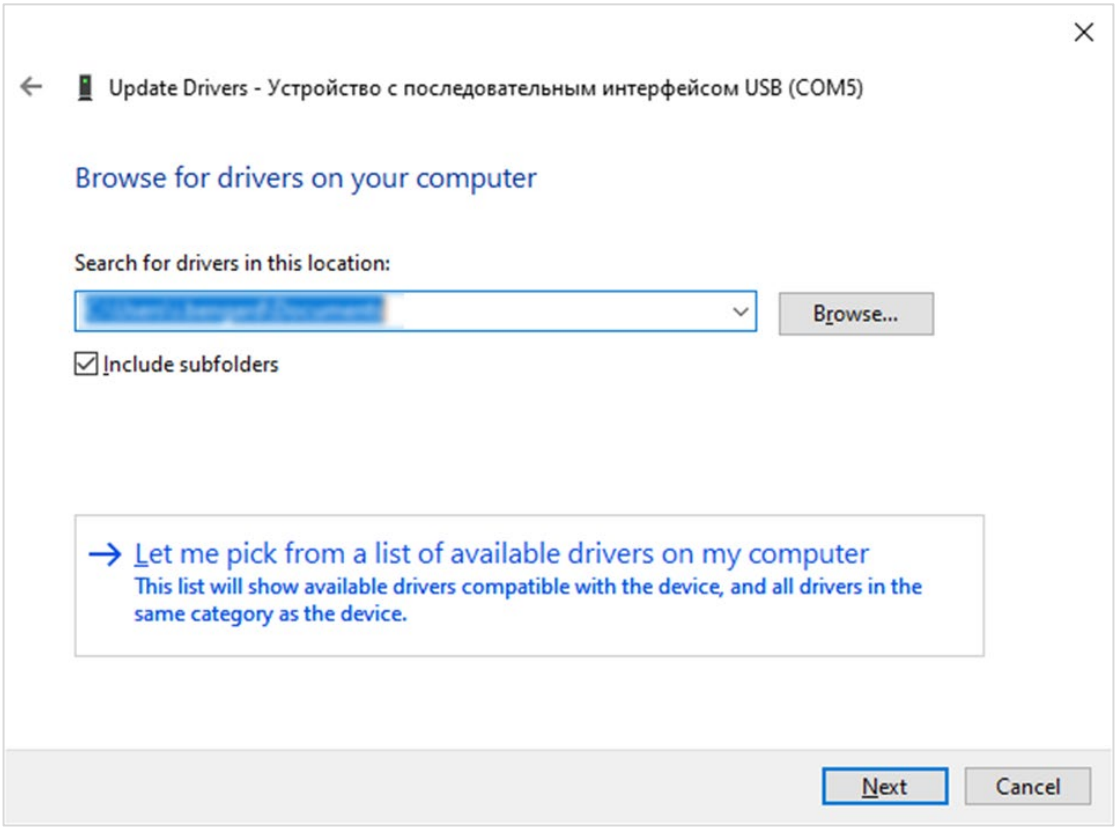
1. Right-click to open the context menu -> Update driver



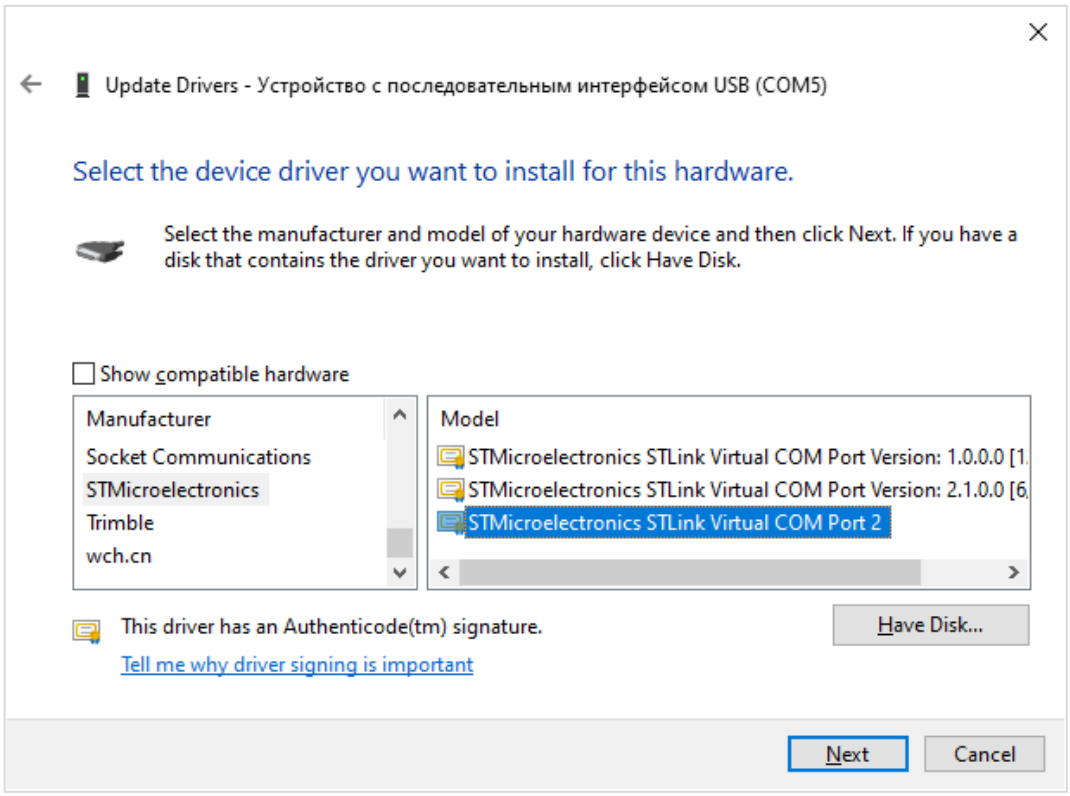
2. Select "Browse my computer for drivers".



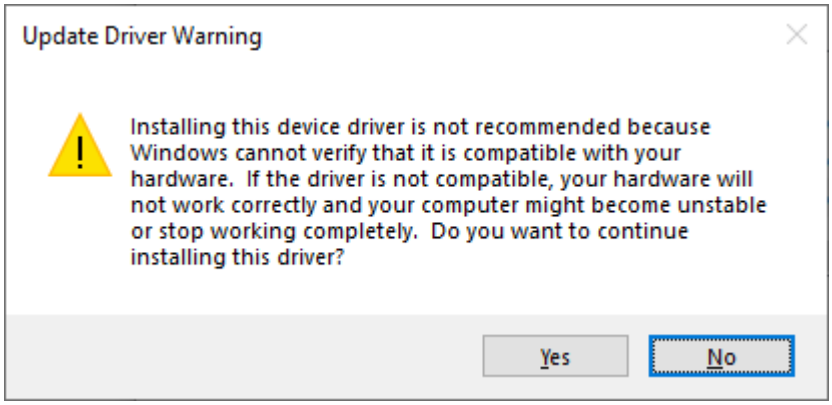
3. In the window that opens, select the item "Select a driver from the list of already installed drivers".



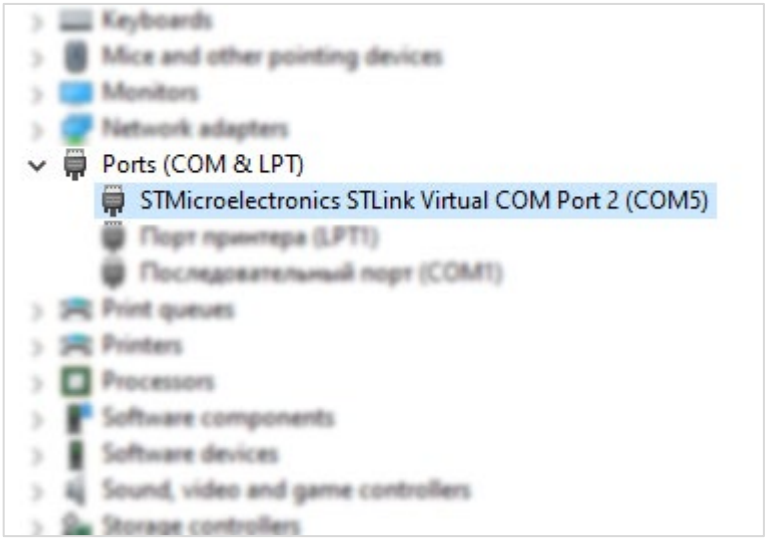
4. Next, find the line "STMicroelectronics" in the list, select it, and click "Next".



5. In the window that appears, click "Yes".



After completing all the steps, the device should be correctly identified in the Device Manager.



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03	13.01.2020	KEV	Minor changes
04	04.03.2022	KEV	Scheduled revision of documentation

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