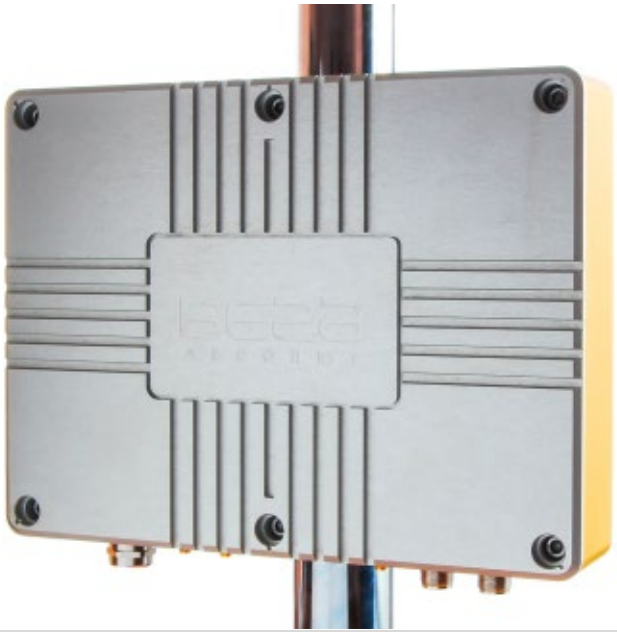
GATEWAY

VEGA BS-3

User Manual



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CONTENT

INTRODUCTION 3
1 DEVICE PURPOSE AND OPERATION PRINCIPAL 4
2 SPECIFICATION 5
3 OPERATION 6
Device appearance 6
Control instruments – buttons and switches 11
Indication 12
Mounting Recomendations 13
Antenna mounting recommendations 14
4 CONFIGURING OF THE GATEWAY 15
Gateway connecting to the computer – the operation begining 15
Operation with the configuration file 19
Configuration of a static IP-adress for the gateway 24
Gateway setting up for LTE operation 27
Recommendations for gateway using in white IP net 29
5 STORAGE AND TRANSPORTATION REQUIREMENTS 31
6 CONTENT OF THE PACKAGE 32
7 WARRANTY 33

INTRODUCTION

This manual is designed for Vega BS-3 gateway (hereinafter – the gateway, BS) manufactured by Vega-Absolute OOO and provides information on powering and activation procedure, control commands and functions of the gateway.

This manual is targeted at specialists familiar with installation work fundamentals for electronic and electrical equipment.

The gateway shall be installed and adjusted by qualified specialists to ensure proper operation of the device

Vega-Absolute OOO reserves the right to make changes to the manual related to the improvement of equipment and software, as well as to eliminate typos and inaccuracies, without prior notice.

1 DEVICE PURPOSE AND OPERATION PRINCIPAL

Vega BS-3 gateway is designed to deploy LoRaWAN® network within 863-870 MHz frequency plan.

The gateway operates with Linux operating system and is supplied with pre-installed Packet forwarder software.

The Vega BS-3 gateway has 16 channels and the ability to connect an expansion card that allows the gateway to work on 64 channels.

The gateway is powered and communicates with the server via the Ethernet channel.

The device is configured through Ethernet with SSH protocol or while direct connection to the device board with USB cable. For connection to the gateway, you will need terminal program (e. g. PuTTY).

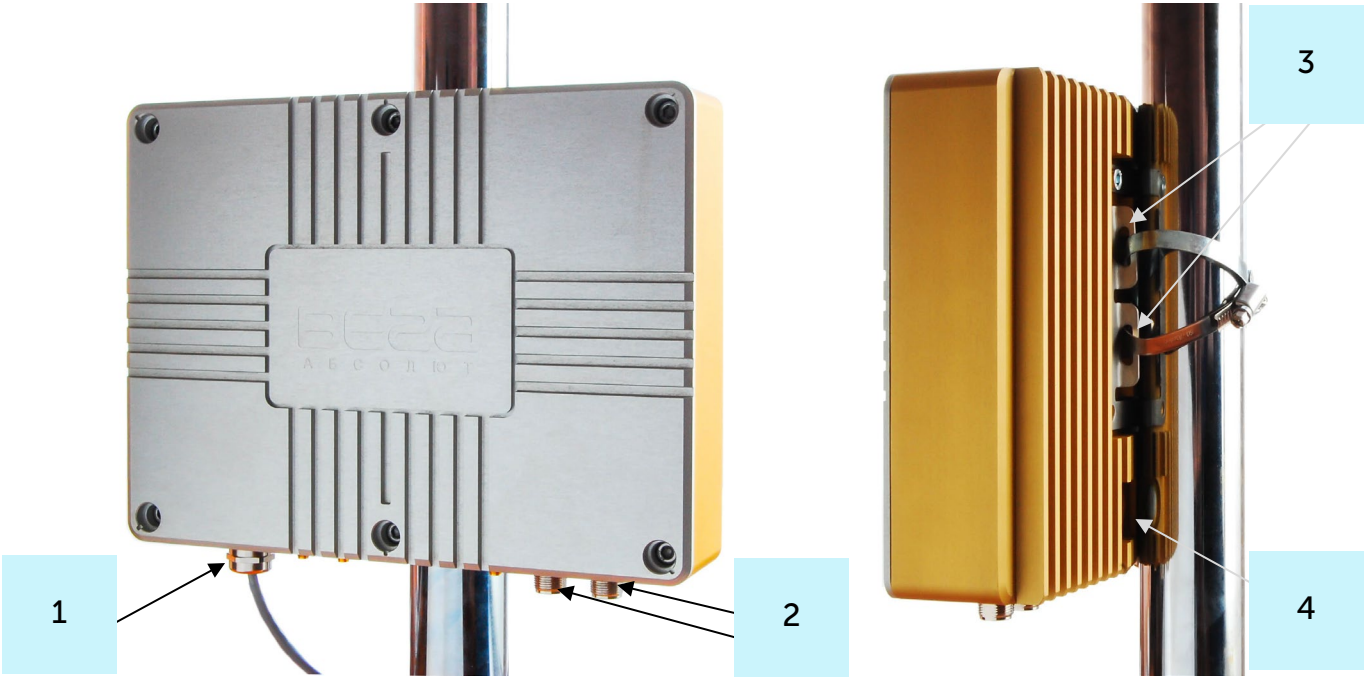
2 SPECIFICATION

MAIN		
GNSS module	yes, with supporting GPS, GLONASS, BeiDou, QZSS, SBAS and Galileo	
GSM modem	Quctel EC21-E, GSM/LTE	
GSM and GNSS antenna connectors	SMA	
Geolocation function	yes	
Communication with server	Ethernet, 3G/LTE	
Operating system	Linux	
USB-port	yes	
Operating temperatures	-40...+70 °C	
LORAWAN®		
Number of LoRa channels	16	64
Frequency band	863-870 MHz	
LoRa antenna connectors	N-Type female	
Radio coverage in restrained urban conditions	up to 5 km	
Radio coverage within line of sight	up to 15 km	
POWER		
Power supply	POE IEEE 802.3bt 4PPoE 50W	
Power consumption	up to 30 W	up to 40 W
CASE		
Housing dimensions	285 x 213 x 67	
Ingress protection rating	IP67	
Additional features	Tamper, vandal-proof, lighting conductor	

3 OPERATION

DEVICE APPEARANCE

Vega BS-3 gateway is represented in vandal-proof metal case with IP67 protection rating. At the back side there is a fastening for the mounting on the mast with metal clamps.



1 – cable gland

2 – N-connectors for LoRa antennas

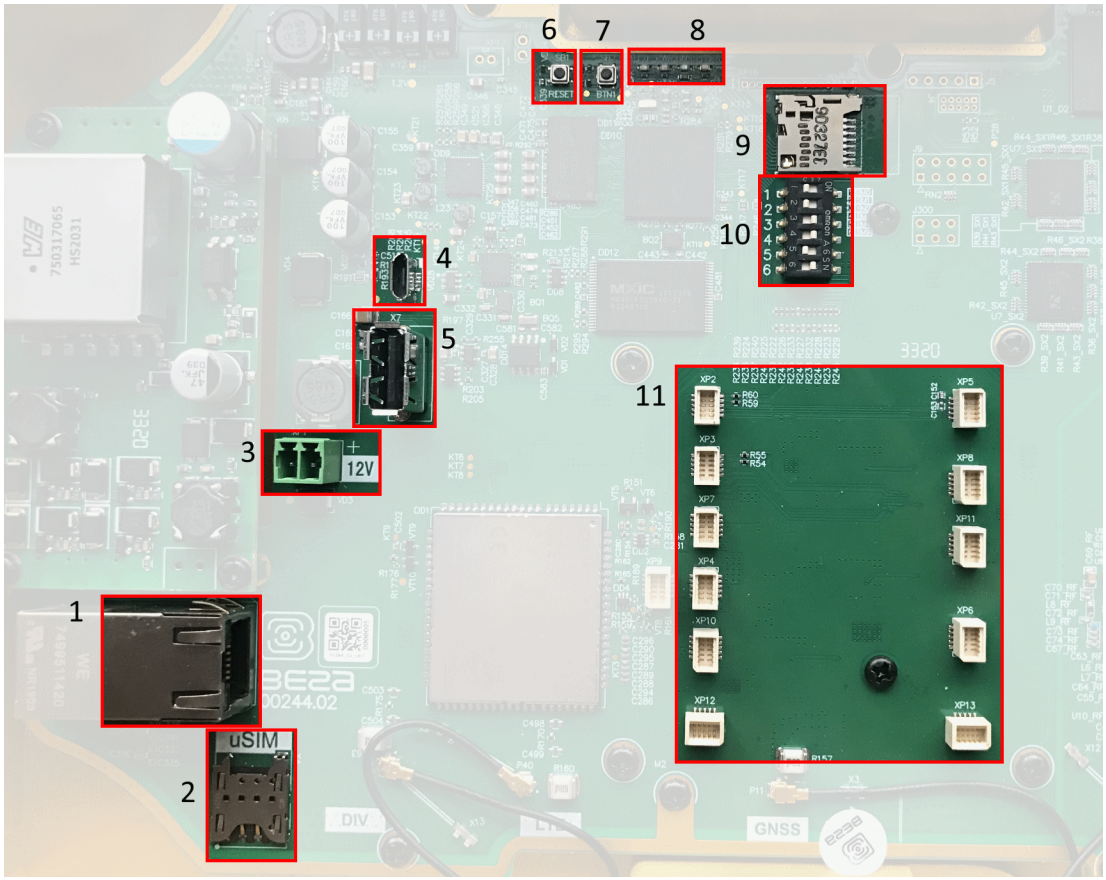
3 – fastening for metal clamps

4 – protective vent

The case is equipped with a hermetic gland of M12 size. A sealant is installed inside the gland, ensuring compliance with the declared Ingress Protection rating of the device case. Also, sealant is placed on the perimeter of case between two case parts. Removing the sealant can lead to moisture entering the gateway case.

Waterproof protective vent serves to equalize the air pressure inside and outside the case.

The gateway board has control and indication instruments, input, and output interfaces.



1 – 8P8C connector

2 – SIM-card slot

3 – additional power connector (optional)

4 – mini USB-port for connection to a computer

5 – USB-host for connection external devices

6 – gateway reset button

7 – *reserve*

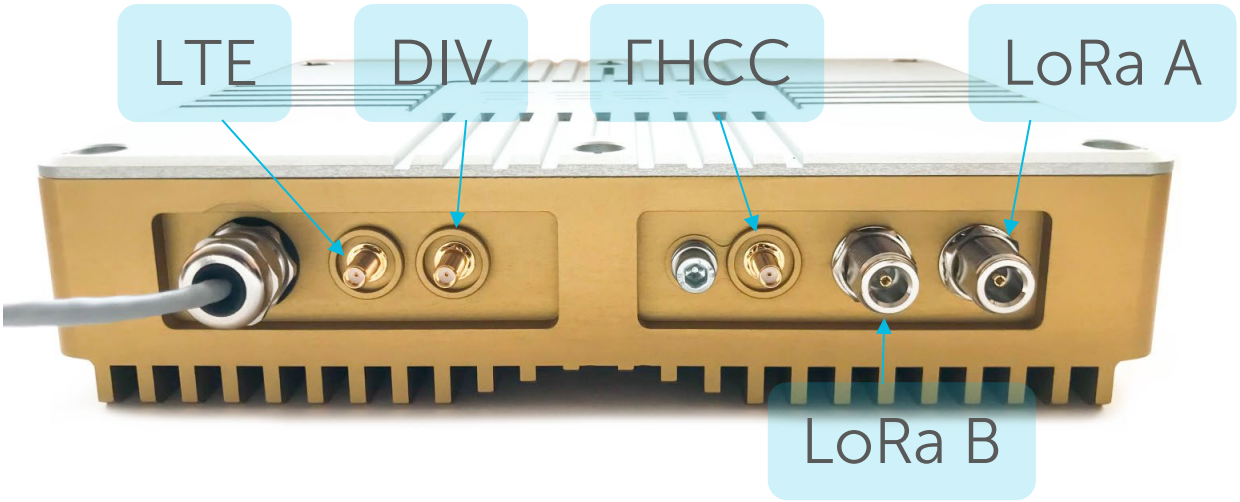
8 – group of indicators

9 – service switches

10 – micro SD-card slot

11 – connectors for expansion card installing

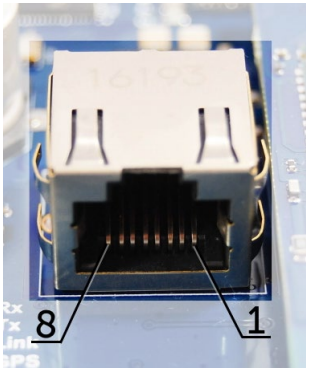
The gateway case has connectors for connecting the external antennas: two connectors for LTE antennas, a connector for GNSS antenna and two connectors for LoRa antennas.



The connectors for LTE are located on the left in the picture above and are marked on the board as LTE - the main connector, and DIV - an additional connector. If there is only one LTE antenna, then it is necessary to connect it to the main connector, if there is a second antenna, it is connected to the additional connector.

On the right are two connectors for LoRa antennas: LoRa A is the main connector, LoRa B is an additional one. If there is only one antenna, connect it to the main connector.

The gateway is connected to the network with an 8-core network cable (twisted pair) through 8P8C connector on the board. Cable shall be crimped in compliance with T568A and T568B standards. Contacts are numerated from 1 to 8 in order right-to-left.



Colors are shown for cable T568B:

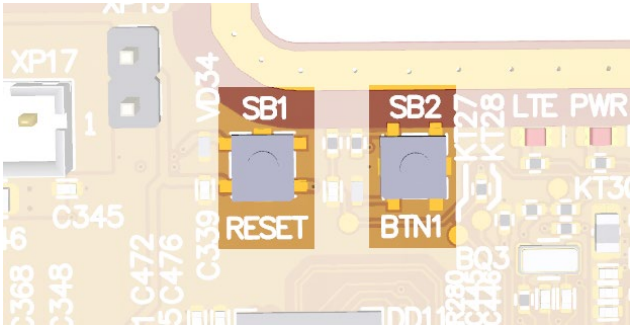
Contact number	Color	Designation
1	Orange-and-white	TD+ signal
2	Orange	TD- signal
3	Green-and-white	RD+ signal
4	Blue	Power
5	Blue-and-white	Power
6	Green	RD- signal
7	Brown-and-white	Ground
8	Brown	Ground

There is an additional power connector on the board. It can be connectable only when power contacts 4, 5 and 7, 8 in the network cable are disabled. Permissible power voltage is 12 V ± 1 V. Minimum power is 20 W.

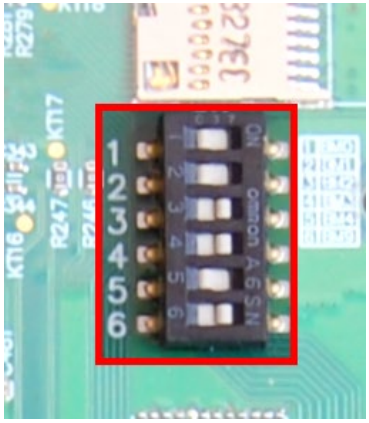
Exceeding the permissible level of supply voltage can lead to the failure of the gateway

CONTROL INSTRUMENTS – BUTTONS AND SWITCHES

There are two buttons on the gateway board. BTN1 is reserved for further developments. Press the RESET for the gateway instantaneous rebooting.



In addition, there are service switches on the board used to select the download option of the firmware image: from internal memory, from the SD card or via mini-USB from the computer. The switches are only for service conditions. In operating mode, only switches 3, 4 and 6 shall be enable, as it shown at the figure below.



INDICATION

There is a group of indicators on the terminal board; its signals showing in the table below. They indicate operation of systems: power (on / off), visibility of GPS satellites, GSM modem (on / off), operation of the LoRa signals processing program (Packet forwarder on/off).

LED	Color	Indication
LTE	Green	*Lights* – GSM-modem is enabled *Does not light* – GSM-modem is disabled
PWR	Red	*Lights* – gateway is powered *Does not light* – gateway is not powered
GNSS[1]	Blue	*Does not light* – no data from GPS-receiver *Flashes*– there data exist, but are not valid for use by Packet forwarder *Lights* – location identified
LoRa	Yellow	*Lights* – Packet forwarder is started *Does not light* – Packet forwarder is stopped

[1] GNSS LED indicates the GPS/GLONASS system functioning only while Packet forwarder processing (LoRa LED lights).

MOUNTING RECOMENDATIONS

The necessary stage for the network deploying including a big quantity of end devices is a radio planning work with nature experiments.

For mounting you will need:

- cross-shaped screwdriver for gateway assembling;
- mounting belts and tool for them;
- wire cutters;
- a set of tools for cable crimping (stripper, crimper, twisted pair tester, cap, connector);
- antenna mounting wrenches;
- laptop.

Step by step mounting guide:

1. Setting the gateway is usually carried out in the office (see Network Deployment Manual).
2. Determination of suitable places for mounting at the object with a network tester — radio planning work.
3. Antenna placement and mounting. It's important to place the gateway antenna properly for high-quality signal reception. Antenna installing recommendations see below.
4. Connection POE-injector cable to the gateway. To do this, you need to pass it through the cable gland of the case, and then crimp it with an Ethernet connector.
5. Gateway placement on the pole with mounting belts.
6. Power applying on the POE.
7. By the laptop you can make sure that the device successfully sends the data.
8. Installing of gateway case top.

ANTENNA MOUNTING RECOMMENDATIONS

The Antenna included in the scope of supply has fasteners for installation on a mast support. To ensure maximum communication range, follow the installation guidelines for the antenna:

1. Install the antenna outside, preferably on the roof of the building (the higher - the better, depending on the surrounding buildings). Installing the antenna in the room significantly weakens the sensitivity of the antenna.

2. The installation site shall be as far as possible from the cellular antennas. Antenna tuning requires the maximum distance from other antennas. After tuning and testing, antenna can be brought back closer to the cellular antennas, if the quality of the communication is satisfactory.

3. The antenna shall not stand in the proximity to obstacles (about 2 meters from railing, walls, etc.). The sensitivity towards the obstacle weakens.

4. The gateway shall be installed in the proximity to the antenna – at the length of the antenna coaxial conductor. Increase of the cable length between the antenna and the gateway will result in a loss of antenna sensitivity.

For example, 25 meters of RG-58 cable attenuate the signal by 14 dBm, i.e. if transmission power is 14 dBm (25mW), the power on the antenna will be 1mW

5. The antenna directional pattern shall be considered. In the horizontal plane, the antenna has a circular direction, but no vertical direction. Therefore, the quality of communication directly under the antenna will be worse than at some distance from the antenna.

4 CONFIGURING OF THE GATEWAY

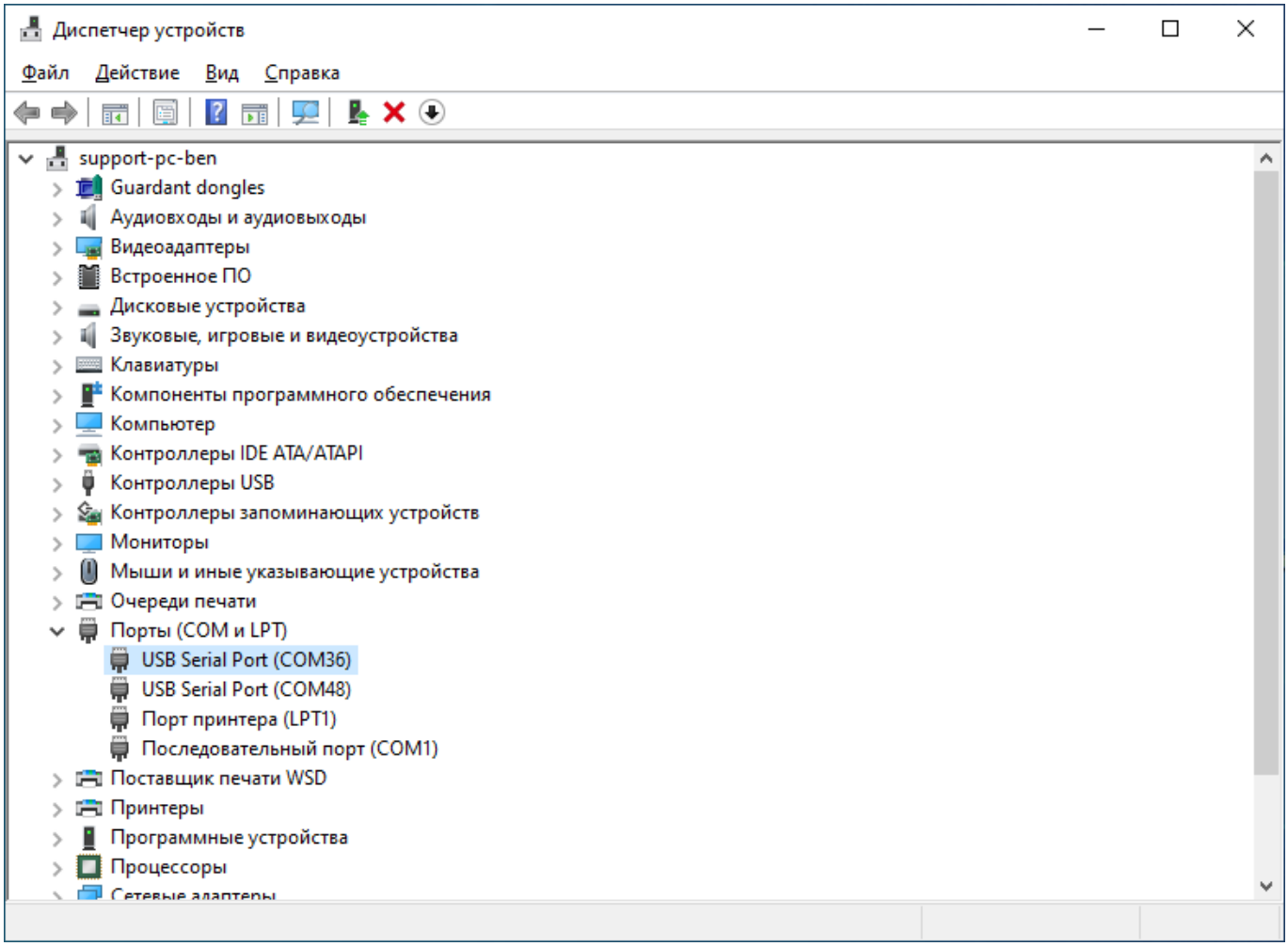
GATEWAY CONNECTING TO THE COMPUTER – THE OPERATION BEGINING

Connection is possible, for example, with a free PuTTY program. There are two ways of connection to the gateway – a direct USB connection or remote connection through SSH.

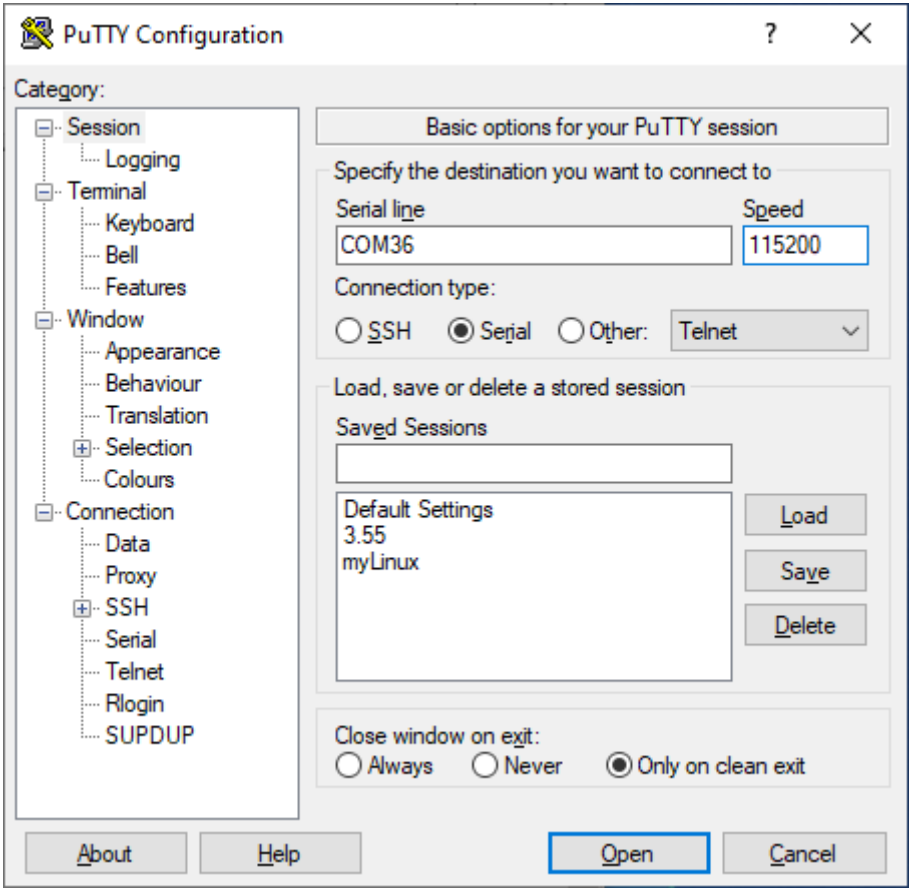
1. USB connection

In case of a USB connection, you need to connect the gateway with a personal computer through a mini-USB connector cable. Next, connect to a virtual COM port by installing the driver for MCP2200. **"Ports (COM and LPT)"** menu appears at the device manager.

Search **"USB Serial Port"** in the "Ports" menu and see its number.


Диспетчер устройств
Файл
Действие
Вид
Справка
support-pc-ben
Guardant dongles
Аудиовходы и аудиовыходы
Видеоадаптеры
Встроенное ПО
Дисковые устройства
Звуковые, игровые и видеоустройства
Клавиатуры
Компоненты программного обеспечения
Компьютер
Контроллеры IDE ATA/ATAPI
Контроллеры USB
Контроллеры запоминающих устройств
Мониторы
Мыши и иные указывающие устройства
Очереди печати
Порты (COM и LPT)
USB Serial Port (COM36)
USB Serial Port (COM48)
Порт принтера (LPT1)
Последовательный порт (COM1)
Поставщик печати WSD
Принтеры
Программные устройства
Процессоры
Сетевые адаптеры

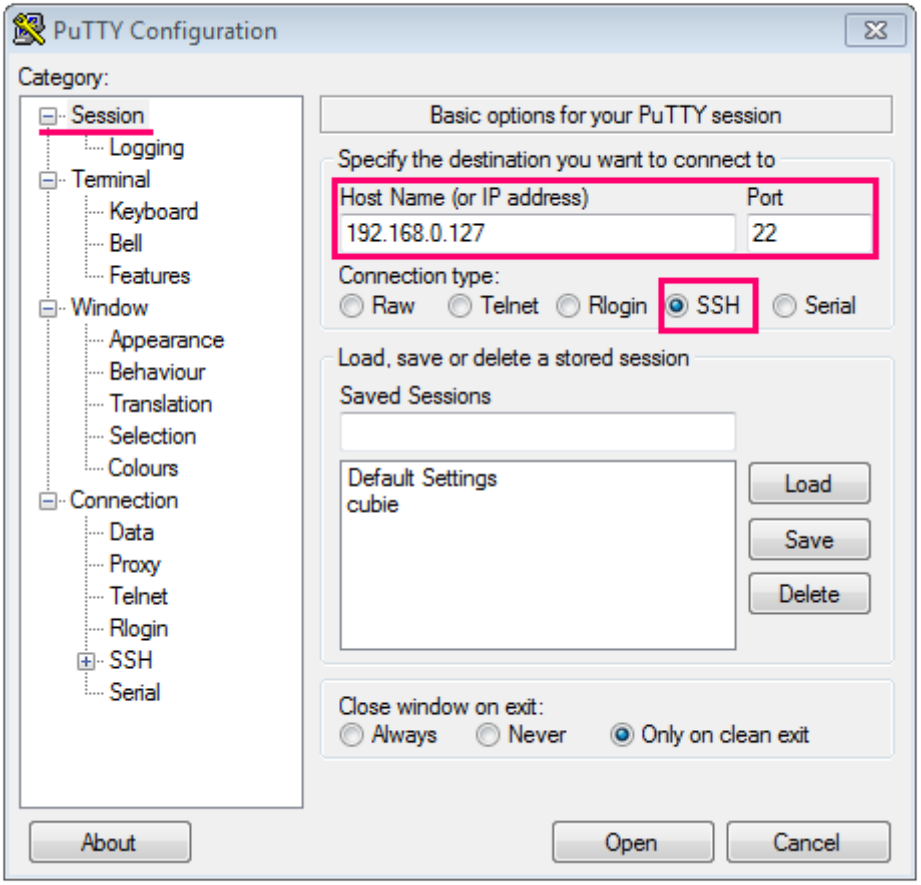
Open PuTTY, select **Serial**, enter number of the gateway virtual COM-port and speed (115200) in the corresponding fields.



Press "**Open**" button.

2. Connection via SSH

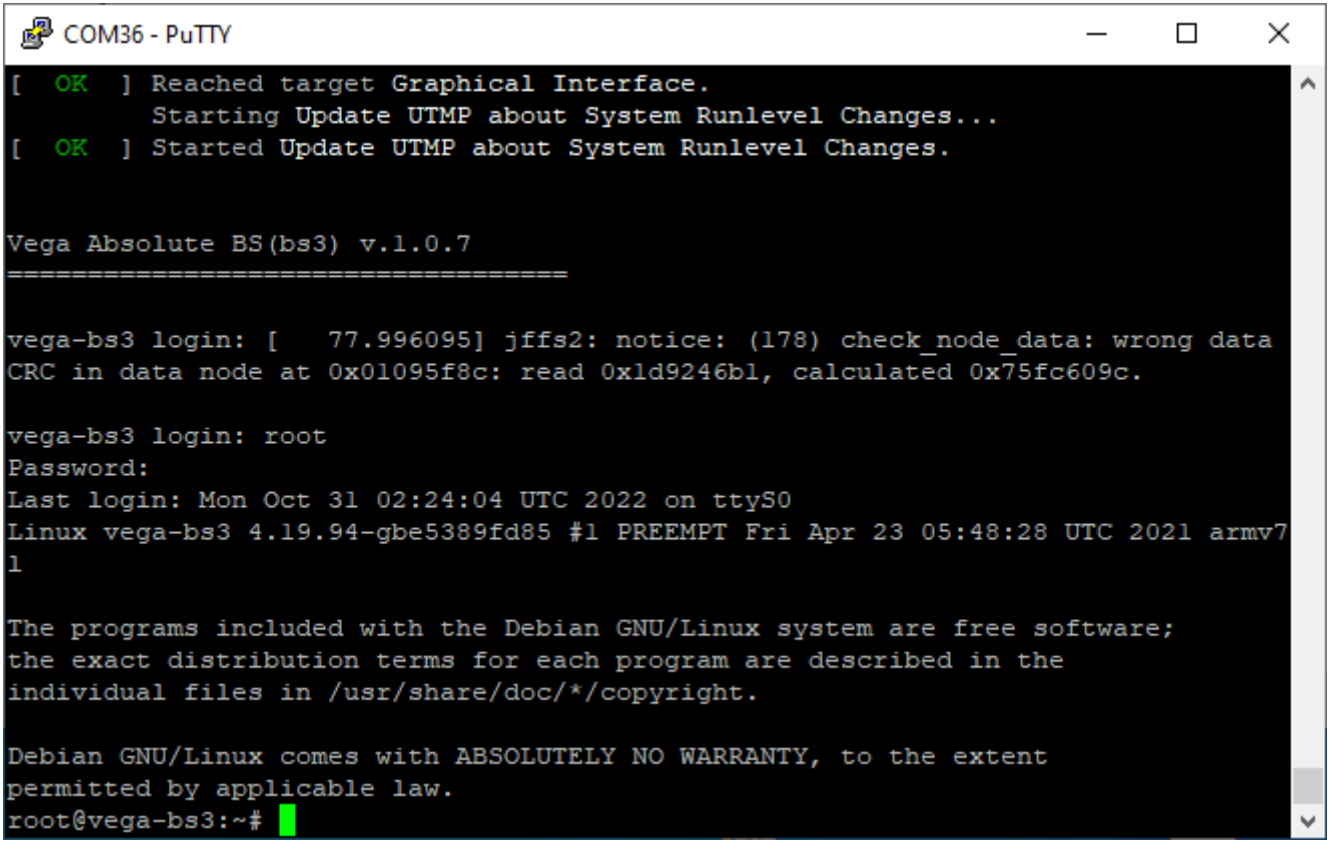
In case of SSH connection there is no need to direct connection. Select SSH connection in the PuTTY dialog box, enter the device's IP-address and port 22. By default, the device obtains an IP-address via DHCP when connected via Ethernet.



Press "**Open**" button.

After connecting to the gateway by one of the methods, PuTTY terminal window appears where you should enter login and password. By default, login **root** and password **temppwd** (symbols not displaying while entering the password) are used for connection to the

gateway. At the first connection, it is recommended to change the password for individual access.

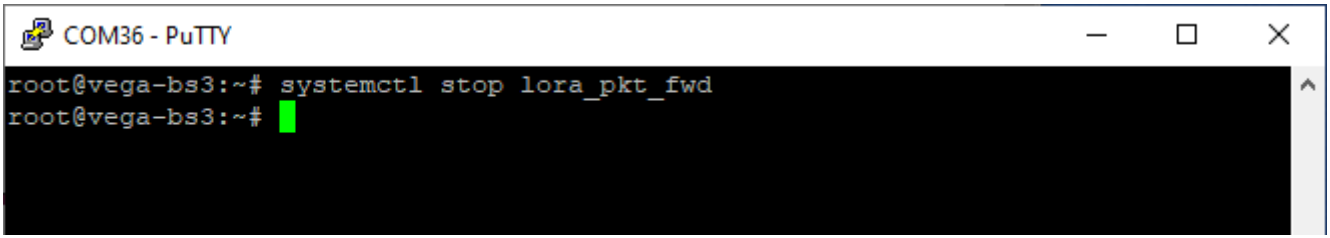


Now the configuration can be carrying out.

OPERATION WITH THE CONFIGURATION FILE

Packet forwarder starts automatically when the system starts. Before the gateway configuring, stop Packet forwarder by entering command:

systemctl stop lora_pkt_fwd

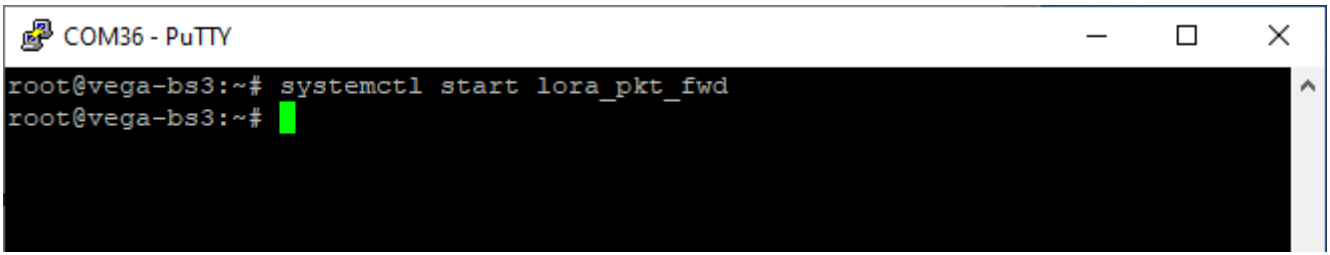


Configuration file **global_conf.json** is in the directory **/opt/LoRa/config/** – it may contain frequency band, the gateway ID, IP-address and server ports settings.

Enter the command, containing the required configuration file to change the settings, for example:

After all changes completed enter the command:

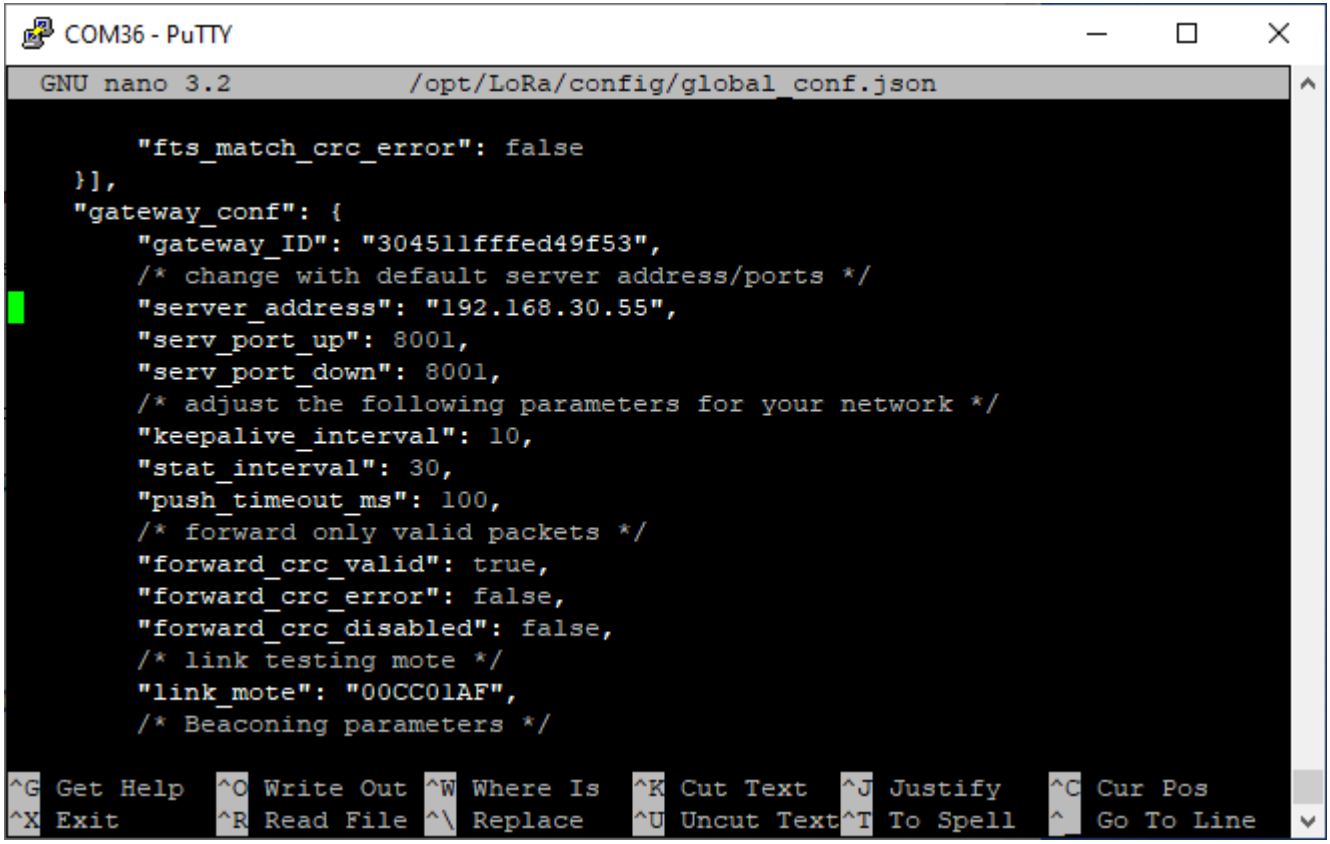
systemctl start lora_pkt_fwd



Packet forwarder will automatically start with new settings.

To connect the gateway to the server, you must use the UDP port specified in the server configuration file. On the gateway, the port configuration is in the global_conf.json file

In the **global_conf.json** file, the UDP port settings are in the gateway_conf section, there are server_port_up and server_port_down parameters.

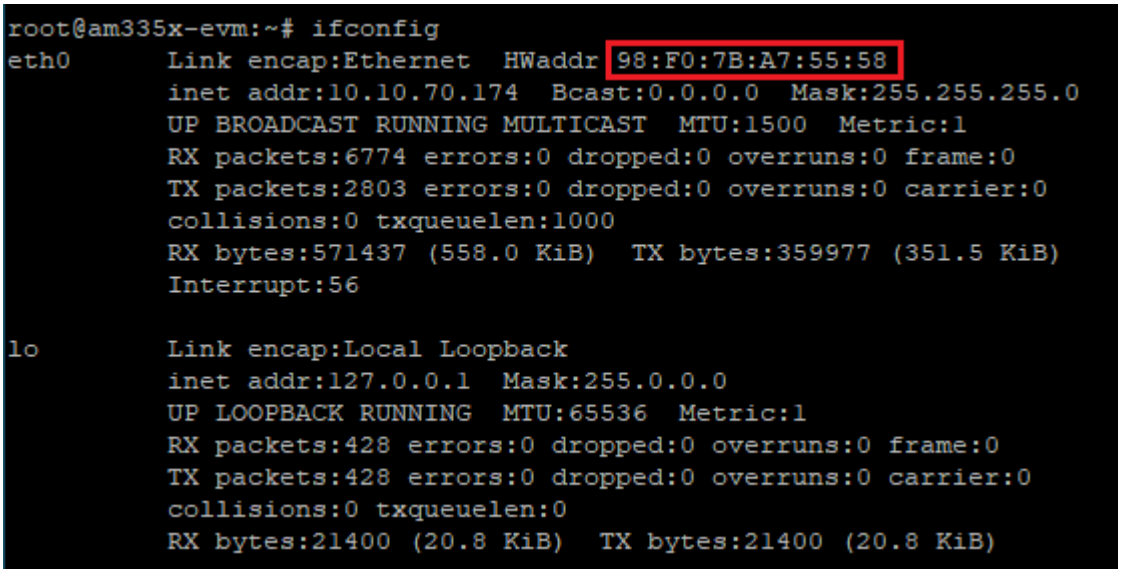


To communicate with the server correctly, you should make sure that these UDP port parameters correspond to those specified in the server configuration file (see details in the «IOT Vega Server Manual»).

To replace configuration file (for example, for change frequency plan) you need to make the following steps:

1. Go to directory with config files examples by the command:
   cd /opt/LoRa/config/
2. Choose necessary file and make a copy with new name global_conf.json by the command:
   cp config_test_single_antenna_16ch_16x1_EU868.json global_conf.json
3. Open file global_conf.json by the command:
   nano global_conf.json
   and specify parameters *"gateway_ID"*, *"server_address"*, *"serv_port_up"*, *"serv_port_down"*, and then save and close the file.

Parameter *gateway_ID* is formed out of gateway MAC address and "**FFFE**" symbols.
For example:
To get gateway MAC address you need to enter a command:
ifconfig



In our example MAC address is: **98:F0:7B:A7:55:58.**
Then you need to copy that MAC address, delete ":" symbols and put "**FFFE**" at the middle of line.

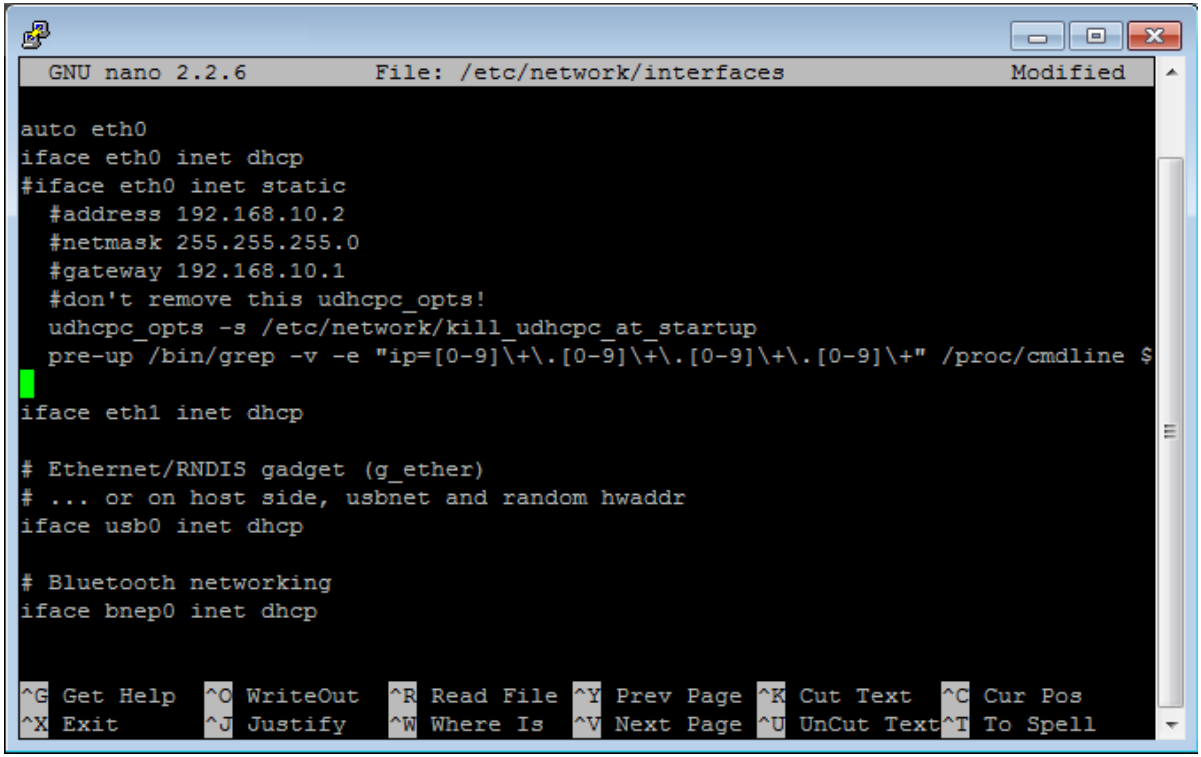
Example of ready *gateway_ID*: 98F07B**FFFE**A75558

4. Enter a command: **systemctl restart lora_pkt_fwd**

CONFIGURATION OF A STATIC IP-ADRESS FOR THE GATEWAY

Configuration of a static IP is carrying out with the terminal program in the following way:

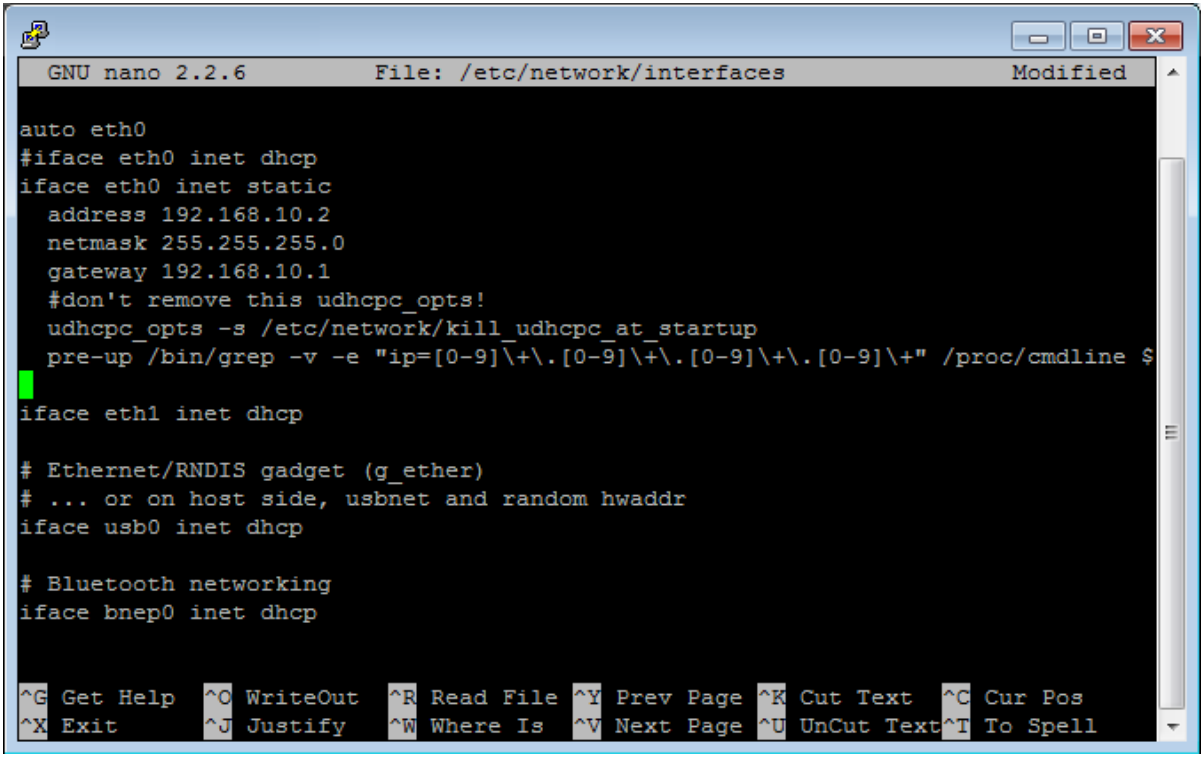
1. After connecting to the gateway, enter login and password in the PuTTY terminal window.
2. Go to the directory with interfaces config file by the command:
   cd /etc/network
3. Download config file with a command:
   wget ftp://lora_guest:vnm\$4JHW@178.208.75.230:21/ForBS/interfaces
4. Open file **nano /etc/network/interfaces.** Search authorization settings in this file:



5. That are strings exactly:

```
auto eth0
iface eth0 inet dhcp
#iface eth0 inet static
  #address 192.168.10.2
  #netmask 255.255.255.0
  #gateway 192.168.10.1
  #don't remove this udhcpc_opts!
```

6. For static IP mode, you should remove # symbol from the 3rd to 6th strings and specify your parameters are address, netmask, and gateway.
7. Comment the 2nd string, there is result on the following screenshot (address values will be different):



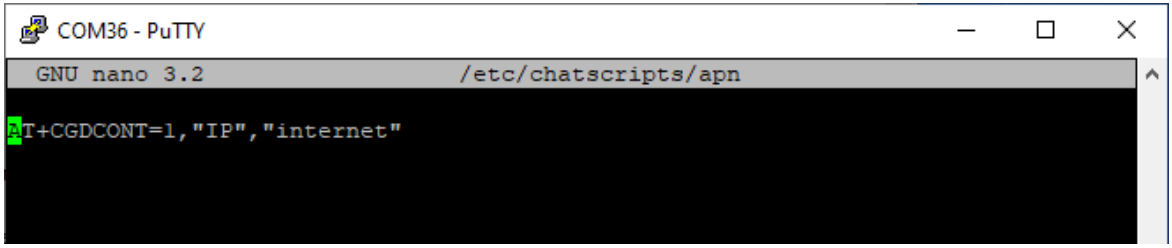
In that example shown setting of the static IP-address 192.168.10.2 and gateway 192.168.10.1
You need to change those values to others, which are necessary to your own case

8. Type **reboot** in command line for gateway restarting with new settings.
9. Going back is similar.

GATEWAY SETTING UP FOR LTE OPERATION

Gateway setting up for LTE operation using the terminal program is in the following order:

1. After connecting to the gateway enter login and password in the PuTTY terminal window.
2. Open APN file by the command:
   nano /etc/chatscripts/apn
3. Specify APN according to used operator:



where "**internet**" is APN of cellular operator. Change APN value according to APN cellular operator using by the gateway.

In that example shown LTE setting for Megafone cellular operator
You need to change those values to others, which are necessary to your own case

Gateway is switching between Ethernet and LTE automatically

Recommendations for gateways using white IP see in next part.

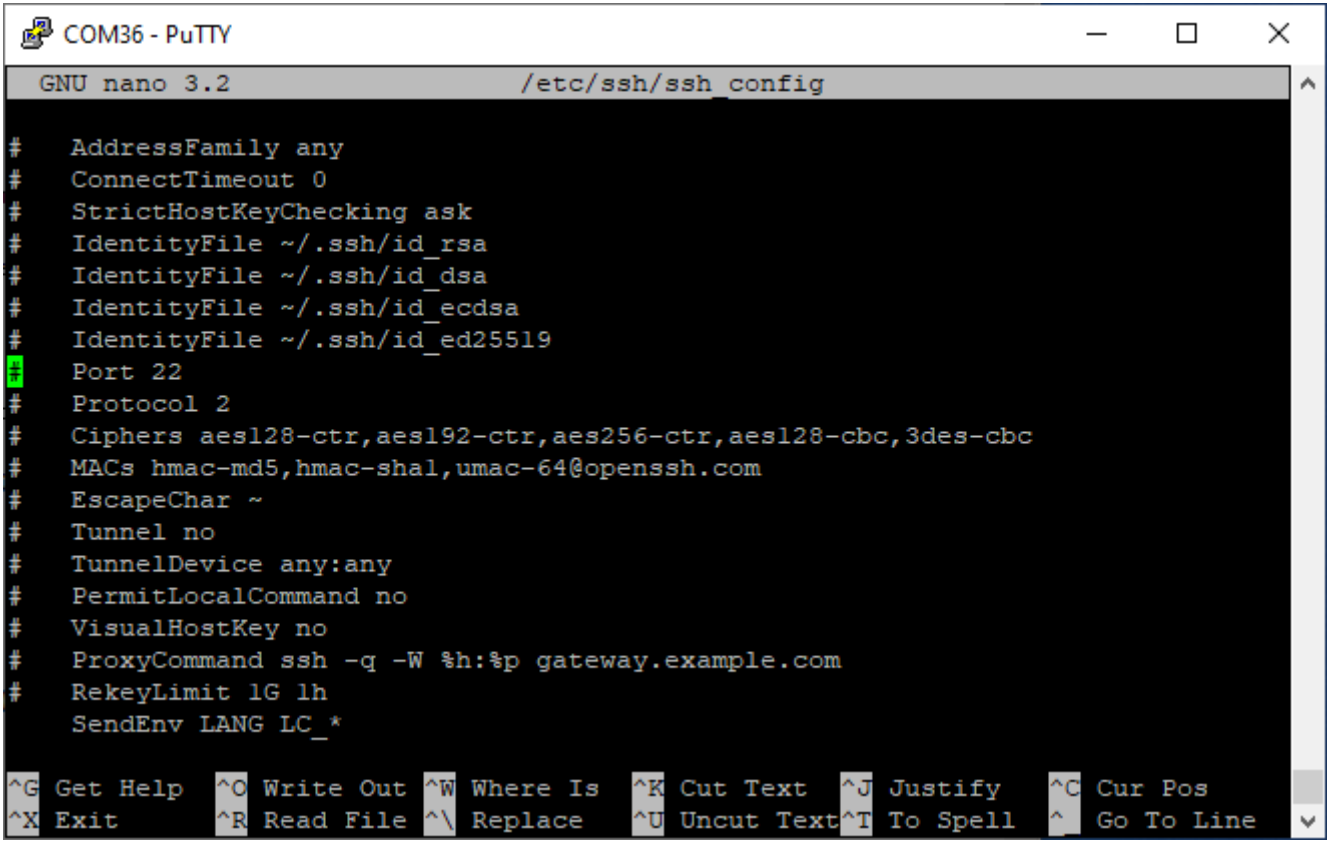
If you use such two communication channels as Ethernet and LTE at the same time you should to remember that Ethernet has a priority for communication and LTE used as a backup option if gateway cannot communicate with the server via Ethernet

RECOMMENDATIONS FOR GATEWAY USING IN WHITE IP NET

In case the BS-3 is used in network with white IP, it is recommended to change the standard port numbers of ssh and telnet to others. This should be considered while port forwarding. The steps sequence for changing BS-3 dropbear and telnetd ports is described below.

To change ssh port:

1. Enter at the command line of the terminal program **systemctl stop ssh**
2. Open file **nano /etc/ssh/ssh_config**



3. Find string Port=22 and change standard port «22» to another, then save the file.
4. Enter at the command line of the terminal program **systemctl start ssh**

5 STORAGE AND TRANSPORTATION REQUIREMENTS

Vega BS-3 gateways shall be stored in the original packaging in heated room at temperatures +5 °C to +40 °C and relative humidity less than 85 %.

The gateway transportation is permissible in covered freight compartments of all types at any distance at temperatures -40 °C to +70 °C.

6 CONTENT OF THE PACKAGE

The gateway delivered complete with:

Vega BS-3 gateway (with or without an expense card) – 1 pc.

Factory certificate – 1 pc.

7 WARRANTY

The manufacturer guarantees that the product complies with the current technical documentation, subject to the storage, transportation and operation conditions specified in the "User Manual".

The warranty period is 36 months.

The warranty does not apply to PoE-injector.

The warranty period of operation is calculated from the date of sale marked in the product factory certificate, and from the release date when such a mark is absent. During the warranty period, the manufacturer is obliged to provide repair services or replace a failed device or its components.

The manufacturer does not bear warranty obligations in the event of a product failure if:

- the product does not have a factory certificate;
- the factory certificate does not have an TCD stamp and / or there is no sticker with information about the device;
- the serial number (MAC) printed on the product differs from the serial number (MAC) specified in the factory certificate;
- the product has been subject to alterations in the design which are not provided for in the operational documentation;
- the product has mechanical, electrical and / or other damage and defects arising from violation of the conditions of transportation, storage and operation;
- the product has traces of repair outside the manufacturer's service center;
- the components of the product have internal damage caused by the ingress of foreign objects / liquids and / or natural disasters (flood, fire, etc.).

The average service life of the product is 5 years.

In the event of a warranty claim, contact the service center:

119A, Bol'shevistskaya Str., Novosibirsk, 630009, Russia.

Tel.: +7 (383) 206-41-35.

e-mail: remont@vega-absolute.ru

DOCUMENT INFORMATION	
Title	Gateway Vega BS-3
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Document number	V02-BS3-01
Revision and date	05 of 31 October 2022

Revision History

Revision	Date	Name	Comments
01	19.03.2020	KEV	Document creation date
02	16.06.2020	KEV	Minor changes
03	19.10.2020	KEV	Case and some specifications are changed
04	07.04.2022	KMA	Content of the package edit
05	31.10.2022	KEV	Planned revision of documentation, finalization of the gateway functionality

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