

Emu Router

User Manual: ER2000T-XX-CAT1

Rev: V0. 6

2nd August 2017

Revision History:

Date	Rev No.	Description	By
07-10-2017	V0.1	Initial draft	CIO
07-27-2017	V0.2	Numerous Updates	CIO
07-28-2017	V0.3	Nomenclature clean-up	CIO
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08-02-2017	V0.6	Removed -VZ-CAT1 from the Manual	CIO

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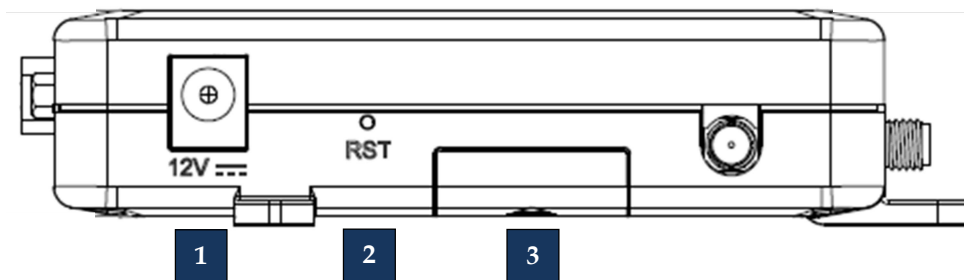
1. Introduction

Connected IO Inc's., Emu Router is a 4G router offering CAT1 connectivity for M2M applications. The Emu router includes a 4G modem with an embedded host processor based on Mediatek MT7620A SoC which also supports 802.11 b/g/n WiFi functionality. The 4G connectivity is made by an operator certified LTE module.

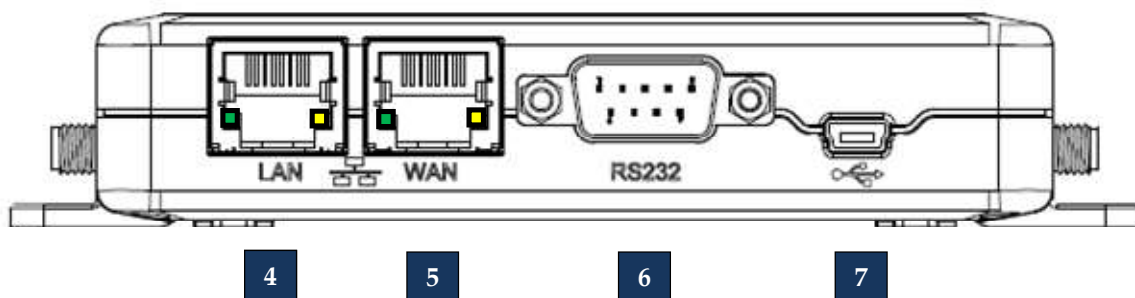
This document provides instructions, and basic operational guidelines, to aid a Systems Administrator with the deployment of this product.

2. Hardware Configuration

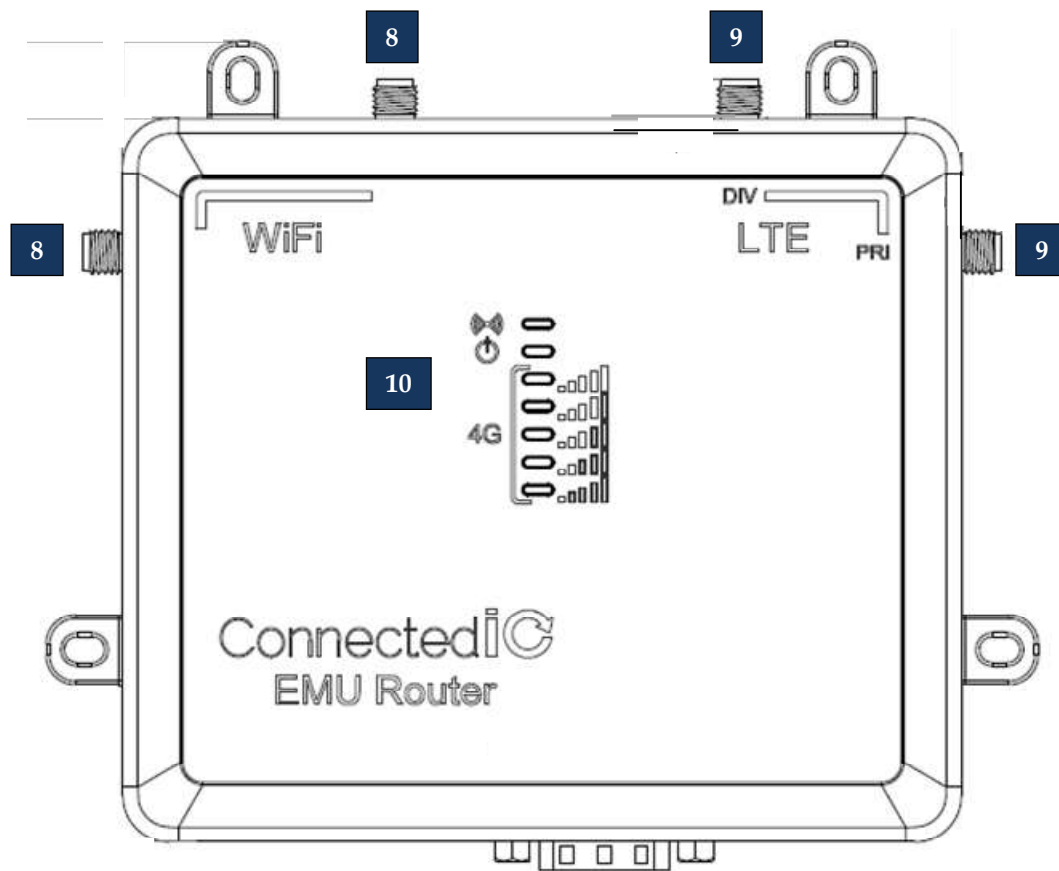
2.1. Product Interfaces



Number	Item	Description
1	DC Power Input	12VDC @ 2.0A Input. Center conductor is Positive
2	Reset Button	Push & Release to reset the device Push & Hold for 5-seconds then release installs factory preset
3	SIM Access	2FF Mini-SIM format Slide the door open to access the SIM holder. Push SIM into the holder to engage, push a second time to eject the SIM



Number	Item	Description
4	LAN Port	LAN Port for Wired Ethernet Clients LED: Solid Green for Link, Flashing Yellow for Traffic
5	WAN Port	WAN Port for establishing links to leased telecommunication circuits LED: Solid Green for Link, Flashing Yellow for Traffic
6	RS232 Port	Serial Communications port per EIA asynchronous data transfer
7	USB Port	Mini-USB 2.0 provides connectivity for optional storage or a USB Ethernet dongle. Port supplies up to 0.5A of 5V to connected devices.



Number	Item	Description
8	WiFi Antenna	SMA connector for WiFi Antennas (NOT Reverse Polarized)
9	Cellular Antennas	SMA connector for both Primary and Diversity Antenna Ports
10		WiFi LED, Orange: Wifi is Connected/Off No WiFi/Flashing Orange for traffic

		Power LED, Yellow: On Power is good
		Cellular Connection Strenght Indicators, Green: Cellular Connection The following table lists the signal strength range corresponding to the number of LEDs lit: 5-LEDs On: > -61dBm 4-LEDs On: -63 dBm to -71 dBm 3-LEDs On: -73 dBm to -83 dBm 2-LEDs On: -85 dBm to -98 dBm 1-LED On: -97 dBm to -107 dBm No-LEDs: < -109 dBm

2.2. Radio Configurations

Model Name	LTE Band (MHz)	3G (MHz)	WiFi
ER2000T-NA-CAT1	• B2: 1900 PCS • B4: 1700/2100 AWS 1 • B5: 850 • B12: 700 ac • B13: 700 c	• B2: 1900 • B5: 850	• Yes, 802.11 b/g/n compliant

3. System Configuration

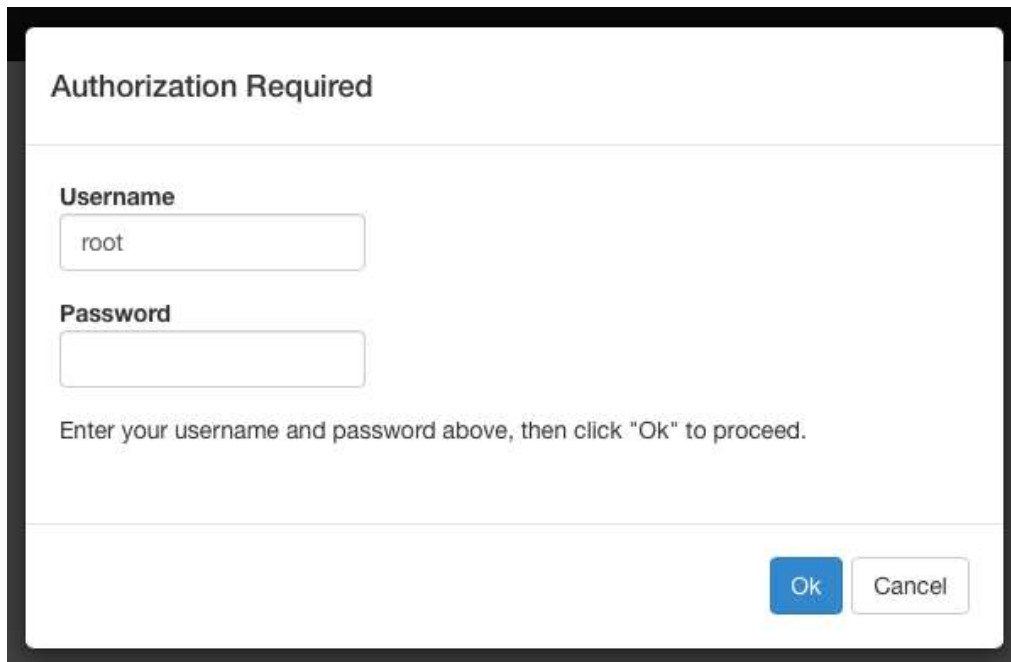
3.1. Initial IP Setup

The Emu Router Management GUI can be accessed through the Ethernet ports with the default IP address of **192.199.1.1**.

To configure the Emu Router, follow the following sequence:

- Connect the Ethernet cable between the computer and the Emu Router LAN port
- Setup the desktop as a static IP in **192.199.1.x** domain or DHCP client to get IP from EMU Router
- Open a browser and type [http:// 192.199.1.1](http://192.199.1.1) to start the settings

On login page, you can just click the Login icon to enter the GUI as shown in Figure 1. Default password is "password", it is recommended that a new password be created under Web GUI System->Administration page.



The screenshot shows a web browser window with a title bar. The main content area has a header 'Authorization Required'. Below it, there are two input fields: 'Username' with the text 'root' and 'Password' which is empty. Below the password field is a line of text: 'Enter your username and password above, then click "Ok" to proceed.' At the bottom right, there are two buttons: 'Ok' (blue) and 'Cancel' (white with a grey border).

Authorization Required

Username
root

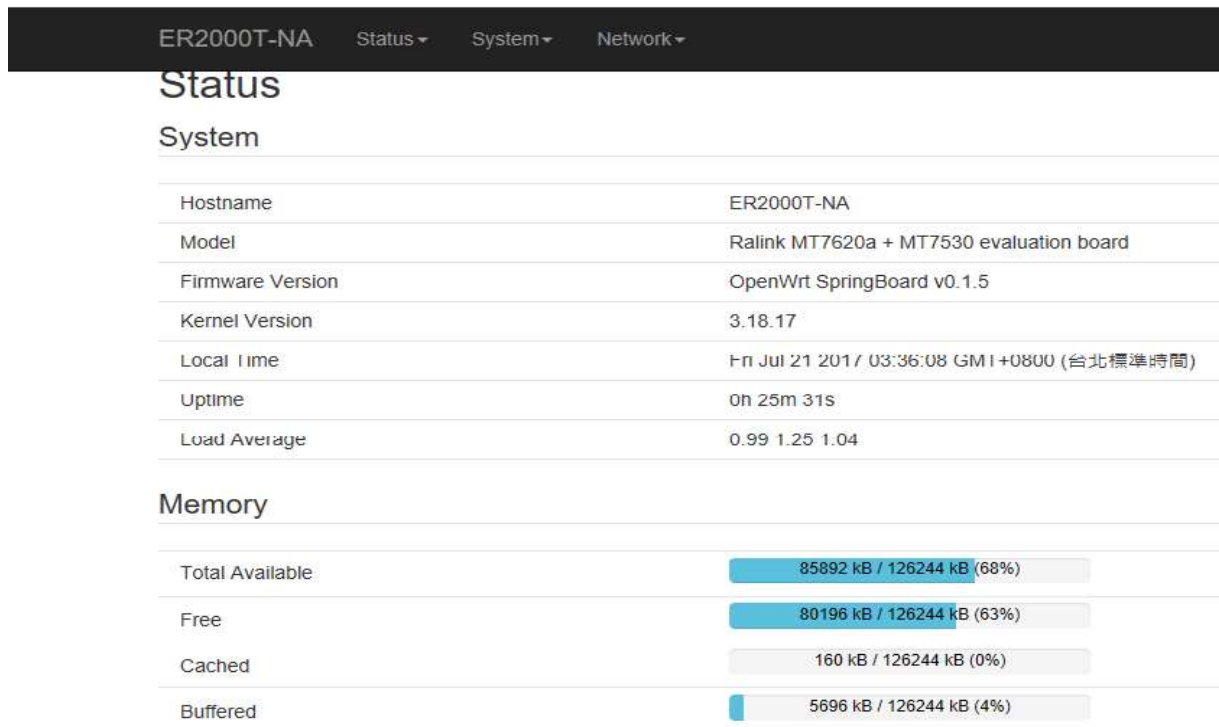
Password

Enter your username and password above, then click "Ok" to proceed.

Ok Cancel

Figure 1: Login Page

You can see the EMU Router overview after login into GUI, the overview page includes important messages such as system status, and memory information as shown in Figure 2.



The screenshot shows the EMU Router GUI overview page. At the top is a dark navigation bar with 'ER2000T-NA' and three dropdown menus: 'Status', 'System', and 'Network'. Below the navigation bar, the 'Status' section is active. It contains a 'System' table with various system information and a 'Memory' section with a table and progress bars showing memory usage.

ER2000T-NA		Status ▾	System ▾	Network ▾
Status				
System				
Hostname	ER2000T-NA			
Model	Ralink MT7620a + MT7530 evaluation board			
Firmware Version	OpenWrt SpringBoard v0.1.5			
Kernel Version	3.18.17			
Local Time	Fri Jul 21 2017 03:36:08 GMT+0800 (台北標準時間)			
Uptime	0h 25m 31s			
Load Average	0.99 1.25 1.04			
Memory				
Total Available	85892 kB / 126244 kB (68%)			
Free	80196 kB / 126244 kB (63%)			
Cached	160 kB / 126244 kB (0%)			
Buffered	5696 kB / 126244 kB (4%)			

Figure 2: Overview Page

3.2. Setup New IP

Select Network->Interfaces as shown in Figure 3.

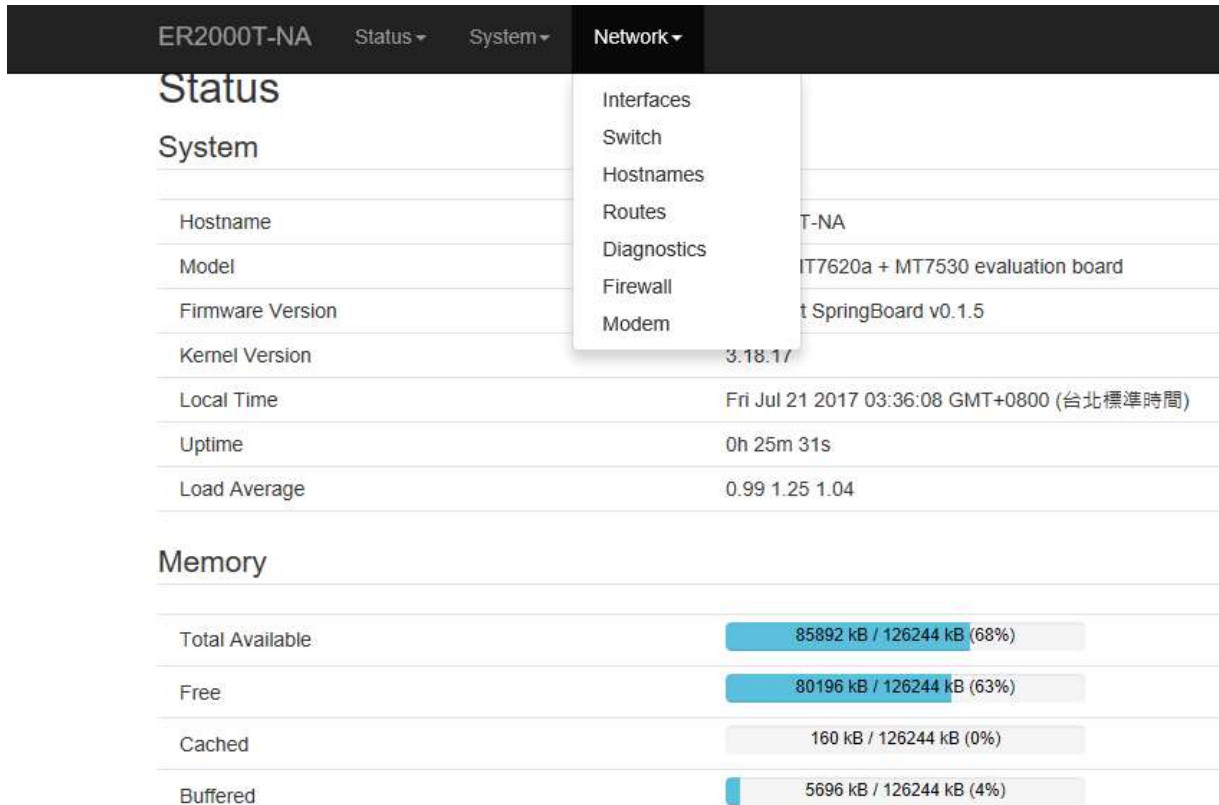


Figure 3: Network List

Select LAN and click "Edit" from Figure 4.

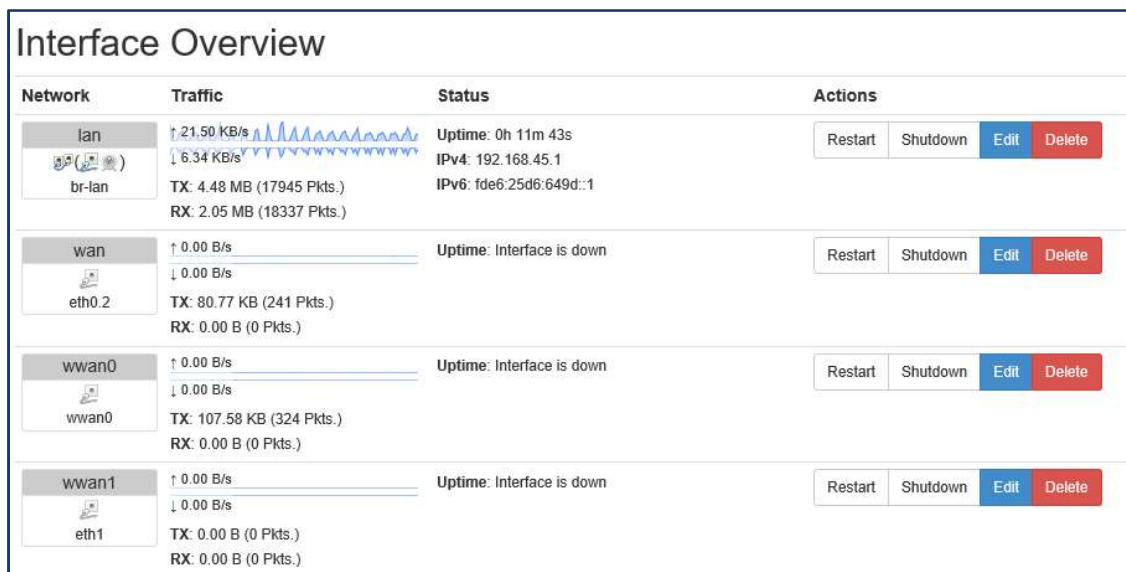


Figure 4: Interface Overview

Enter the new IP address in the “IPv4 address” field, and then click the “Change” icon in the bottom-right corner in [Figure 5](#).

Configure "lan"

General Settings
IPv6
Physical Settings

Start on boot ☒

Protocol Static address ▼

IPv4 address 192.199.1.1

IPv4 netmask 255.255.255.0 ▼

IPv4 broadcast

IPv4 gateway

DNS servers 192.199.1.1 +

Change
Cancel

Figure 5: New IP Address for LAN

After setup new IP, the GUI will return to “Interface Overview”, you have to press “Apply” in the upper right corner as shown in [Figure 6](#).

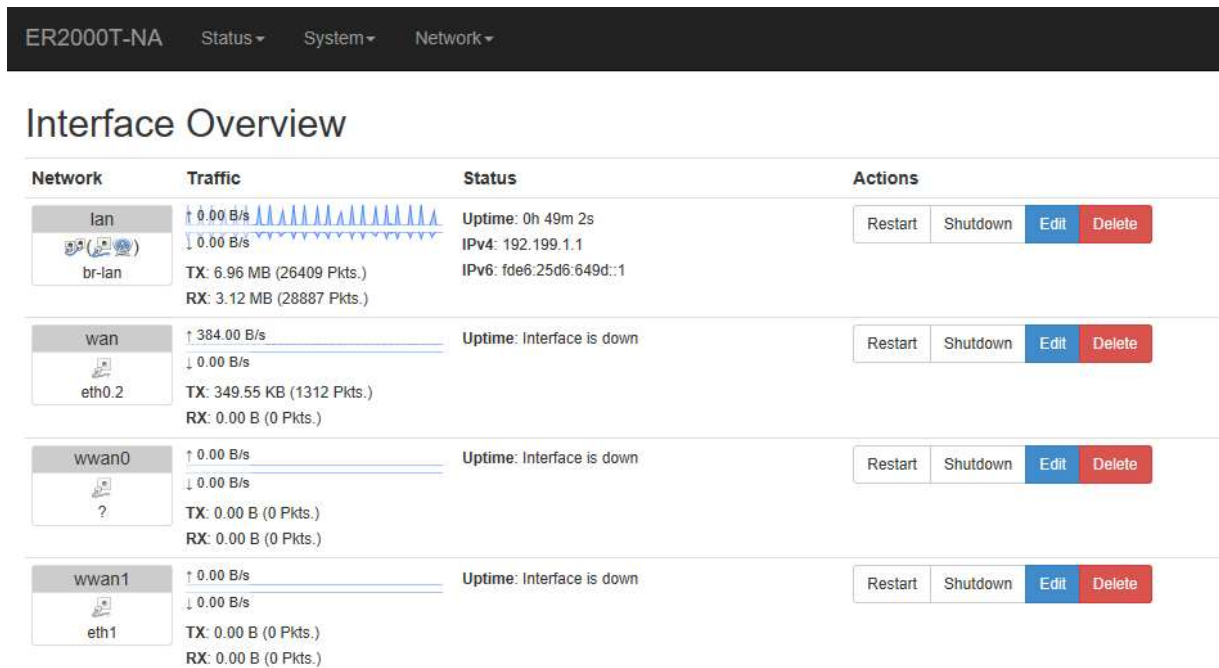


Figure 6: Save the New Setting

After pressing “Apply”, the system will show a confirmation window. Please see Figure 7.

Staged configuration changes

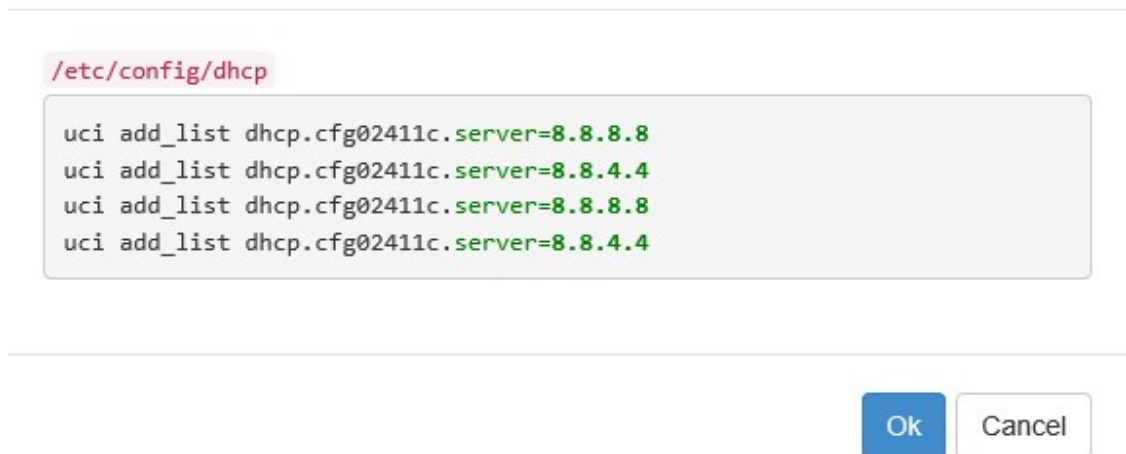


Figure 7: Configuration Change

3.3. Enable/Disable the DHCP Server on LAN Interface

[N.A]

3.4. Connecting to the WiFi

For computers using Windows operating system (For instance: Windows 10), Click the network internet access icon and there are wireless networks in range, and try to connect to a WiFi “AP102F” network without security key input as shown in Figure 6.

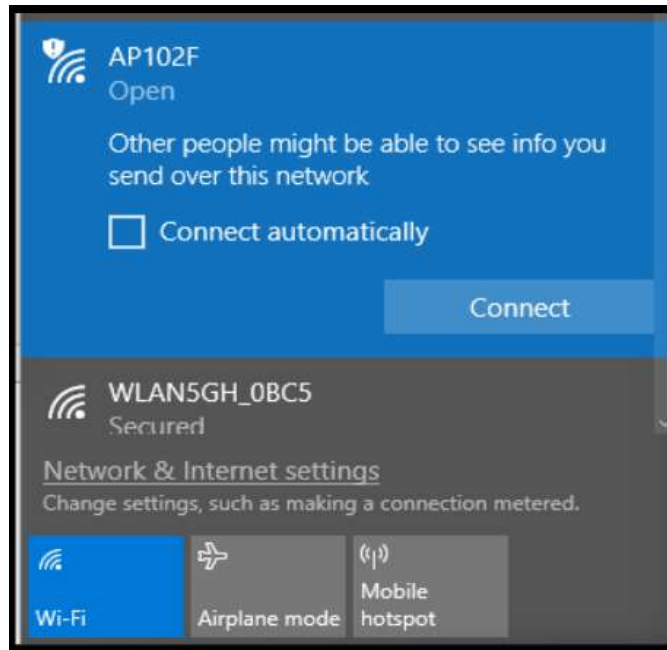


Figure 8 : Network Internet Access

Open a browser and typing <http://192.199.1.1> to login into the GUI again. Once the GUI is up the user should see the EMU Router overview with WiFi Connection information as shown in Figure 9, Wireless Information.

DHCP Leases

Hostname	IPv4-Address	MAC-Address	Leasetime remaining
?	255.255.255.255	d8:50:e6:1e:89:26	11h 41m 11s
Michelle-NB	255.255.255.255	24:0a:64:cb:b3:c3	11h 59m 3s

Wireless



Generic MAC80211 802.11bgn (radio0)

Channel: 11 (2.462 GHz) | TX Power: 20 dBm



Mode: Master | Bitrate: ~ 72.2 Mbit/s | SSID: AP102F | BSSID: 8C:C7:AA:00:C0:2C | Encryption: None

Associated Stations

	MAC-Address	Signal	Noise	RX Rate	TX Rate
	24:0A:64:CB:B3:C3	-64 dBm	0 dBm	72.2 Mbit/s, MCS 7, 20MHz	72.2 Mbit/s, MCS 7, 20MHz

Figure 9: Wireless Information

4. System Maintenance

This chapter describes how to back-up the current EMU Router configuration to your computer, and how to restore that same configuration at a later date if needed. This can be done by selecting System > Backup/Upgrade:

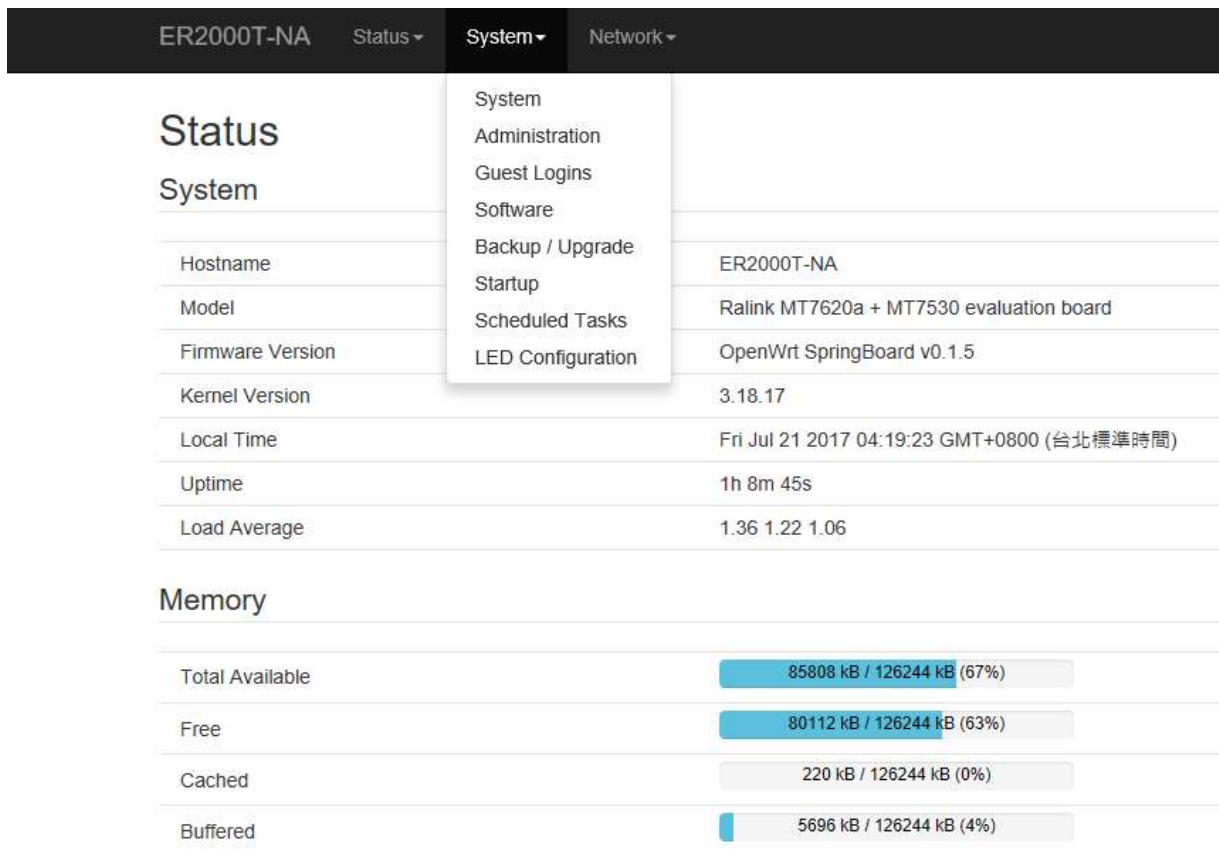


Figure 10: System List

4.1. Backup the Configuration

Select Firmware in the GUI page then click the icon “Generate archive” to save this configuration file in the folder you specified.

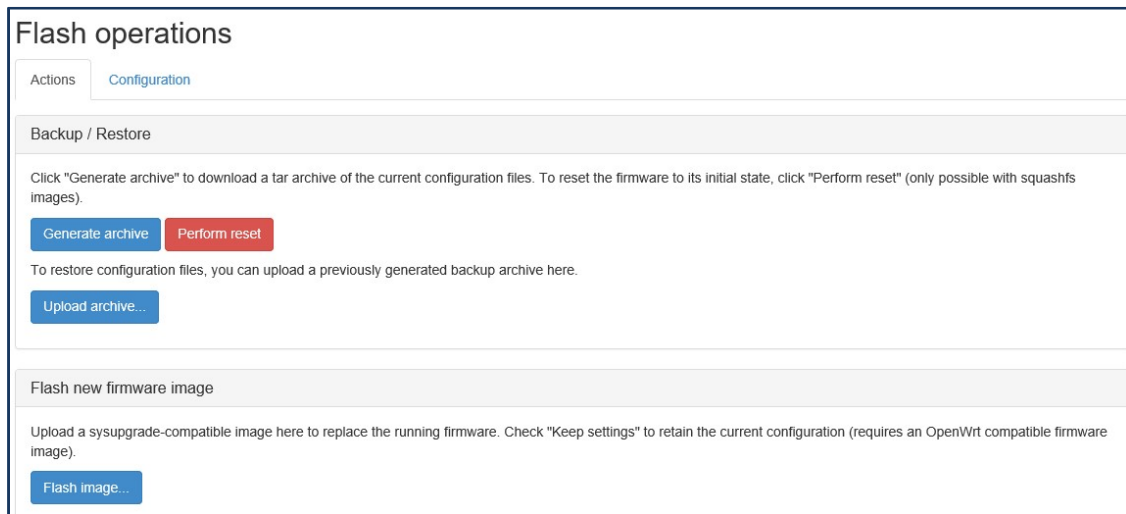


Figure 11: Backup the Configuration

The file is in tar.gz format, we suggest that you can rename it to a meaningful file name.

4.2. Restore the Configuration

Click the icon “Update archive” in flash operations page as shown [Figure 8](#). Device will write the stored configuration back to flash then reboot the system.

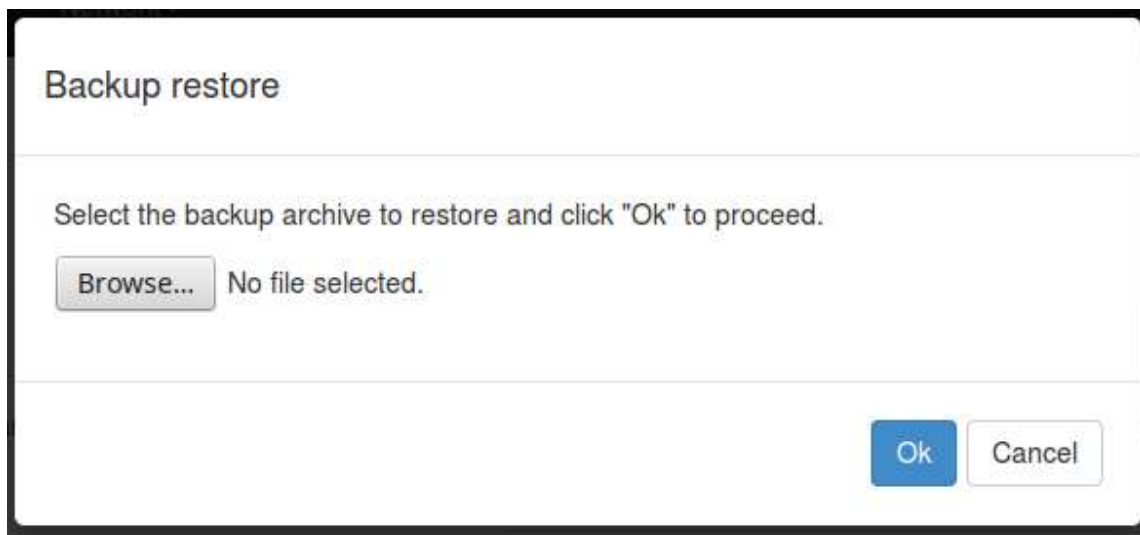


Figure 8: Restore the Configuration

4.3. Reset to Factory Default under Web GUI

Click the icon “Perform reset”, a warning window will pop-up saying “Really reset all changes?” The device will reset to factory default and reboot if “Yes” is chosen.

NOTE: It is important NOT to power off the device before the entire process is completed.

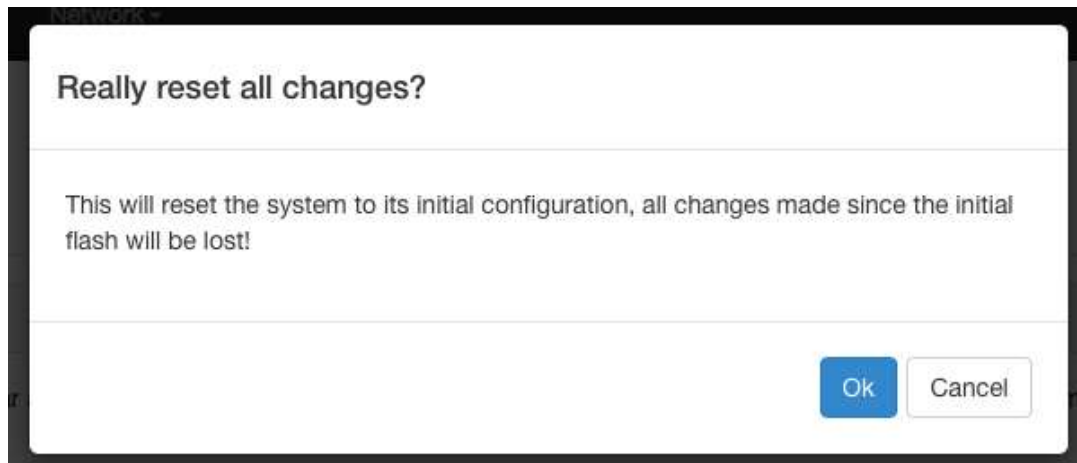


Figure 9: Reset to Default

4.4. Firmware Upgrade

Select System from web GUI, and find "Flash image" section. Click the icon "browse" and select the new image that you want upgraded to the device.

The upgrade process may take longer than 10 minutes for flashing and rebooting. It is important NOT to power off the device during the process. Administrators can PING the device after the upgrade process is completed to ensure that the device is programmed and rebooted successfully.



Figure 10: Firmware Upgrade

After upgrading the new FW, check if the FW version is correct. This can be done by selecting Status-> Overview, and find the "Firmware Version" field.

ER2000T-NA Status ▾ System ▾ Network ▾	
Status	
System	
Hostname	ER2000T-NA
Model	Ralink MT7620a + MT7530 evaluation board
Firmware Version	OpenWrt SpringBoard v0.1.5
Kernel Version	3.18.17
Local Time	Fri Jul 21 2017 04:35:29 GMT+0800 (台北標準時間)
Uptime	1h 24m 52s
Load Average	1.55 1.34 1.19

Figure 11: New Firmware Version

5. Modem

Select Network -> Modem as shown [Figure 12](#).

ER2000T-NA Status ▾ System ▾ Network ▾

Modem

AT command

APN Change

Information

Module	AT+GMM
Status	Disconnect
Mode	3G
RSSI	
APN	

Preferred Network

☒ Auto
☐ LTE
☐ 3G

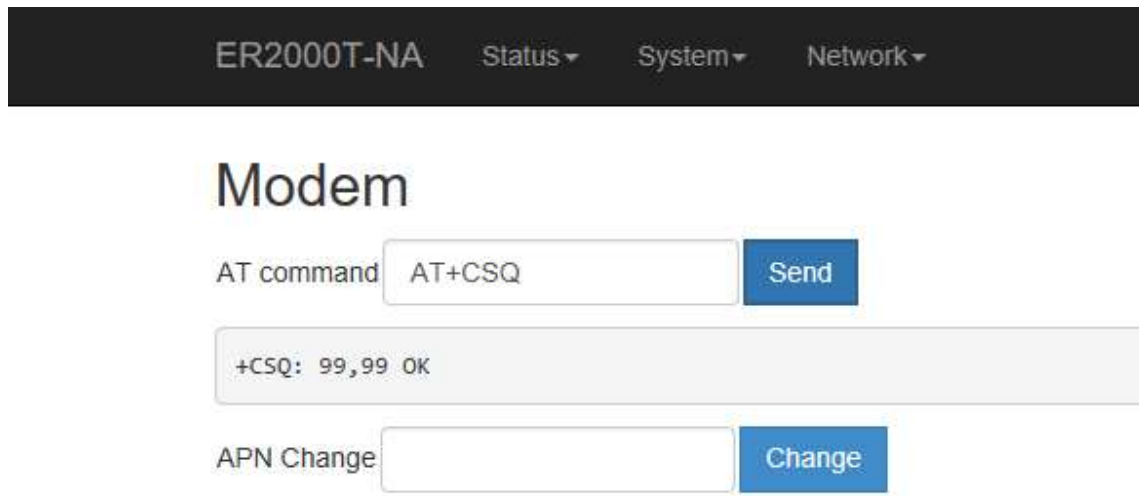
☒ Auto Connect

Figure 12: Modem Page

5.1. AT Command

You can use the AT command to check the LTE status. The AT command format is “AT+ Command” for example: AT+CSQ. Enter the AT command and click “Send”.

AT command responses will be displayed in the message bar right below the command as shown in Figure 13.



ER2000T-NA Status ▾ System ▾ Network ▾

Modem

AT command

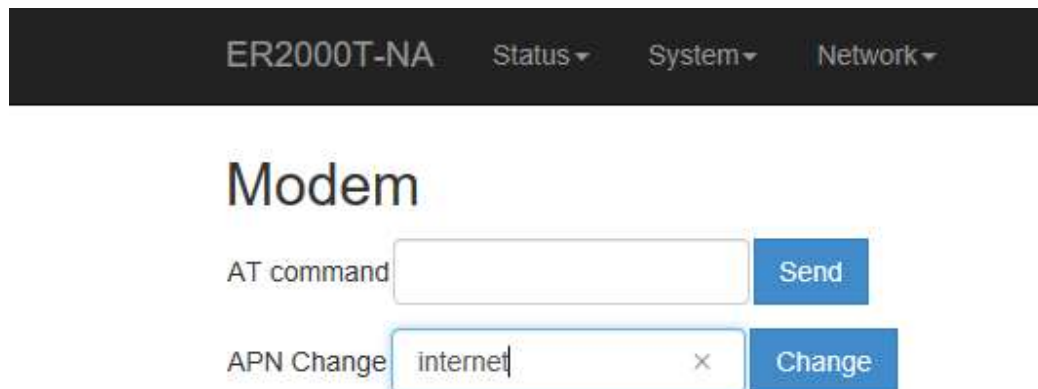
`+CSQ: 99,99 OK`

APN Change

Figure 13: AT Command Example

5.2. APN Change

Typically, your APN is auto-configured or auto-detected. The APN Change command allows you to change the local telecommunication company. Enter the APN name and click “Change” button as shown in Figure 14.



ER2000T-NA Status ▾ System ▾ Network ▾

Modem

AT command

APN Change

Figure 14: APN Change

If you would like to check whether the APN setting is successful, please enter AT command “AT+CGDCONT?” See Figure .

ER2000T-NA Status System Network

Modem

AT command

`+CGDCONT: 1, IP, internet, ,0,0 OK`

APN Change

Figure 19: Check APN Function

5.3. Mode Setting

EMU Router supports the switching between 3G and LTE modes. We suggest that you should choose Auto mode for most of the applications. In Auto mode the system will automatically coordinate between different modes.

Mode

☒ Auto

☐ LTE

☐ 3G

☒ Auto Connect

Figure 20: Mode Change

6. LOG

6.1. System LOG

Select Status -> System Log

ER2000T-NA Status System Network

System Log

Thu Jul 20 22:49:57 2017 kern.info kernel: [13158.740000]

Thu Jul 20 22:49:57 2017 kern.info kernel: [13158.740000] br-lan: port 1(eth0.1) entered forwarding state

Thu Jul 20 22:49:57 2017 kern.info kernel: [13158.740000] ralink_soc_eth 10100000.ethernet eth0: port 0 link up (100Mbps/Full duplex)

Figure 21: System Log

6.2. Kernel LOG

Select Status -> Kernel Log

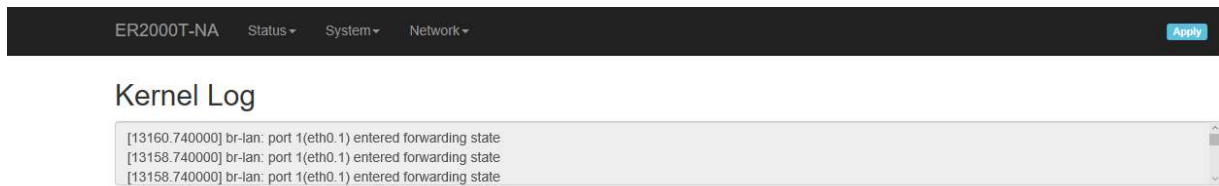


Figure 15: Kernel Log

7. Antenna

7.1. Detachable Antenna Guidelines

This M2M Router device, ER2000T-NA-CAT1, integrates an LTE (4G) and WiFi radio function. It uses an external antenna (dipole antenna) and a standard antenna connector (SMA type) which is not covered under FCC 15.203 requirements. Therefore, this equipment needs to be installed by a professional technician since the M2M application usually resides inside other equipment where the end-user cannot change the external antennas easily.

There is no doubt that the antennas can be replaced by the end-user once installed in the final configuration.

7.2. Antenna - Installation Guidelines

When installing the antenna to the EMU Router product line there are a number of items to consider so good antenna performance can be maintained.

- Install the antenna in a place covered by the LTE signal.
- Antenna must not be installed inside a metal case.
- Antenna shall also be installed according to the Antenna manufacturer instructions.
- Antenna integration should optimize the Radiation Efficiency. Efficiency values >50% are recommended on all frequency bands for any antennas selected.
- Antenna integration should not dramatically perturb the radiation pattern. It is preferable to get, after antenna installation, an omnidirectional radiation pattern for the best overall coverage.
- Antenna Gain must not exceed values indicated in the regulatory requirements in order to meet related EIRP limitations.
 - Typical antenna Gain in most M2M applications should not exceed 2dBi.
- At least 20cm of separation distance between the antennas, the collocated router transmitters, and the human body must be maintained always.

7.3. Recommended Antennas

To aid in selecting an antenna for this router device the following antennas are recommended as functional and meeting the requirements for most M2M applications.

No.	Manufacturer	Part No.	Antenna Type	Peak Gain
1	GTT Europe LTD	OA-LTE-01-01-GT	Omni-Dipole	698-960MHz/1710-2170MHz/2500-2960MHz/2400MHz-2500MHz 0.7 dBi Max / 3.8 dBi Max / 3.2 dBi Max / 3.1 dBi Max

8. Environmental

8.1. Operating Environment

- Operating Temperature: -20°C to +55°C
- Storage Temperature: -40°C to +85°C

8.2. Physical Parameters

- Size: 114.6mm x 99.6mm x 24.7mm
- Weight: 157gr.

9. Approvals and Certifications

9.1. Manufacturing

- RoHS Compliance
- This device has been tested and found to be RoHS compliant with the council RoHS directive – 2011/65/EU.

9.2. North American Certifications

9.2.1. ER2000T-NA-CAT1

- FCC Compliance:
 - 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 device has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules.

- Canada
 - **CAN ICES-3 (B) / NMB-3 (B)**
 - This device Complies with ICES-003:2016 Issue 6, Class B.
- PTCRB Certification
 - This device has been tested and conforms to the PTCRB testing standards which confirms that this cellular product operates within a defined global and industry specification and meets the minimum level of Network performance required by PTCRB operator Member networks.

9.2.2. ER2000T-VZ-CAT1

- FCC Compliance:
 - 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 device has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules.
- Canada
 - **CAN ICES-3 (B) / NMB-3 (B)**
 - This device Complies with ICES-003:2016 Issue 6, Class B.
- Verizon Open Development Certification

9.3. FCC General Warning

This equipment has been tested and found to comply with the limits for a Class B Digital Device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try and correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.

- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

CAUTION:

Any changes or modification not expressly approved by the grantee of the device could void the user's authority to operate the equipment.

RF exposure warning

This equipment must be installed and operated in accordance with provided instructions and the antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter. End-users and installers must be provided with antenna installation instructions and transmitter operating conditions for satisfying RF exposure compliance.

Detachable Antenna:

This M2M Router device, ER2000T-NA-CAT1, integrates an LTE (4G) and WiFi radio function. It uses an external antenna (dipole antenna) and a standard antenna connector (SMA type) which is not covered under FCC 15.203 requirements. Therefore, this equipment needs to be installed by a professional technician since the M2M application usually resides inside other equipment where the end-user cannot change the external antennas easily. There is no doubt that the antennas can be replaced by the end-user once installed in the final configuration.

This radio transmitter FCCID: 2AMRIER2000TNAC1 has been approved by FCC to operate with the antenna types listed below with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

No.	Manufacturer	Part No.	Antenna Type	Peak Gain
1	GTT Europe LTD	OA-LTE-01-01-GT	Omni-Dipole	698-960MHz/1710-2170MHz/2500-2960MHz/2400MHz 0.7 dBi Max / 3.8 dBi Max / 3.2 dBi Max / dBi Max

9.4. Industry Canada (IC) Notices

Canada, Industry Canada (IC) Notices

This device complies with Canada license-exempt RSS standard(s).

Operation is subject to the following two conditions:

- (1) this device may not cause interference, and
- (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Canada, avis d'Industry Canada (IC)

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

- (1) l'appareil ne doit pas produire de brouillage, et
- (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Radio Frequency (RF) Exposure Information

The radiated output power of the Wireless Device is below the Industry Canada (IC) radio frequency exposure limits. The Wireless Device should be used in such a manner such that the potential for human contact during normal operation is minimized.

This device has also been evaluated and shown compliant with the IC RF Exposure limits under mobile exposure conditions. (antennas are greater than 20cm from a person's body).

Informations concernant l'exposition aux fréquences radio (RF)

La puissance de sortie émise par l'appareil de sans fil est inférieure à la limite d'exposition aux fréquences radio d'Industry Canada (IC). Utilisez l'appareil de sans fil de façon à minimiser les contacts humains lors du fonctionnement normal.

Ce périphérique a également été évalué et démontré conforme aux limites d'exposition aux RF d'IC dans des conditions d'exposition à des appareils mobiles (antennes sont supérieures à 20 cm à partir du corps d'une personne).

Detachable Antenna:

This M2M Router device, ER2000T-NA-CAT1, integrates an LTE (4G) and WiFi radio function. Is uses an external antenna (dipole antenna) and a standard antenna connector (SMA type) which is not

covered under FCC 15.203 requirements. Therefore, this equipment needs to be installed by a professional technician since the M2M application usually resides inside other equipment where the end-user cannot change the external antennas easily.

There is no doubt that the antennas can be replaced by the end-user once installed in the final configuration.

This radio transmitter IC: 22975-ER2000TNAC1 has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Cet émetteur radio IC: 22975-ER2000TNAC1a été approuvé par Industrie Canada pour fonctionner avec les types d'antennes énumérés ci-dessous avec le gain maximal admissible et impédance d'antenne requise pour chaque type d'antenne indiqué. Types d'antennes n'est pas inclus dans cette liste, ayant un gain supérieur au gain maximal indiqué pour ce type, sont strictement interdits pour une utilisation avec cet appareil.

No.	Manufacturer	Part No.	Antenna Type	Peak Gain
1	GTT Europe LTD	OA-LTE-01-01-GT	Omni-Dipole	698-960MHz/1710-2170MHz/2500-2960MHz/2400MHz-2500MHz 0.7 dBi Max / 3.8 dBi Max /3.2 dBi Max/ 3.1 dBi Max

===== End of Document =====