ACKSYS
COMMUNICATIONS & SYSTEMS

APPLICATION NOTE

APNUS034How To Setup your Cellular Router

November 2023

Content

1. Glossary

APN : Access Point Network

ISP : Internet Service Provider

GUI : Graphic User Interface

SIM: Subscriber Identify Module

RSSI : Received Signal Strength Indicator

GNSS: Global Navigation Satellite System

ICMP: Internet Control Management Protocol

LTE: Long Term Evolution**TCP**: Transmission Control Protocol

BER: Bit Error Rate estimator

ARFCN: Absolute Radio Frequency Channel Number

LAC/CID: Base station Local Area Code and Cellular cell ID.

MCC/MNC: Mobile Country Code / Mobile Network Code

IPv4: Internet Protocol Version 4

IPv6: Internet Protocol Version 6

2. Introduction

This application note provides a full description on how to install and setup your Acksys Cellular Router:

- Installing the SIM card
- Installing the cellular and GNSS antennas
- Configuring your internet service provider settings to get internet access

3. Setting up your Cellular router

Follow the steps below to get your Acksys Cellular SIM + Device up and running.
There are different types of 4G/5G LTE Cellular Routers that serve various business needs including wired and wireless routers with different method to insert SIM card.

3.1 SIM installation General best practices

To connect your SIM card to the cellular router, in most of cases, follow these step-by-step instructions:

1. **Check compatibility**: Ensure that your SIM card is compatible with the router's supported networks (e.g., 2G, 3G, 4G, or 5G) and SIM card slots
2. **Power off the router**: Turn off the Cellular router and disconnect it from the power source to avoid any electrical damage during setup
3. **Locate the SIM card slot**: Look for the SIM card slot on the router. It is usually located on the back or bottom of the device. Refer to the router's user manual
4. **Insert the SIM card**: Gently insert the SIM card into the SIM card slot, following the correct orientation as indicated by the router. Be careful not to force it or insert it incorrectly to prevent damage.
5. **Power on the router:** Connect it back to the power source and turn it on. Wait for the router to boot up completely. The router should recognize the SIM card and establish a network connection automatically (in case of Auto APN + default pin code = 0000, otherwise you have to configure your APN + pin code).
6. **Configure network settings**: Access the router's administration interface by entering its IP address in a web browser. The default IP address and login credentials are usually mentioned in the user manual or labeled on the router.
7. **Configure APN settings**: In the router's administration interface, navigate to the Network or SIM settings section. You may need to enter the Access Point Name (APN) provided by your network carrier. The APN information can typically be obtained from the carrier's website or by contacting their customer support.
8. **Save and apply settings**: After entering the correct APN settings, save and apply the router's administration interface changes. The router will then attempt to establish a cellular connection using the SIM card
9. **Connect devices to the router**: Once the router establishes a cellular connection, you can connect your devices (such as smartphones, tablets, or computers) to the router's network (in case of Wi-Fi AP configured on your router). Look for the network name (SSID) and password, usually mentioned on the router or in its user manual
10. **Test the connection**: Verify that the devices connected to the router can access the internet by opening a web browser or using any online application. If everything is set up correctly, you should have an active internet connection through the SIM card.

3.1.1 Format of SIM card

Acksys Cellular routers are compatible and support two SIM card families formats as described in bellow table:

	RailBox Cellular Router Series	AirBox, AirWan , EmbedAir Router
Format of SIM card	Micro-SIM (3FF) cards	Nano-SIM (4FF)

NOTE: Nano-SIM (4FF) cards can be used with a 3FF SIM card adapter as shown on the bellow figure:

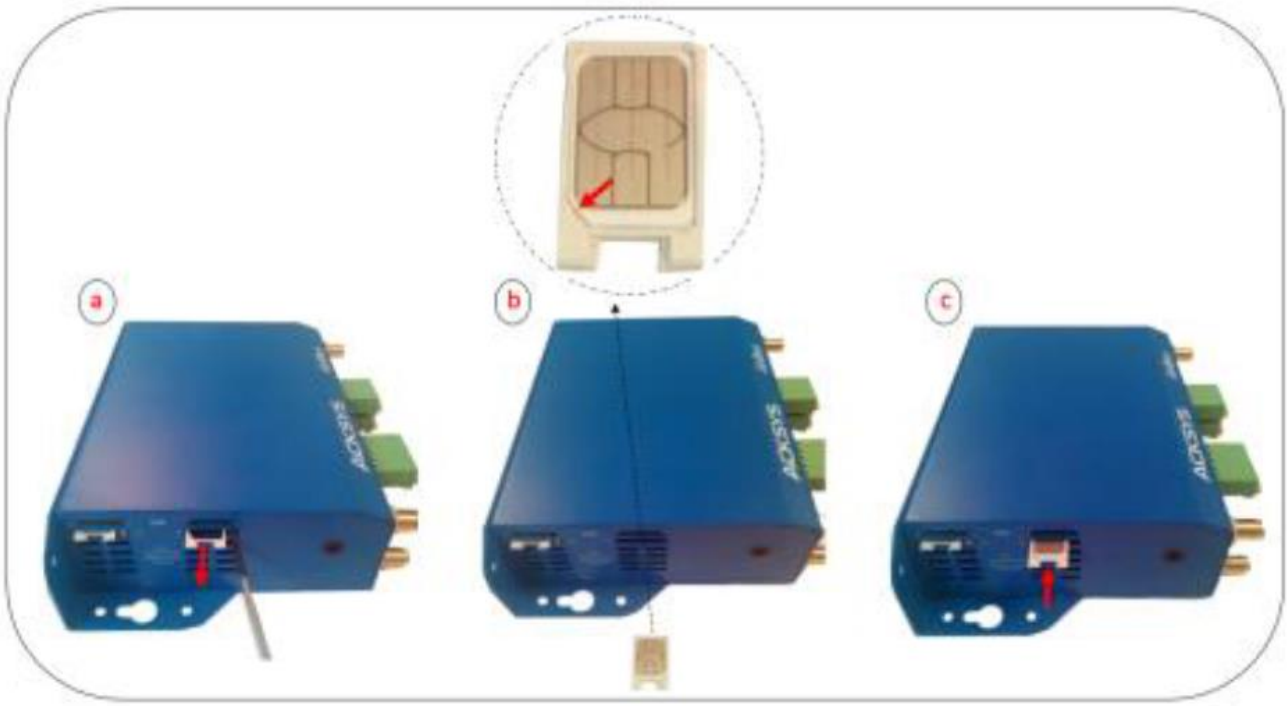
3.1.2 SIM card insertion on AirWan, AirBox

We advise our customers to power off the router before inserting the SIM card, otherwise it is totally fine inserting and removing SIM cards while the router is in a working state, but you will have to restart the cellular router for SIM card detection.

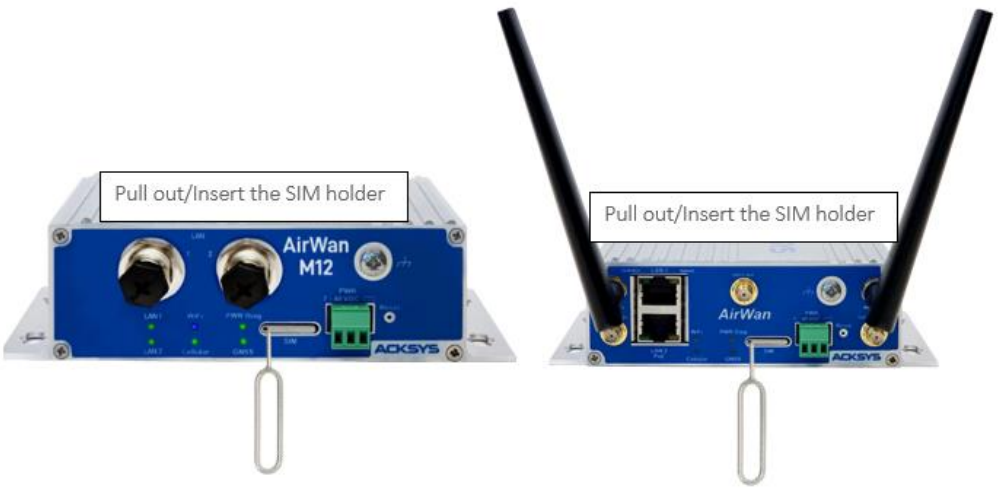
- AirBox Cellular Router is a product designed to accept 2 SIM cards in Nano-SIM format (the smallest format) .
- AirWan Router has 1 SIM Card .

We invite our customer to double check the compatibility of their SIM card and follow these steps below:

1 Push the SIM holder button with the SIM needle.
2 Pull out the SIM holder.
3 Insert your SIM card into the SIM holder (check the SIM card orientation before).
4 Slide the SIM holder back into the router.



NOTE: Inserting SIM Card on AirBOx is look similar except the SIM holder is located back to the router



3.1.3 SIM card insertion on RailBox Cellular Series

RailBox Cellular Series are routers designed to accept 2 SIM cards in Micro SIM formatPlease check the compatibility of your SIM card and follow these steps below:

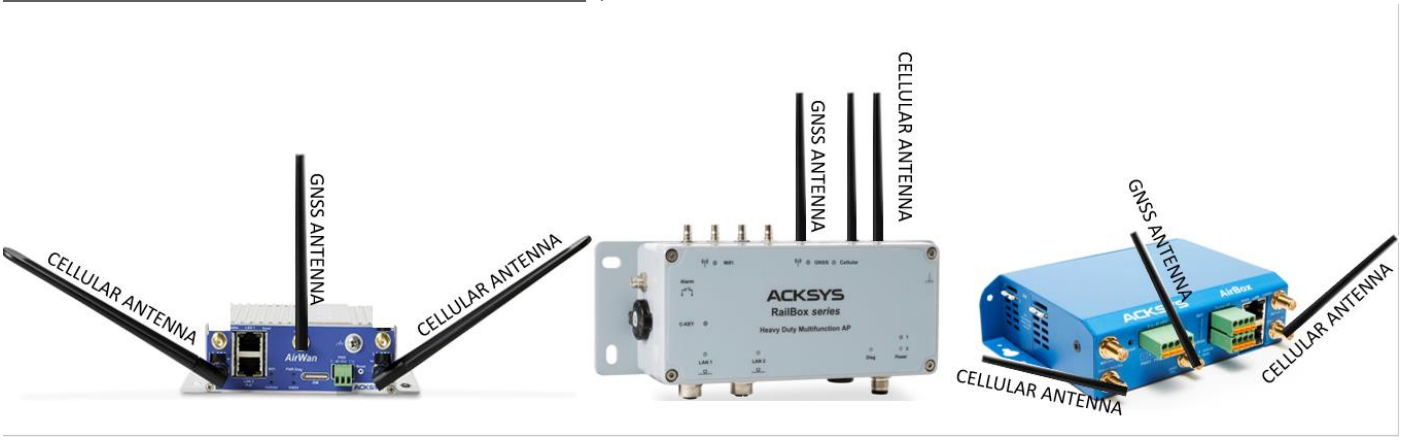
1. Power Off the Router by unplugging the power Supply.
2. If necessary, move the product in a safe area free from dust and water
3. Unscrew the top 4 screws of the box and remove the cover (2Nm +/-10%) with « in a criss-cross pattern »
4. Locate the two flat Micro SIM slots near the lights for WiFi 1 (border side)
5. Choose one slot; they are labelled on one side (near the center of the device PCB)
6. To open the slot: make the slot cover slide by pushing it gently towards the border side
7. Now the cover can be lifted from the center side, around the axle which is at the border side
8. Place the Micro SIM card, gold contacts facing down, cut corner towards the border side
9. Lower back the slot cover and push it towards the SIM slot label, you should hear a faint click
10. Put back the cover in place and tight the 4 screws in a criss-cross pattern to a torque of 2Nm ±10%

3.2 GNSS and Cellular Antennas installation

Acksys Cellular routers are compatible with a wide range of Antennas with the requirement described in bellow table:

Items	RailBox Cellular Router Series	AirBox, AirWan Router
LTE	3 x QMA*	2 x SMA female
GNSS	1 x QMA	1 x SMA female

Example of 3 Cellular Router Antenna Installation: AirWan, RailBox and AirBox.
Please check that the antenna support the frequency band that you want to tune on.
For passive or active GNSS antenna requirements, please refer to the datasheet of the router.



3.3 Installation Overview and Prerequesites

Before we begin, let's overview the configuration that we are attempting to achieve and the prerequisites that make it possible in this application note :

- 1 Acksys Cellular router (AirBox) or any type of Acksys Cellular Router with 1 SIM Card slot
- Any release for WaveOs
- A valid SIM card from a known ISP
- SIM needle
- 1 screwdriver
- Laptop to configure the router

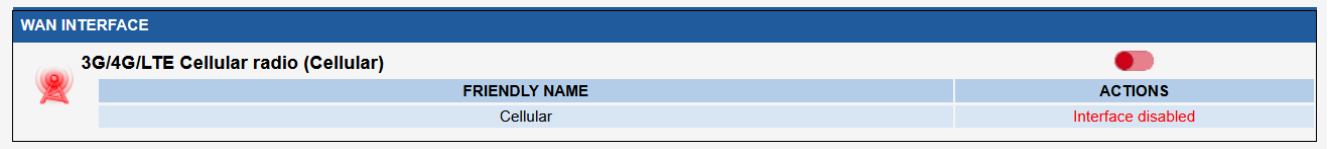
3.4 Configuring your internet service provider settings

The Cellular Radio interface is disabled by default. It is an IP-only interface except in WaveOs release 4.22.0.1 with the AutoAPN feature (with cellular radio is active).

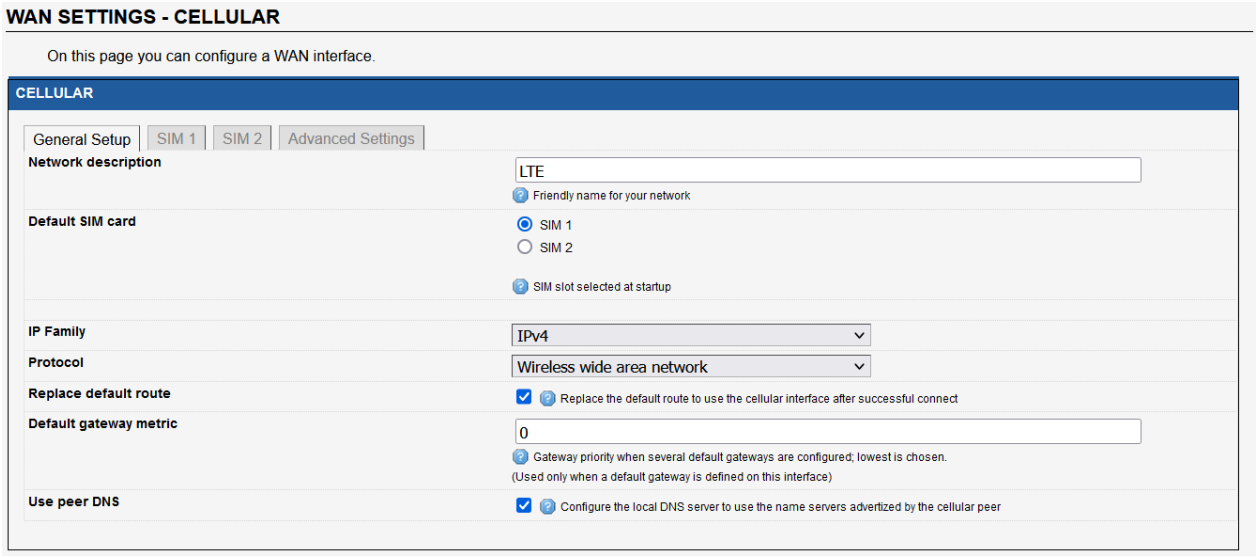
Configuring WAN Interface

If you have familiarized yourself with the configuration scheme,we can start configuring the router using instructions provided in this section:

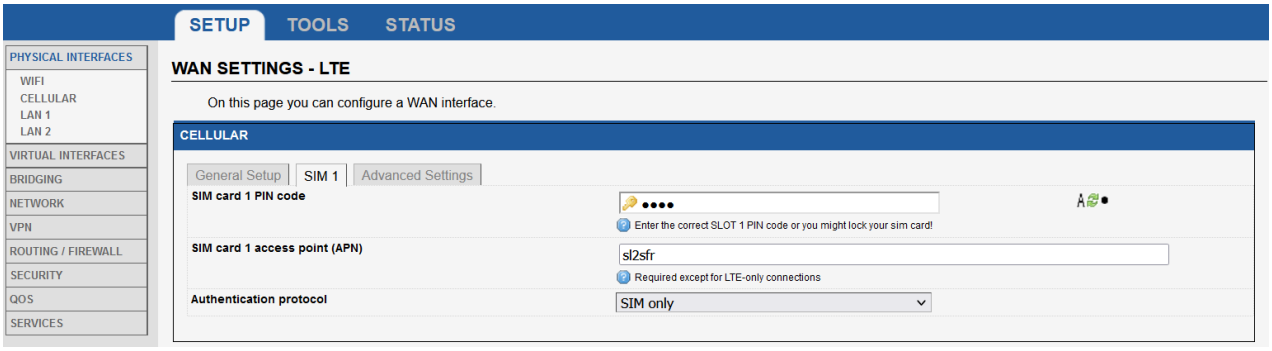
In GUI,go to Setup → Physical Interfaces → Enable the WAN Interface.



- Click the "Edit" button located to the right and configure WAN Interface.
  - General Setup
    - Select IPv4 in IP family (please check that your ISP supports IPv4 otherwise select IPv6)
    - Check Replace default route (to use ISP network as default gateway/route)
    - Set 0 as routing metric 0 for default gateway
    - Check Use peer DNS in case DNS is on the LAN to use the ISP DNS
    - Save

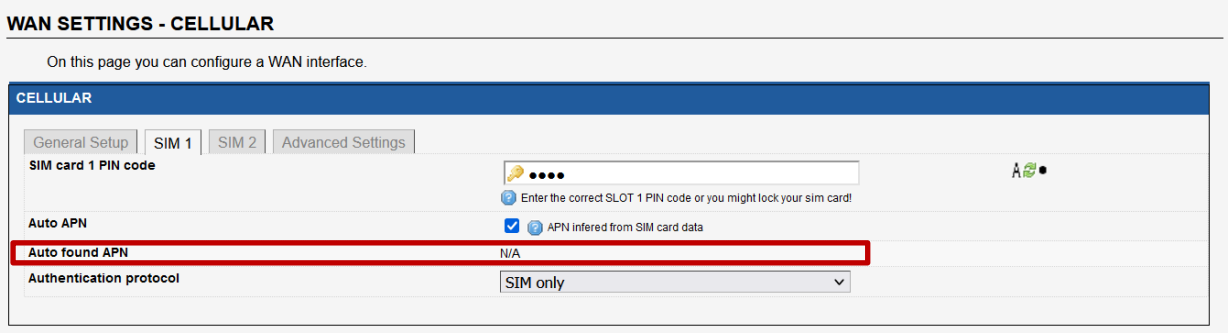


- Select the correct SIM slot (in case of dual SIM) and fill out APN with the connection information provided by the ISP (in this case sfr SIM card is used): sl2sfr



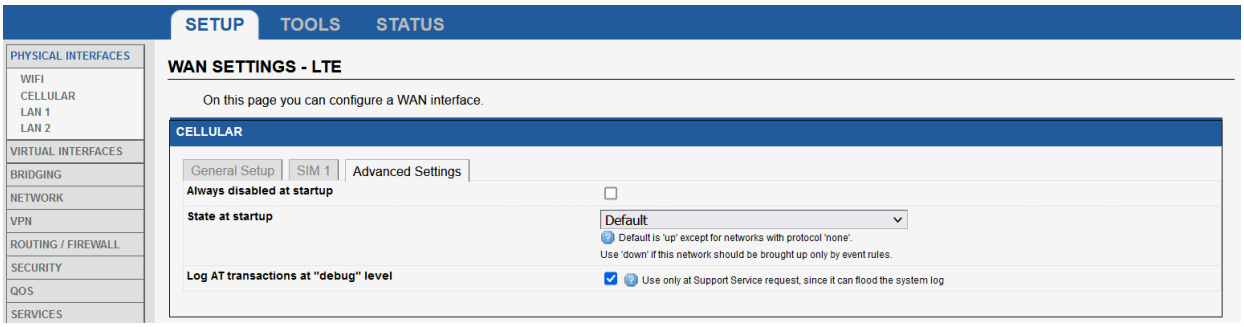
In case of WaveOs release 4.22.0 with AutoAPN features, no need to configure the APN Setting.

- SIM1
  - SIM card 1 PIN code: Your custom PIN code to avoid the SIM lock
  - Auto APN: Enable APN inferred from SIM card data (**Enabled by default**)
  - Auto found APN (): N/A until we have save and apply the configuration. Then it will automatically select the APN found in the database for this simcard.
  - Authentication protocol: SIM only



- Advanced Setting (*Check if the predefined configuration suite your use case*)

- Enable AT transactions logs for better understanding in troubleshoot in case of issue.
- Save and apply the config



- Save the config

Go in Tools Logs Setting→ Cellular → Log Setting (for troubleshooting purpose)

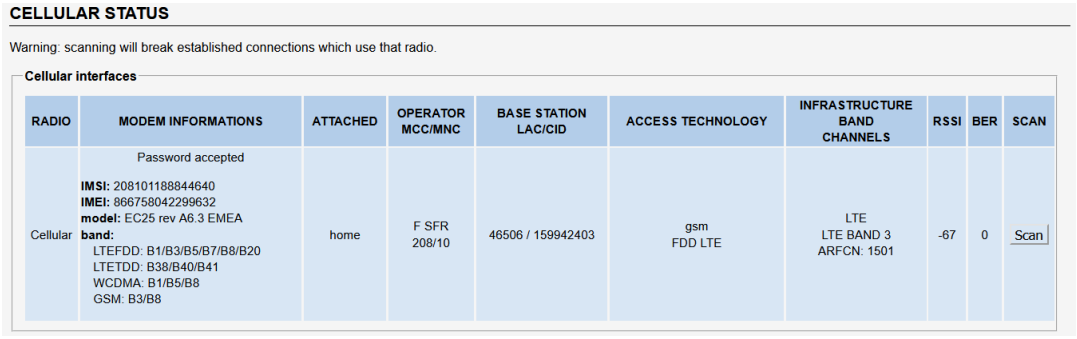
- Save and apply the config

4. STATUS

If you've followed up all the steps presented above, your configuration should be finished and let have an overview on status of your Cellular connection:

WAN Router Cellular: Status

In GUI and go to **Status → Cellular**



CELLULAR STATUS

Warning: scanning will break established connections which use that radio.

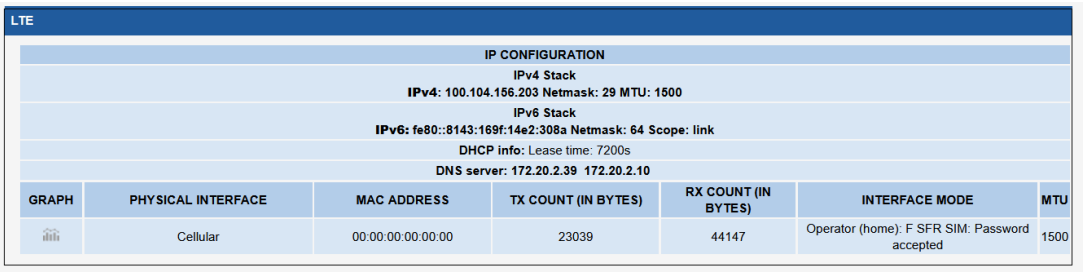
Cellular interfaces

RADIO	MODEM INFORMATIONS	ATTACHED	OPERATOR MCC/MNC	BASE STATION LAC/CID	ACCESS TECHNOLOGY	INFRASTRUCTURE BAND CHANNELS	RSSI	BER	SCAN
Cellular	Password accepted **IMSI:** 208101188844640 **IMEI:** 866758042299632 **model:** EC25 rev A6.3 EMEA **band:** LTEFDD: B1/B3/B5/B7/B8/B20 LTETDD: B38/B40/B41 WCDMA: B1/B5/B8 GSM: B3/B8	home	F SFR 208/10	46506 / 159942403	gsm FDD LTE	LTE LTE BAND 3 ARFCN: 1501	-67	0	Scan

WAN Router: Network Status

To verify the connection, click in Status>Network as shown in the screenshot below where the WAN interface received Internet IP address.

In GUI and go to **Status → Network**



LTE

IP CONFIGURATION

IPv4 Stack

IPv4: 100.104.156.203 Netmask: 29 MTU: 1500

IPv6 Stack

IPv6: fe80::8143:169f:14e2:308a Netmask: 64 Scope: link

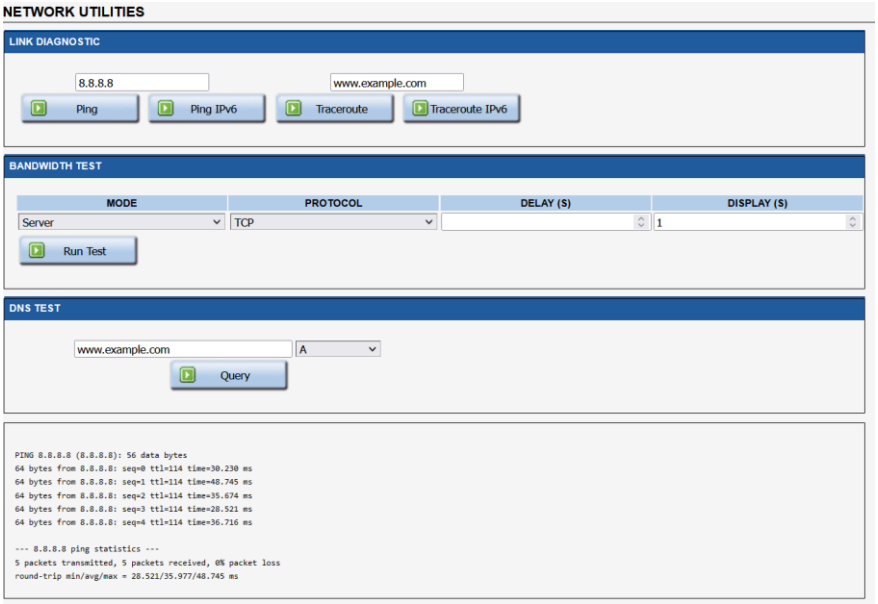
DHCP info: Lease time: 7200s

DNS server: 172.20.2.39 172.20.2.10

GRAPH	PHYSICAL INTERFACE	MAC ADDRESS	TX COUNT (IN BYTES)	RX COUNT (IN BYTES)	INTERFACE MODE	MTU
	Cellular	00:00:00:00:00:00	23039	44147	Operator (home): F SFR SIM: Password accepted	1500

WAN Router: Network Testing

we do network connectivity test with ping on google DNS works with success as shown the screenshot below:



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