MEC User manual

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1 Product overview

1.1 Product appearance

Figure 1-1 Equipment appearance

Table 1-1 shows the interface description of MEC.

Interface name	Number of Ports	Interface type	Interface Capablity	remarks
LS	4	RJ45	100/1000Base-T，RJ45	
AC SOCKET	1	AC socket	90-264V AC, 3-6 amp	
HDMI	1	HDMI	User interface display	Disabled
USB	2	USB	USB 2.0, 480 Mbps	
HS	3	RJ45	100 / 1000/ 10000 Mbps Base-T，RJ45	

Table 1-2 MEC LED/ indicator

LED	Power switch with LED	Blue: On, the system starts normally Blue: Off, system not started
	Alarm LED	Red: on, any failure on gNB side
	LAN port	100 / 1000 adaptive, green and yellow LEDsGreen (link): on, light port worksnormally Green (link): off, faulty or not workingRed (ACT): flashing, with data transmission Red (ACT): off, no data transmission NOT support 10Mbps
	RF1	When RF cell -1 is up
	Sync	When UE is attached with RAN

1.2 Technical specifications

1.2.1 Hardware specifications

Project	Describe
Installation mode	Indoor lab equipment
Power consumption (Max)	850W
Power module	240V AC
CPU Spec	SUPERMICRO MBD-X12DPL-NT6 Motherboard Dual Socket with Dual Processor
RF card	N310
SSD	500GB
RAM	128GB
LAN management port	4X1G RJ45, 1X10G RJ45

1.2.2 Technical specifications

Project	Description			
Performance	1. Support 1 radiation surface			
	2. Carrier bandwidth: single carrier 100MHz			
	3. Backhaul: 1G Optical interface SFP+			
Compatible design	Supports distributed base stations			
Synchronization mode	1. IEEE1588V2 synchronization			
	2. SyncE synchronization			
Heat management	4X 120 mm Fan			
	Aluminum passive heat blocks on each side			
Band and bandwidth	Support standard 5G-NR rel-15			
	Support FDD and TDD band. 10,20MHz for n2, n5, n66, n77 band & 40MHz for n2, n66, n77 band & 100MHz for n77 band			
Frequency Range (MHz)	n2	n5	n66	n77
	1930-1990	869-894	2110-2200	3700-3980
Tune up Tolerance	+/- 2dB	+/- 2dB	+/- 2dB	+/- 2dB
Tx Spec	For N310 USRP device has four TX/RX port. For TX/RX port TX power 19.76dBm max RX power -15dBm			
Rx Spec	For N310 USRP device has four RX port. For RX port RX power -15dBm			

1.2.3 Environmental specifications

Project	Description
Storage temperature / humidity	The equipment shall be able to work or store normally within the following temperature and humidity range: Operating temperature: - 5 ° C to + 30 ° C Storage temperature: - 40 ° C to + 70 ° C Relative humidity: 5% ~ 95% (no condensation)
Heat dissipation mode	Natural convection heat dissipation
Atmospheric pressure	86 Kpa~106 Kpa
Protection level	IP30
Surge	Indoor products, no surge requirements

2. Configuration

2.1 MEC Hardware Setup

Cables should be connected as shown in the image.

2.2 Ip address configuration (Optional)

The default configuration is static with IP address 192.168.2.16, and you canchange this IP following below operations.

- ➔ Login via SSH user: miab password: root@123
- ➔ Edit IP configuration file with below command

  sudo vi /etc/netplan/01-netcfg.yaml

  Save file and exit

```
        enp108s0:
                optional: true
                dhcp4: no
                addresses:
                        - 192.168.6.252/24
                        - 192.168.2.132/24
                nameservers:
                          addresses: [8.8.8.8, 8.8.8.4]
                gateway4: 192.168.6.1
                mtu: 1500
~
```

➔ To apply new configuration, use below command

sudo netplan apply

3 Provisioning of execution and configuration

3.1.0 Provisioning of execution and configuration for RF1

Provision

1. Open terminals as required (min 3)
   i. Run the command in all the terminals
      ssh root@192.168.2.16
      pass- root@123

3.1.1 Execution of L1&L2

For 4x4 Transmission

For L1

2. Perform following steps for run processes: -
   i. To run L1 binary enter following command: -

-> Go to first tab of terminal and enter path for L1

cd /opt/FCC_DEV0/L1/script

Some Details required for running L1

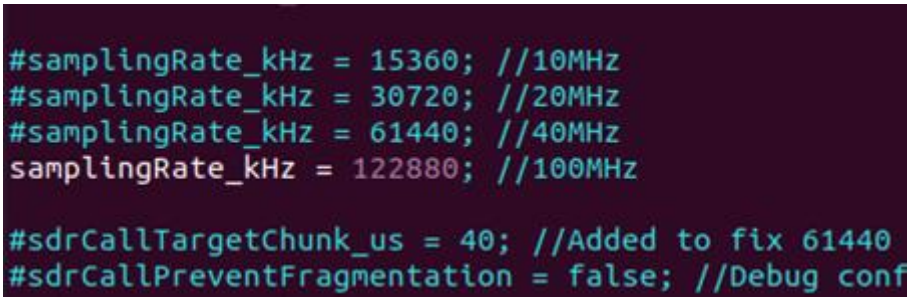
Now first open the L1_NR.cfg by using the command

vi ../cfg/L1_NR.cfg

Go to the insert mode by pressing i key and edit the parameter.

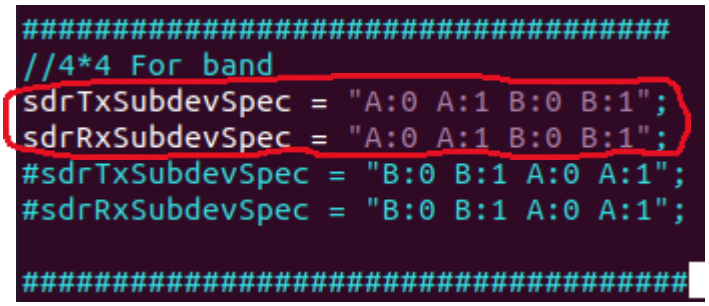
To change the Sampling Rate parameter

Uncomment (Remove #) the samplingRate_kHz value according to the channel bandwidth as shown in below picture.



To assign antenna port value

Set the sdrTxSubdevSpec and sdrRxSubdevSpec should be given in the picture.
If it is not similar to configuration in the L1 config file, then make it like this:



Once done, save the file press ESC and type command :wq then press ENTER.

Now Run L1 by using this command

./runL1.sh dpdk

For L2

To run MAC_NR binary enter the following commands in second terminal

-> Go to second tab and change path for MAC_NR

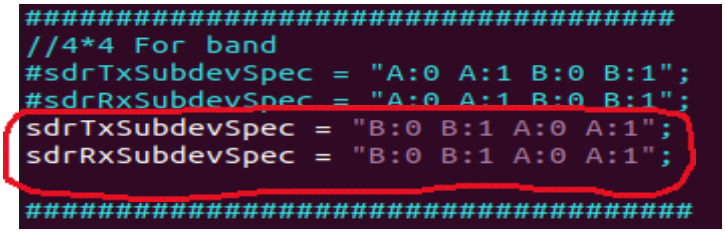
cd /opt/FCC_DEV0/L2/src

-> To edit config file of L2 refer point (c) Configuration from page number 5 (Use another terminal)

-> Run L2 by using this command

taskset -ac 20,21,84,85 ./MAC_NR 0

Once done, both L1 and L2 are live. Now just press **ctrl+c** after at least 10 seconds on the L2 terminal. Go to the L1 terminal, comment (Add # at the starting of command) on the previous sdrTxSubdevSpec and sdrRxSubdevSpec parameter, and uncomment (Remove #) the sdrTxSubdevSpec and sdrRxSubdevSpec, which are shown in the below picture. After that, just save the file, press **ESC**, type command **:wq** then press **ENTER**.



Once done, run L1 and L2. Wait for some time until **"L1 is now live"** is visible on the terminal, then both processes are up. Once all LEDs are glowing on RF1, you are able to take observations on the 4 TX ports.

Note: Whenever you want to change frequency and band, you need to repeat the above process.

3.1.2 Configuration for config file

3. Perform following steps for opening configuration file :-

i. Go to the third tab of terminal
ii. Enter **cd /opt/FCC_DEV0/L2/cfg** for config path
iii. Enter **vim config.cfg** to open config file in vim text editor.
iv. After completion of vim command a list of parameters will appear as shown below.

```
# TDD = 0,  FDD = 1
DuplexingMode=0
# Supported Band n2(FDD), n5(FDD), n66(FDD), n77(TDD)
Band=77
# SubcarrierSpacing 15KHz = 0, 30KHz = 1
SCS=0
# Downlink bandwidth, 10MHz BW = 0, 20Mhz BW = 1, 40Mhz BW = 2, 100Mhz BW = 3
Dl_Channel_Bandwidth=3
# Range 0 - 1000
Tx_Gain=850
# Downlink ARFCN pointA
Frequency_PointA=627056
# Downlink ARFCN SSB
Absolute_Frequency_Ssb=627296
# UL frequency needed if FDD is present
ulPointA_present=0
# Uplink ARFCN pointA if DD is Present
ul_Frequency_pointA=0
# modulation scheme  QPSK = 0, 16-QAM = 1 64-QAM = 2
Modulation_Scheme=0
# Number of Tx Antenna port
NumTxPort=4
# Number of Rx Antenna port
NumRxPort=4
```

Note : When you want to change frequency according to band, first edit the config file of L2 (above picture), then save it. After saving, first run L1 by using ./runL1.sh and then L2 by using taskset -ac 20,21,84,85 ./MAC_NR 0

4. Perform following steps to modify configuration file :-

i. Go to the insert mode by pressing i key and edit the parameter.
ii. To save the file press ESC and type command :wq then press ENTER
iii. If don't want to save file, press ESC and enter command :q! then press ENTER

3.1.3 MIMO (multiple input, multiple output) configuration

Note : It is already defined 4x4 MIMO in config file of L1.

i. Open new terminal and do **ssh root@192.168.16** and provide password **root@123** and run the command below
ii. **sudo vim /opt/FCC_DEV0/L1/cfg/L1_NR.cfg**

```
root@127:~# sudo vim /opt/FCC_DEV0/L1/cfg/L1_NR.cfg
```

iii. After running this command L1_NR.cfg file will open shown in the picture below

```
numTxAntennas = 4;
numRxAntennas = 4;
txGainScalingFactor = 0.05;
timingOffsetThreshold_nsec =1000;
//sdrSendAdvance_ns = 9000;
//sdrSendAdvance_ns = 14000;
sdrSendAdvance_ns = 12000;

###########8.9.1_rc6 change ############################

#sdrTxSubdevSpec = "B:0 B:1";
#sdrRxSubdevSpec = "B:0 B:1";
#########################################################
#sdrTxSubdevSpec = "B:0";
#sdrRxSubdevSpec = "B:0";

###############################################

sdrTxSubdevSpec = "B:0 B:1 A:0 A:1";
sdrRxSubdevSpec = "B:0 B:1 A:0 A:1";

#sdrTxSubdevSpec = "A:0 A:1 B:0 B:1";
#sdrRxSubdevSpec = "A:0 A:1 B:0 B:1";
```

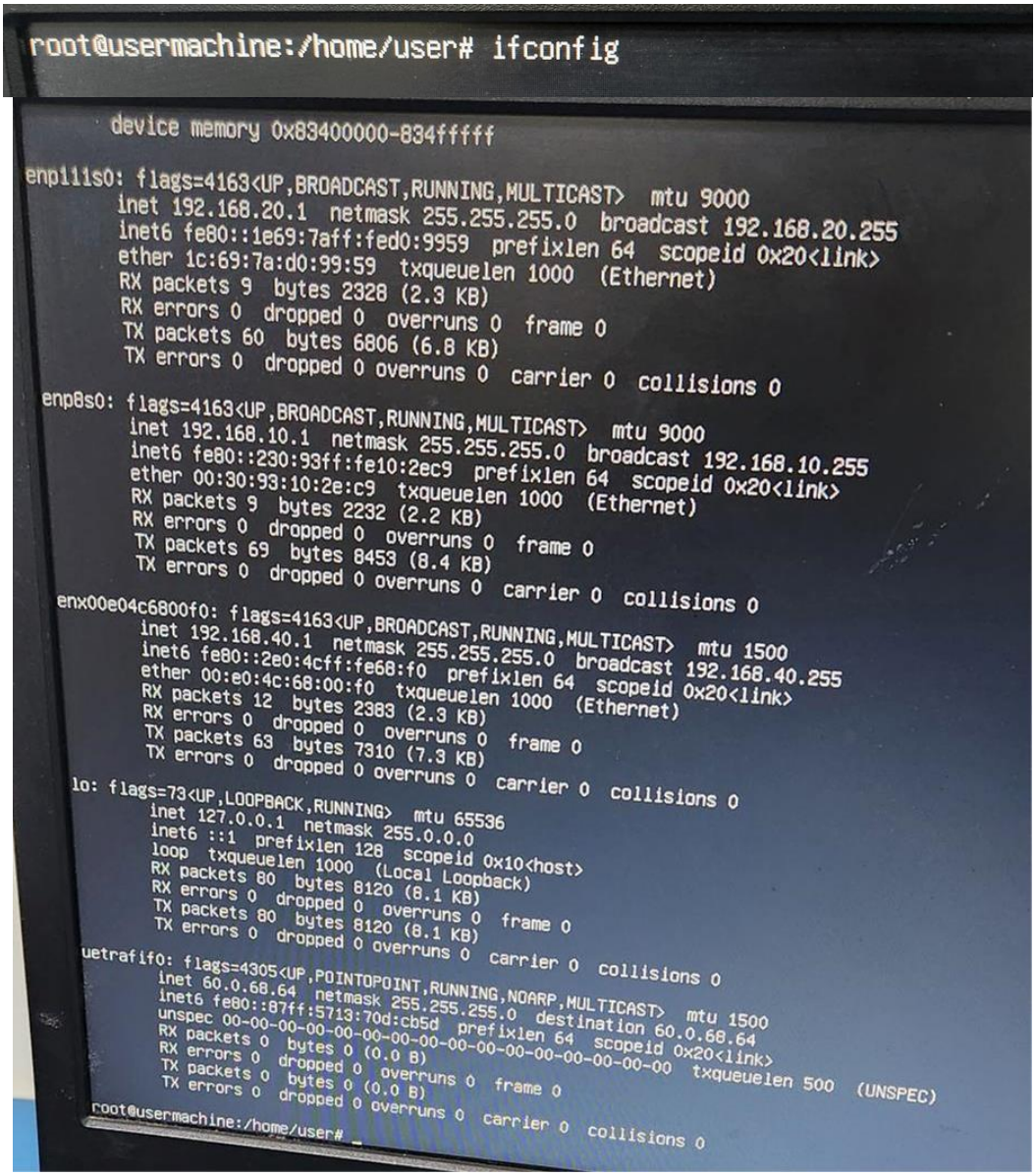
iv. As mention above in the picture the highlight portion, we can change MIMO configurations here.

6. Perform following steps to modify L1_NR.cfg configuration file :-

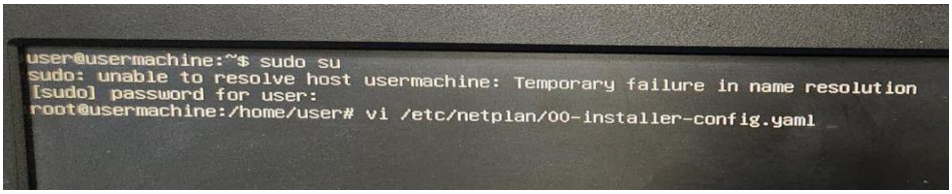
i. Go to the insert mode by pressing i key and edit the parameter as required.
ii. To save the file press ESC and type command :wq then press ENTER
iii. If don't want to save file, press ESC and enter command :q! then press ENTER

3.1.4 Troubleshooting

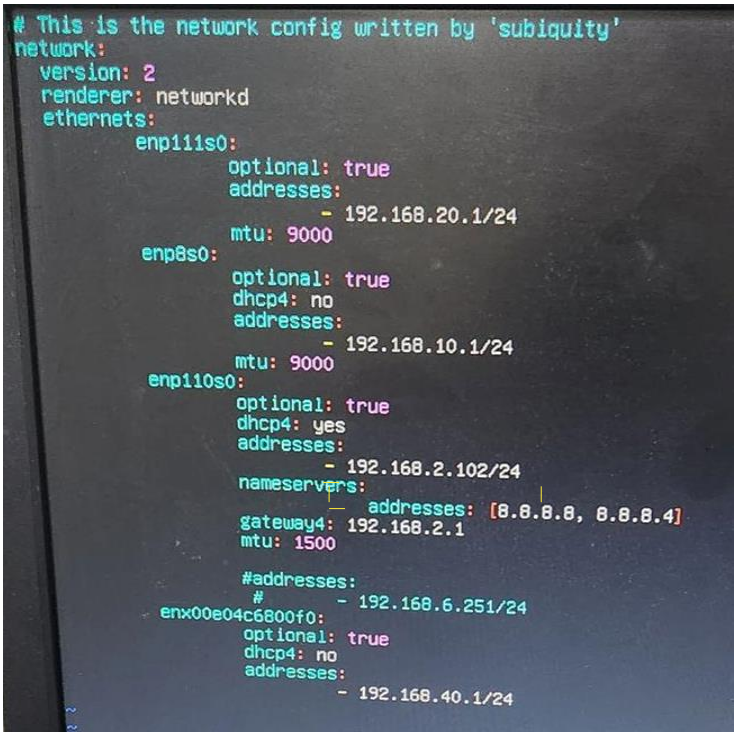
In any case if you are not able to do the ssh or getting trouble while accessing hardware then connect monitor through HDMI/VGA cable. You will get username window then enter Username as miab and Password root@123.
If you get blue screen then enter ctrl+alt+f3. Enter username as miab and Password is root@123. Once the authentication done enter command ipconfig for checking the IP address.



Now First do **sudo su** and password – **root@123**



If you want to change the IP then enter **vi /*etc*/netplan/00-network-manager-all.yaml.** Once you enter, press insert and change the IP address mention in the below picture.


This is the network config written by 'subiquity'
network:
version: 2
renderer: networkd
ethernets:
enp111s0:
optional: true
addresses:
- 192.168.20.1/24
mtu: 9000
enp8s0:
optional: true
dhcp4: no
addresses:
- 192.168.10.1/24
mtu: 9000
enp110s0:
optional: true
dhcp4: yes
addresses:
- 192.168.2.102/24
nameservers:
addresses: [8.8.8.8, 8.8.8.4]
gateway4: 192.168.2.1
mtu: 1500
#addresses:
- 192.168.6.251/24
enx00e04c6800f0:
optional: true
dhcp4: no
addresses:
- 192.168.40.1/24

4.UHD UPGRADE

4.1.1 Prerequesit:

1. Sub_6GHz Hardware should be connected with internet
2. Command: vim */etc/*resolve.conf nameserver 127.0.0.53 change it to 8.8.8.8 save and close file.
3. Now check ping google.com it's output should be like below

64 bytes from del03s16-in-f14.1e100.net (172.217.167.46): icmp_seq=1 ttl=117 time=7.05 ms
Steps to upgrade UHD

if your are facing error something like -:
{
Reading package lists... Done
Building dependency tree
Reading state information... Done
E: Unable to locate package uhd-packages
root@phluido-NUC9i9QNX:~# apt-get purge libuhd-dev
Reading package lists... Done
Building dependency tree
Reading state information... Done
You might want to run 'apt --fix-broken install' to correct these.
}

run this command -: apt --fix-broken install

run below given command

1. sudo apt-get remove uhd-host
2. sudo apt-get remove --auto-remove uhd-host
3. sudo apt-get purge uhd-host
4. sudo apt-get purge --auto-remove uhd-host

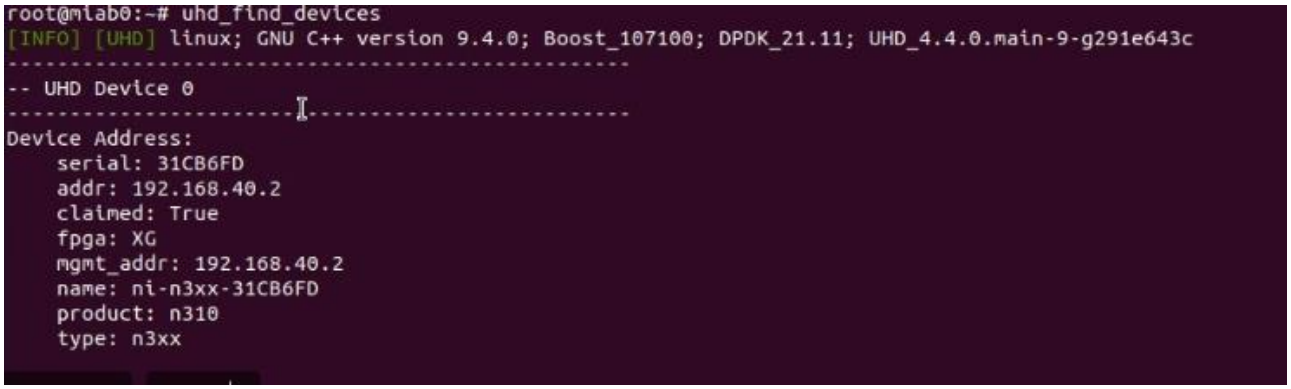
while running these commands it will ask for permission Y/n then enter Y.

- dpkg -l | grep uhd

apt-get purge uhd-packages
vim */etc/*apt/sources.list
deb https://ppa.launchpadcontent.net/ettusresearch/uhd/ubuntu bionic main
deb-src https://ppa.launchpadcontent.net/ettusresearch/uhd/ubuntu bionic main
append above two lines, sva e& close files.
Now run command: apt-get update
while updating it sometimes throws error for key then
apt-key adv --keyserver keyserver.ubuntu.com –recv-keys received keys
Now again run apt-get update

run **apt-get install libuhd-dev uhd-host -y**

run uhd_find_devices
it's output should look like below screen shot:



4.1.2 REBOOT MEC gNB

Note: In case you face the problem like that uhd is not found or you you just want to restart the hardware

Run the below command for rebooting the hardware
reboot -f

4.1.3 FCC Regulations and RF Exposure

FCC Regulations

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

RF Exposure Information

This device meets the government's requirements for exposure to radio waves.
This device is designed and manufactured not to exceed the emission limits for exposure to radio frequency (RF) energy set by the Federal Communications Commission of the U.S.Government.
This device complies with FCC radiation exposure limits set forth for an uncontrolled environment.
In order to avoid the possibility of exceeding the FCC radio frequency exposure limits, human proximity to the antenna shall not be less than 87cm (34 inches) during normal operation.

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This MEC, model no: 5GTP202SSMECn256677 requires training professionals qualified by Service Provider to configure and install the product. This device complies with FCC rules and regulations for fixed-mounted on indoor permanent structure in commercial/business premises excluding private resident/property. This device is distributed through controlled distribution channel and requires that trained professionals to install this product, and this device will not be sold directly to the general public throughretail stores.

This MEC, model no: 5GTP202SSMECn256677 must be installed to provide at least87cm separation distance from bystanders to comply with the General Population /Uncontrolled MPE limit and requirements. RF exposure compliance may need to be addressed at the time of licensing, as required by the responsible FCC bureau(s) includingmitigation actions for fixed RF sources to the extent necessary to ensure compliance withFCC exposure limits per section.