3G/4G Solutions with RouterOS

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MikroTik User Meeting USA 2015

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Overview of this Presentation

- Why Cellular?
- M2M, IoT – Are you in it?
- New Features in RouterOS V6 for 3G/4G
- Cellular Frequency Band Plans (North America)
- Direct-IP Configuration (LTE Modems)
- PPP Configuration (3G Modems)
- SMS Configuration
- Live Demonstration

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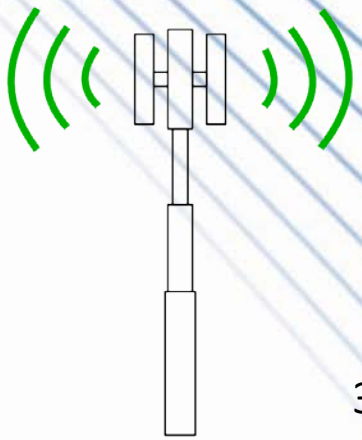
Why Cellular?

- Temporary Connections
- Backup Bandwidth Purposes
- Out of Band Network Management
- Sending SMS for Alert Notifications
- Receiving SMS and Executing Scripts
- Mobile Hotspot Deployment
- GPS Stratum 1 Time Server
- Revenue Opportunities!



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M2M (Machine to Machine)

- M2M is the concept of a device sending data to another device
- Extreme competition in data has carriers looking for “per device” revenue, even if it’s small data.
- Carriers are having to embrace “embedded devices” on their network besides smart phones.
- Typically 50MB/mo and under applications.

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Internet of Things (IoT)

- Internet connected devices
- A network of M2M devices that exchange data between “things” to achieve greater value and service by communication and interoperability.
- By connecting your RouterOS solution to the Internet, you’ve now become part of the Internet of things!

M2M / IoT Growth

- More then 18.2 Billion devices today
- Expected 50.1 Billion by 2020
- Semi-Annual Growth Rate 5.3%
- Revenue of $1.4 Billion by Q2 2015
- Still a lot of market hype

(Gartner Research, Compass Intelligence)

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M2M / 3G Applications

- Backup Application Bandwidth
- Public Safety Data Transmission
- Network Management
- Digital Signage / Kiosks
- Remote Monitoring / Security
- Transportation (GPS Data)
- Parking Meters / Vending

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4G Applications

- Backup Internet Bandwidth
- Video Surveillance
- Video Entertainment (Netflix)
- Mobile/Fixed Hotspots

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Revenue? Tell me more…

- Providing business customers “secondary” bandwidth to your primary WISP connection for business critical functions (credit card processing)
- Out of band remote monitoring of leased PtP links without having customer network access.
- Any application not requiring all you can eat bandwidth..

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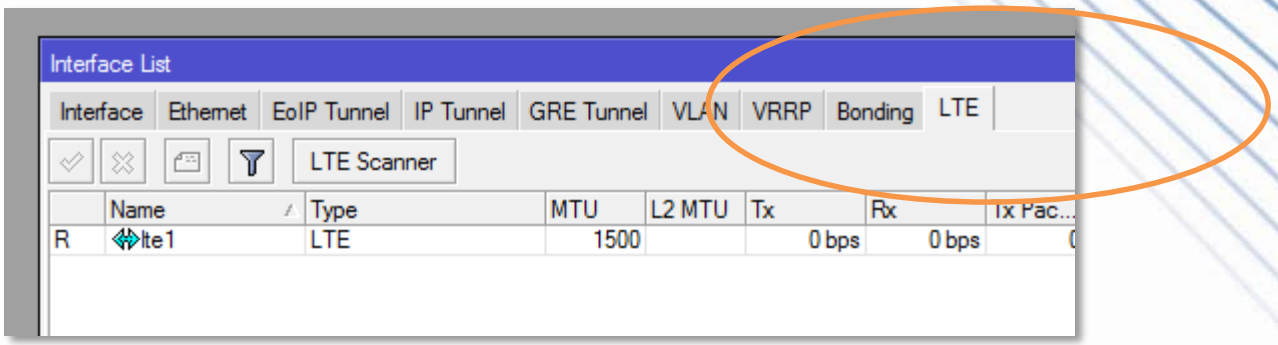
RouterOS Modem Types

- 3G/4G Modem – Use PPP Interfaces
- 4G LTE Modem – Use LTE tab in Interfaces (Currently only supported by DirectIP Modems)



Module Types

- Cellular modems come in both USB and mPCIe cards using USB signals.
- USB Modems are easier to obtain, but protrude out in front or side of your router.
- mPCIe cards are slick, built-in and look like a WiFi Card, but are typically more expensive.
- RB411u, RB912, RB953, RB922 series has mPCIe USB
- RB800 has mPCIe but no USB support
- Other RouterBOARDS with USB ports supported (Check Modem Power Requirements First)

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USB Dongle Type Modems

(RB/951G with USB Port and MaxxWave LTE USB Modem)

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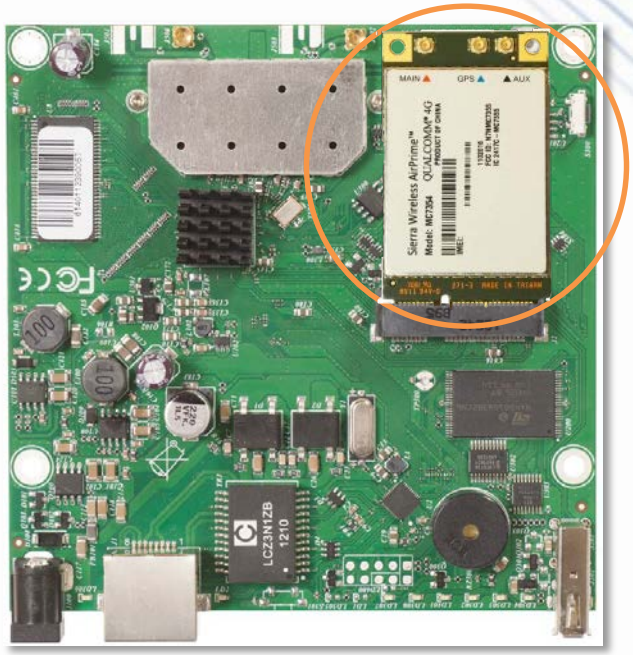
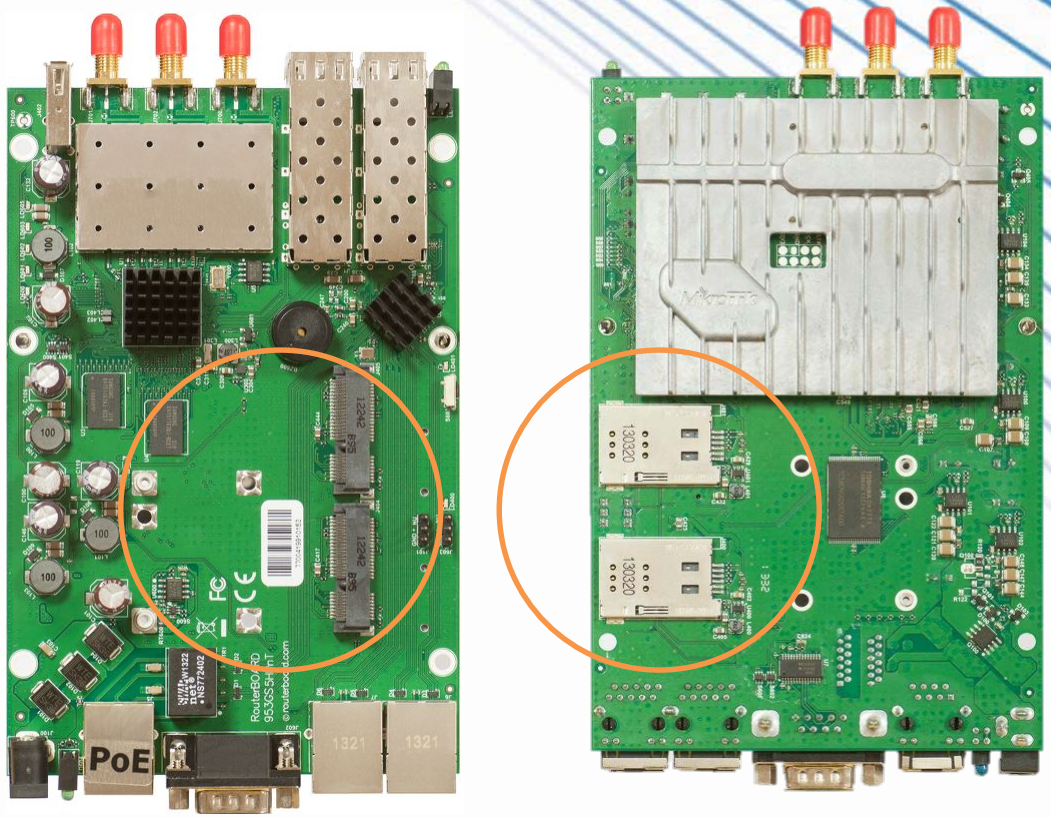
mPCIe Modules w/RB912

- Integrated modules have more industrial applications.
- Requires Carrier Certification (In the USA)



RB/953 has two mPCIe Slots

- Perfect for Multi-Carrier or Load Balance



Tested 3G Cards

- ZTE 2718 (3G – CDMA - Sprint)
- ZTE MF206a (3G – UMTS - ATT/T-Mobile)
- No Verizon Experience

Over 100 more on WIKI.MIKROTIK.COM

Tested 4G North American Cards

- Sierra Wireless MC7700 Series
  - MC7700 – AT&T Certified
  - MC7710 – Europe Version
  - MC7750 – Verizon Certified** (Not Direct IP)

(EOL Sept 2014) – Stock still available

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mPCIe Module Speeds

- Quadband GSM 850/900/1900/2100Mhz
- EVDO Rev A CDMA (3.1 Down / 1.8 Up)
- UMTS/HSDPA (7.2 Down / 2.0 Up)
- HSDPA+ 3.5G (28 Down / 5.8 Up)
- LTE (Long Term Evolution) (100 Down / 50 Up)
- LTE Advanced With 8Tx8R MIMO can Achieve 3.3Gbps Peak per Sector! (100Mhz Channel)

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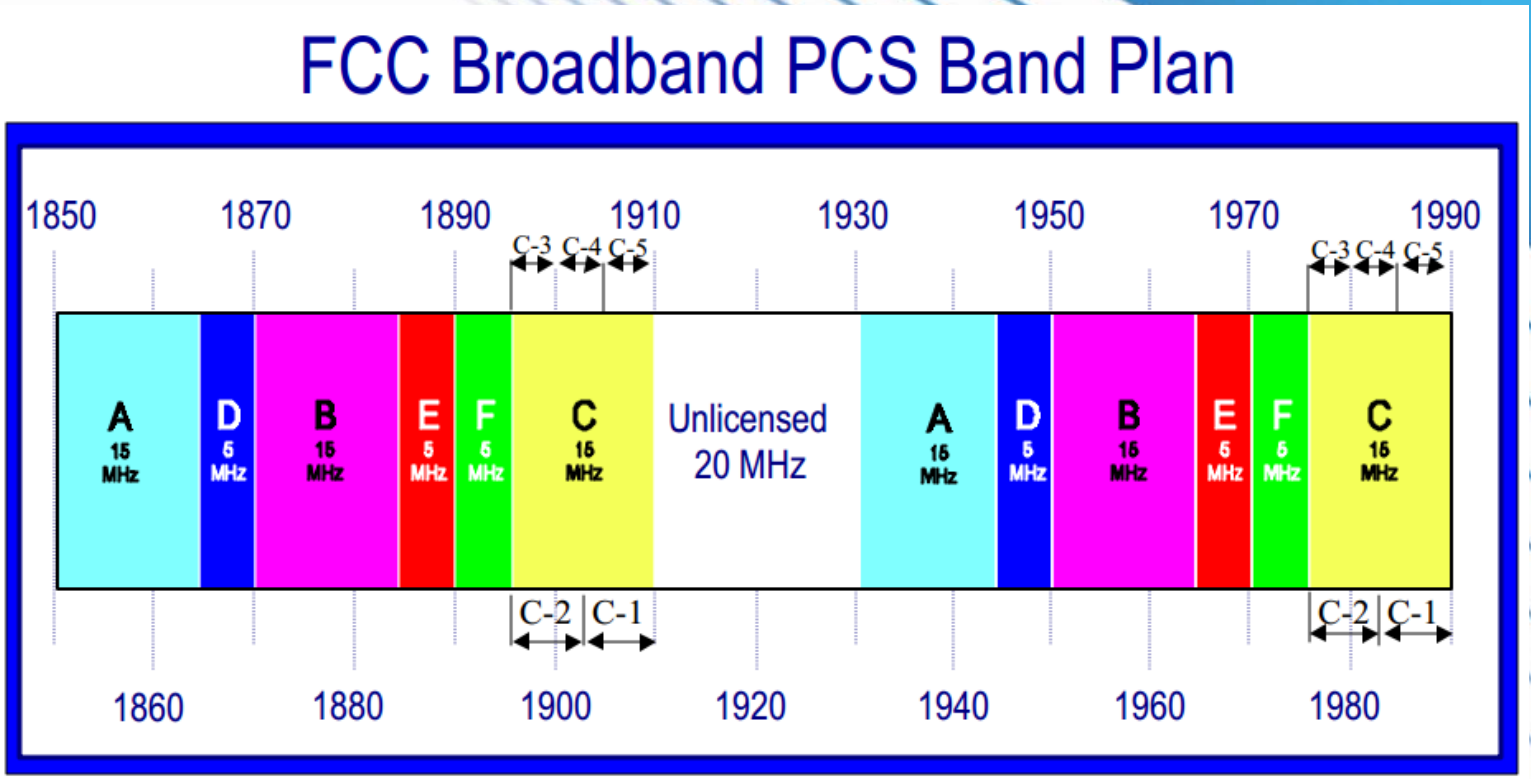
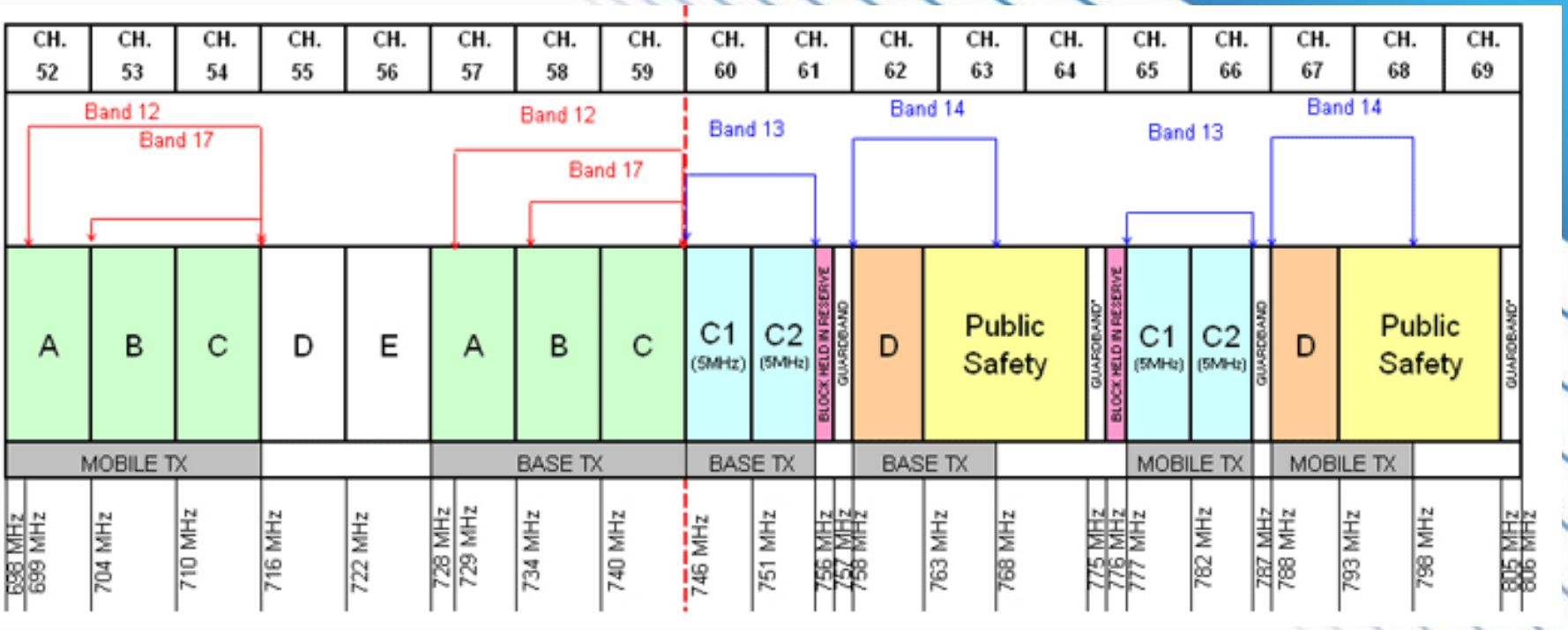
PCS 1800-1900Mhz Band Plan



700 Mhz LTE Band Plan



4G One size fits all solution??

- Yes! Sierra Wireless MC7354!
- Pentaband chipset
- Supports Sprint, AT&T, Verizon Wireless
- AT Command Carrier Selection
- Expensive Solution!

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BUT…….

- Requires QMI mode interface
- DirectIP interfaces are going away in favor of QMI.
- RouterOS 6.x only supports DirectIP
- RouterOS 7 will support QMI
- QMI Backport will not be done

Lower cost LTE on the way…..

- RouterOS 6.28 fixed support for ZTE MF823 (External USB Modem – European LTE 900/2100Mhz Support)
- ZTE ZM8620 Testing to begin shortly Supporting LTE FDD
- 7 Bands Supported
- Currently only AT&T/T-Mobile
- GPS and Standard AT Commands

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RouterOS LTE Summary

- Add supported 4G device
  - Direct-IP Interface only
  - QMI mode coming in RouterOS V7.x
  - Verify SIM card activated with carrier
- Setup APN in LTE interface
- Enable LTE interface
- Enable DHCP-CLIENT on lte1 interface
- Verify Running LTE Interface

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Special LTE Configuration

```
[admin@Cellular Modem] /port firmware> print
                 directory: firmware
  ignore-directip-modem: no
[admin@Cellular Modem] /port firmware>
```

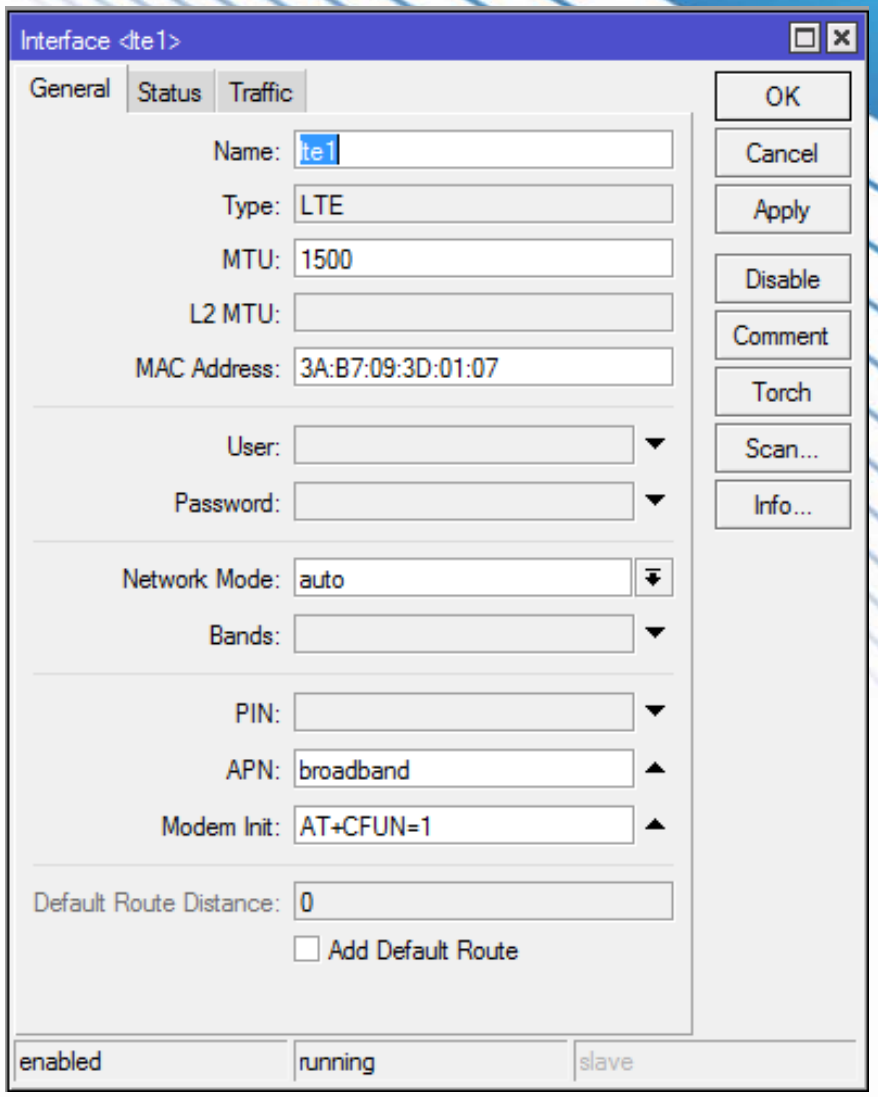
Firmware directory

- Designed to side-load GOBI firmware
- Allows GOBI module to take on new carrier identity by keeping firmware files in “files” area of RouterOS.
- Simply change directory setting
- Must POWER CYCLE! (Gobi won’t grab new firmware unless powered off/on)

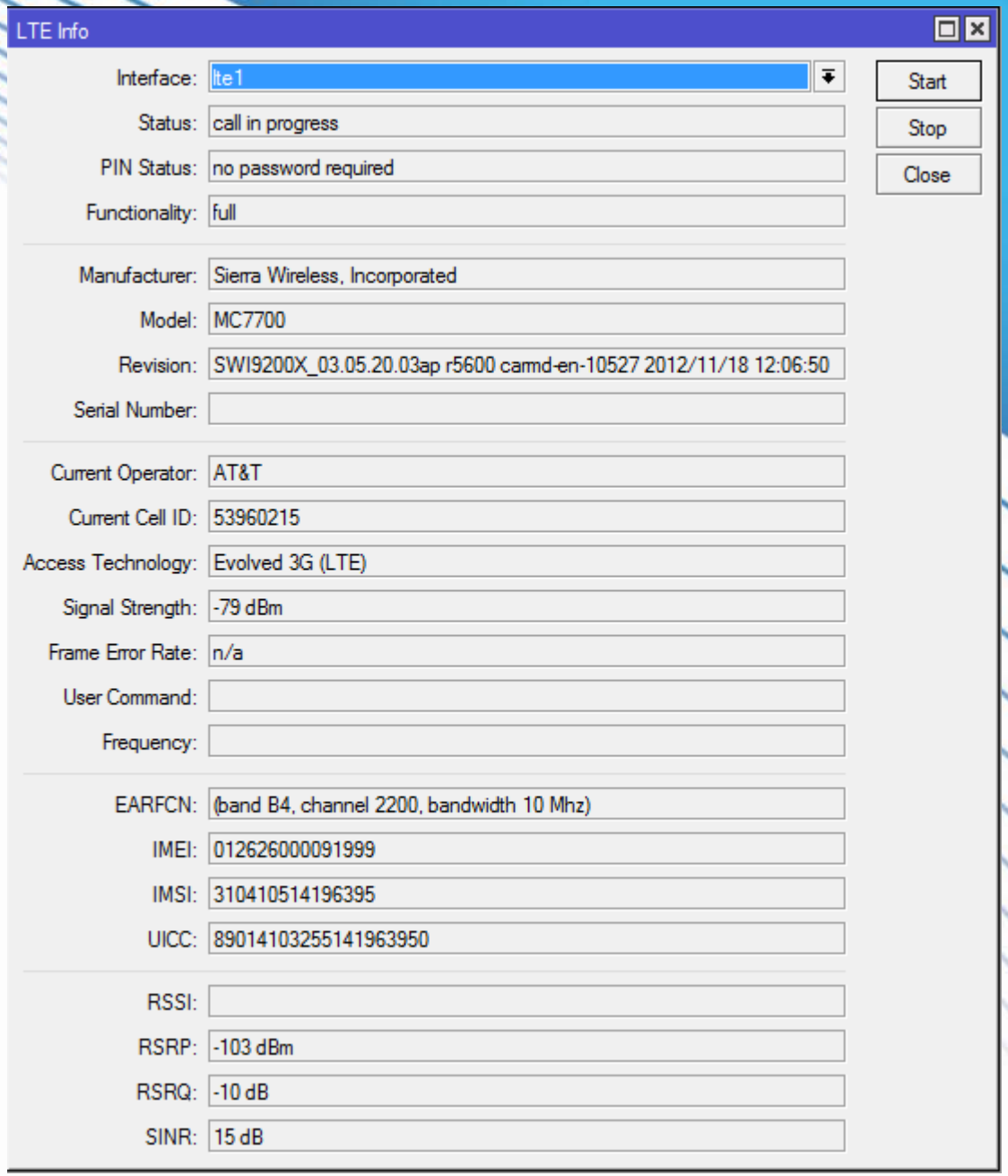
Ignore-directip-modem

- If set to “NO” – Use direct-ip driver of modem and configure using “LTE” interface tab.
- If set to “YES” – Ignore direct-ip mode and let user select modem channel and use standard PPP interface to interact with the modem.
- PPP mode good if you want to use SMS mode along with data call (assuming modem has multiple channels)

LTE Config: Setup LTE Interface



LTE Config: Verify Info Channel and Signal



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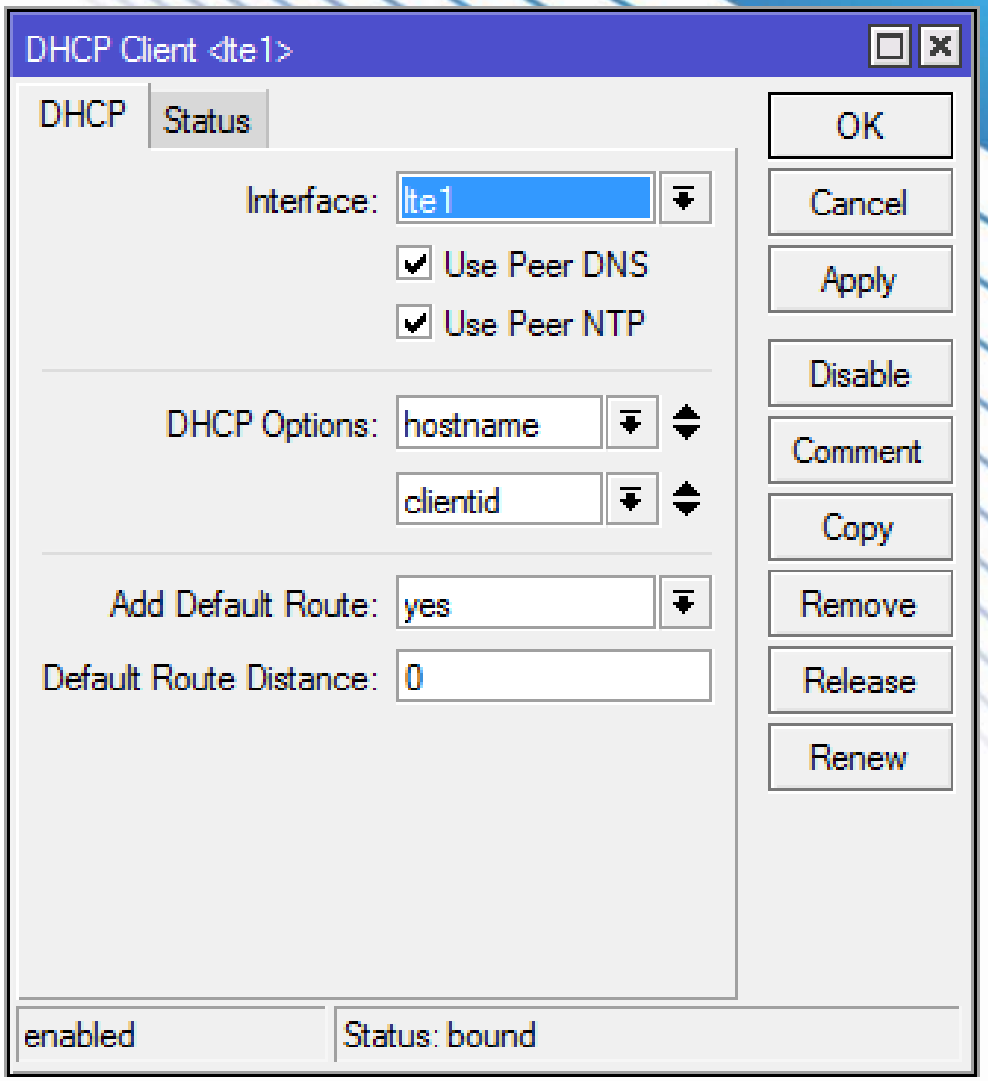
LTE Config: DHCP Settings



LTE Gotcha's

- Upgrading from older RouterOS, LTE Interface may recognize 3G cards as LTE if they have direct-ip support. It may work, it may not --- It is suggested to "ignore direct-ip"
- PPP interface may be created with LTE cards due to the GPS channel being detected by RouterOS. GPS support for direct-ip cards is still a work in progress.

RouterOS 3G/4G PPP Summary

- Add supported 3G/4G device
  - Direct-IP Mode Disable (If Supported)
  - Verify SIM card activated with carrier
- Setup PPP interface, Enabled Advanced Mode
- Setup Data Channel & Info Channel
- Setup APN if required
- Enable Interface

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PPP Config: Find Info/Data Channel

```
[admin@MikroTik] > /system serial-terminal usb1 channel=3

[Ctrl-A is the prefix key]


ati
Manufacturer: Sierra Wireless, Incorporated
Model: MC7700
Revision: SWI9200X_03.05.20.03ap r5600 carmd-en-10527 2012/11/18 12:06:50
IMEI: 012626000091999
IMEI SV: 15
FSN: CAH3111017110
3GPP Release 8
+GCAP: +CGSM

OK
```

```
[admin@MikroTik] > /system serial-terminal usb1 channel=4

[Ctrl-A is the prefix key]


Sierra Wireless, Incorporated
MC7700
APP1

OK
```

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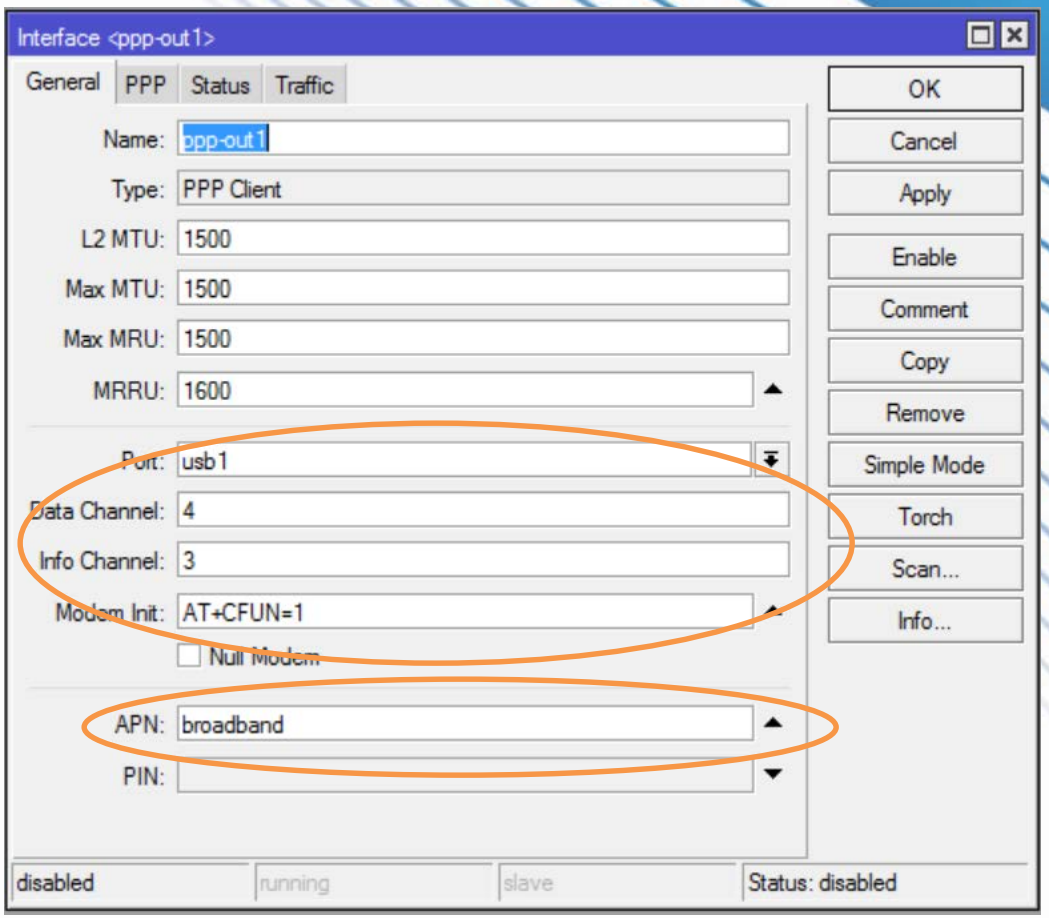
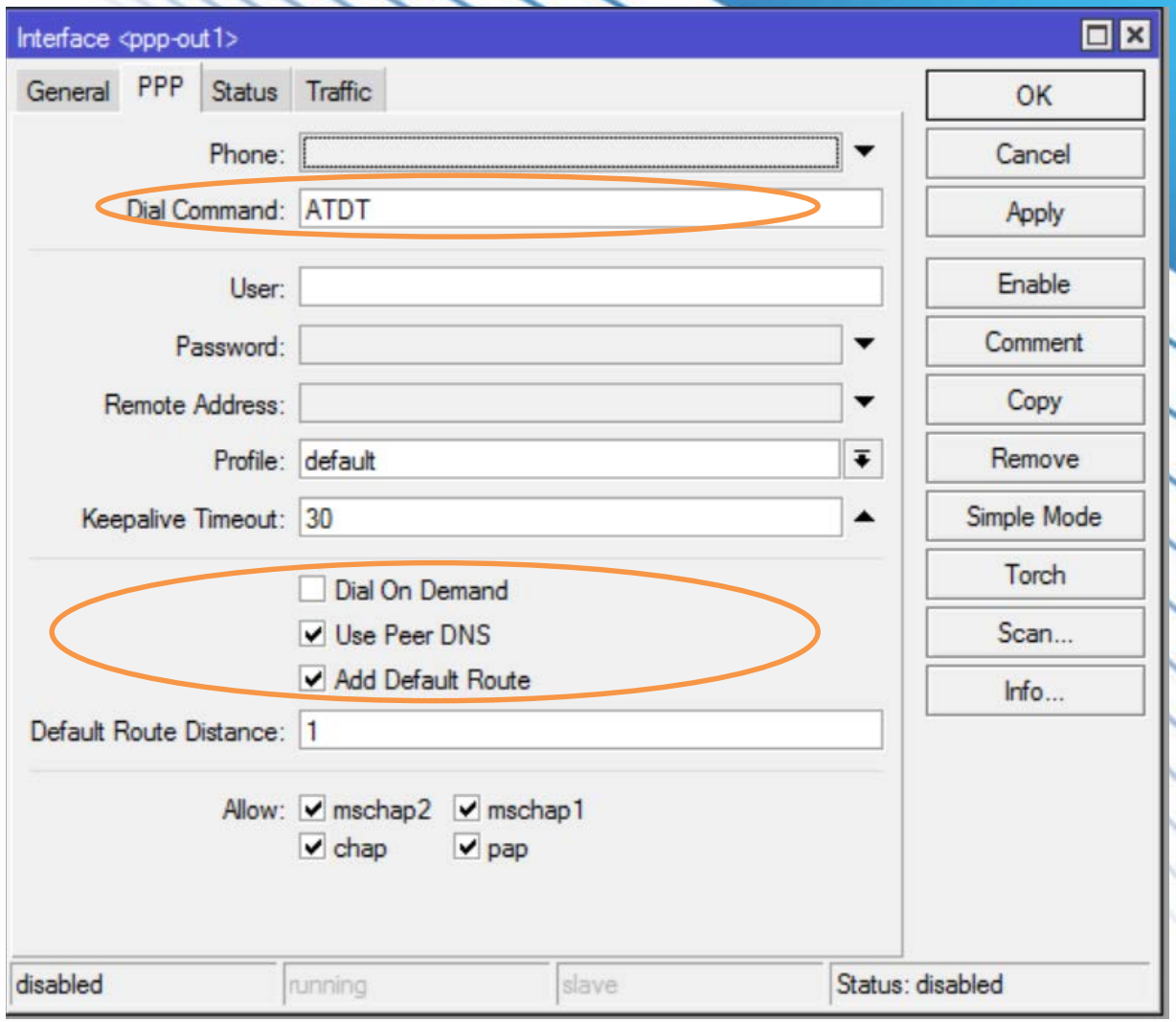
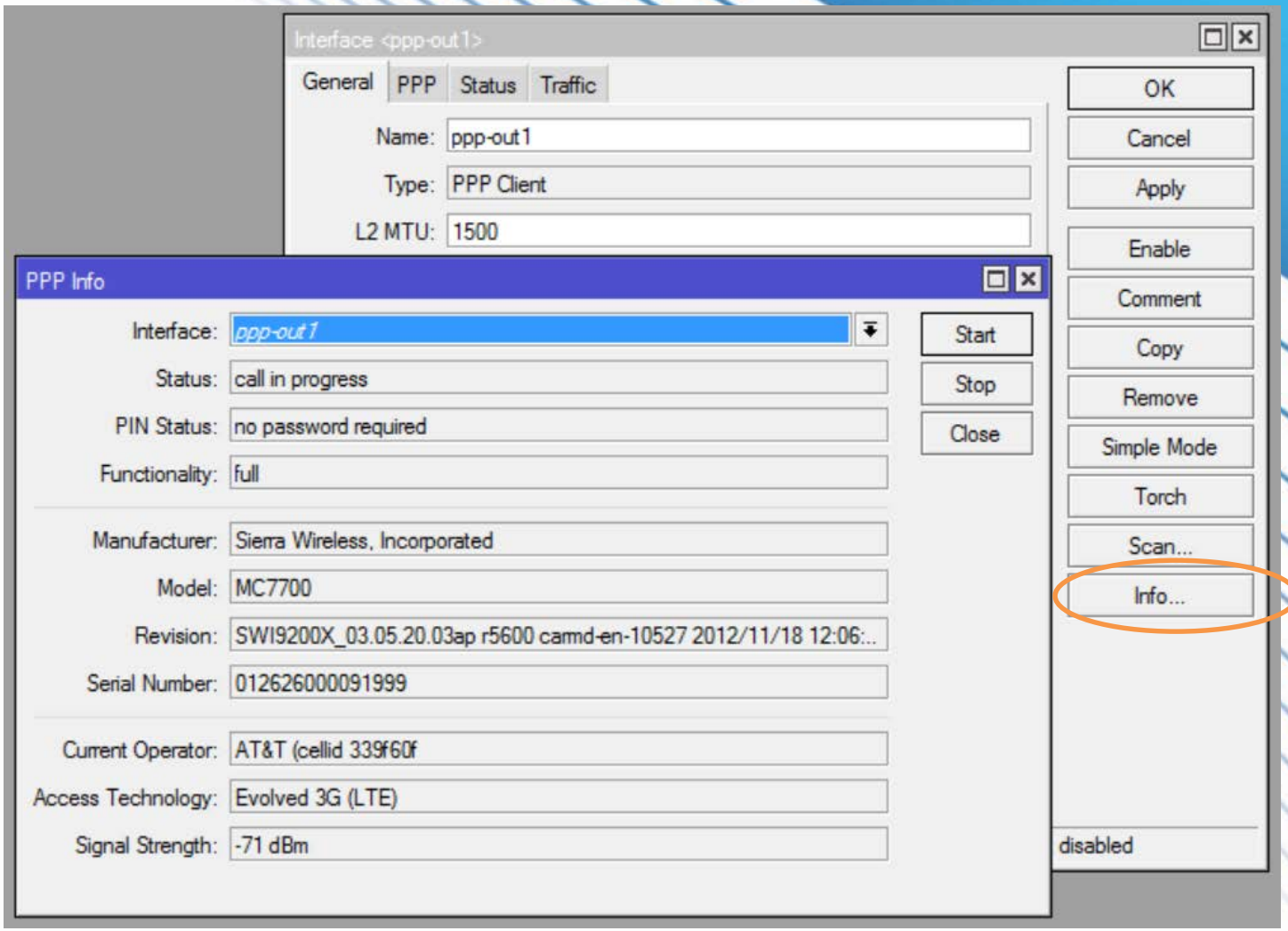
PPP Config: Set Interface Settings



PPP Config: PPP Settings



PPP Config: Verify Info Settings



3G Configuration Reminders

- Don’t forget to add a SRC-NAT rule to Masquerade your ppp-out1 interface
- If your carrier charges for connect time, select that you want to dial on demand vs. always on
- Some carriers will give you private address space, depends on APN you connect to.
- Make sure you are using the default profile and not trying to do encryption

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RouterOS SMS Applications

- RouterOS Supports sending SMS messages by script to any mobile device.
- Only works with GSM/UMTS, Not CDMA
- RouterOS can accept SMS messages and trigger scripts to run
- Applications Include:
  - Remote Router Reboot
  - Check Voltage or Signal Strength and SMS Back

Sending SMS from the Router

- Command line example to send an SMS:
  - /tool sms send usb2 "29111222" channel=0 message="Help!"
- SMS can be sent while the port is in-use by other service (PPP or terminal)

Receiving SMS

- Turn on receiving the SMS
  - specify “port” and “channel”
  - set “secret” (required)
  - set “allowed-number” (optional)
- Received SMSs are stored in /tool sms inbox
- SMS message format
  - :cmd SECRET script NAME [[VAR[=VAL]] ...]

Setting Up SMS Receive and Verifying

```
  receive-enabled: yes
             port: usb1
          channel: 3
           secret: 111
   allowed-number:
     keep-max-sms: 0
          sim-pin:
[admin@MikroTik] /tool sms>
```

```
10 +16308540580    Apr/20/2015 22:27:10 GMT +25   Hello.....r we having fun
                                                  yet?
11 +16308540580    Apr/21/2015 22:13:19 GMT +25   :cmd 111 script script1

[admin@MikroTik] /tool sms inbox>
```

Log

Freeze

all

Apr/21/2015 22:52:21	memory	system, error, critical	router was rebooted without proper shutdown
Apr/21/2015 22:52:28	memory	interface, info	ether2 link up (speed 100M, full duplex)
Apr/21/2015 22:52:29	memory	interface, info	ether1 link up (speed 10M, half duplex)
Apr/21/2015 22:52:32	memory	dhcp, info	dhcp1 deassigned 192.168.1.254 from 00:0E:C6:FE:31:DD
Apr/21/2015 22:52:32	memory	dhcp, info	dhcp1 assigned 192.168.1.254 to 00:0E:C6:FE:31:DD
Apr/21/2015 22:54:50	memory	system, info, account	user admin logged in from 192.168.1.254 via winbox
Apr/21/2015 22:56:45	memory	system, info, account	user admin logged in from 192.168.1.254 via telnet
Apr/21/2015 22:57:01	memory	system, info	device changed by admin
Apr/21/2015 22:57:21	memory	system, info	device changed by admin
Apr/21/2015 22:57:30	memory	system, info	device changed by admin
Apr/21/2015 23:00:46	memory	gsm, info	running script: script1
Apr/21/2015 23:00:46	memory	script, info	Script1 has been run!

Troubleshooting

- **Can you talk to the modem at all?** Try using serial terminal to talk to the modem!
- **Disable Direct-IP Mode**
- **Verify Firmware Directory & Files** (GOBI Only)
- **Is the SIM card requiring the PIN?** Disable PIN request, or, enter your PIN in winbox!
- **Consult MikroTik WiKi** and any 3G/GPRS AT Command Reference!

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A Note on GPS……

- We have successfully tested GPS functions only with the ZTE 2718 module. (Sprint)
- With the correct GPS antenna (passive) attached, we're able to sync RouterOS time and make it a stratum one time server.
- SNMP GPS data is available to the dude server for asset tracking and monitoring.

References / Live Demonstration

- http://wiki.mikrotik.com/wiki/Supported_Hardware#3G_cards
- http://wiki.mikrotik.com/wiki/Supported_Hardware#4G_LTE_cards
- http://forum.mikrotik.com
- http://www.mikrotik.com
- http://www.balticnetworks.com

Thank You!

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