MUM MikroTik User Meeting in Shenzhen China, April 2, 2011

802.11n and 3G Applications

Jesse Liu

Convergingstream

About Me

- Jesse Liu, Convergingstream
  - Over 7 years experience using RouterOS
  - Specialization in Wireless, VPN, Traffic control and User management
  - MikroTik MTCNA, MTCWE Certifications (2011)
  - GFI Software LANguard, EventsManager, EndPointSecurity, Network Server Monitor, MailArchiver Certifications (2010)
  - Cisco CCNA, CCDA, CCNP, CCDP Certifications (2001)
  - Novell (1996), Microsoft (1997), Oracle (1997) Certifications

PART 1

- Introduction 11n products
  - RouterBOARD, MIMO Antenna, USB 11n Adapter
- 11n application examples
  - Application examples 1 (Outdoor wireless bridge)
    - Speed test (RB711-5Hn to RB711-5Hn, RB493G to RB493G)
  - Application examples 2 (Indoor wireless access point)
    - Speed test (H3C Dual Band 802.11n USB Adapter)
- New product (RB/SXT)
- AR9380 chipset support

RB493G

Switch

Switch | Port | Host | VLAN | Rule

Name	Switch	VLAN Mode
cpu	switch1	fallback
ether1	switch1	fallback
ether6	switch1	fallback
ether7	switch1	fallback
ether8	switch1	fallback
ether9	switch1	fallback
ether2	switch2	fallback
ether3	switch2	fallback
ether4	switch2	fallback
ether5	switch2	fallback

10 items

RB493G
AR7161 680MHz
256MB DDR SDRAM
128MB NAND
Nine 10/100/1000 Mbit/s **Gigabit** Ethernet ports supporting Auto-MDI/X
2x AR8316
Three MiniPCI Type IIIA/IIIB slots
One DB9 RS232C asynchronous serial port
1x USB 2.0 non powered, injector required
Power and User LED
Yes
1x microSD
Power over Ethernet: 10..28V DC (except power over datalines) Power jack: 10..28V DC
Two DC fan power output headers with rotation sensor and automatic fan switching (maximum output current - 500mA total)
105 mm x 160 mm
160 g
Operational: -20°C to +65°C (-4°F to 149°F)
Operational: up to 70% relative humidity (non-condensing)
~3W without extension cards, maximum - 25W (18W output to extension cards)

RB/GPOE

R52nM and R52Hn

Key Features and Benefits

- Dual band IEEE 802.11a/b/g/n standard
- Output Power of up to **23dBm**
- Support for up to 2x2 MIMO with spatial multiplexing
- Four times the throughput of 802.11a/g
- Atheros AR9220, chipset
- High Performance (up to 300Mbps physical data rates and 200Mbps of actual user throughput) with Low Power Consumption
- Two MMCX antenna connectors
- Modulations:
  OFDM: BPSK, QPSK, 16 QAM, 64QAM
  DSSS: DBPSK, DQPSK, CCK
- Operating temperatures: -50ºC to 60ºC
- Power consumption MAX 1.95W
- ESD protection +/- 12kV

802.11b	RX Sensitivity	Composite TX Power
1Mbit	-95	20
11Mbit	-91	21
802.11g		
6Mbit	-95	23
54Mbit	-81	19
802.11n 2.4GHz		
MCS0 20MHz	-95	21
MCS0 40MHz	-90	21
MCS7 20MHz	-78	17
MCS7 40MHz	-75	16

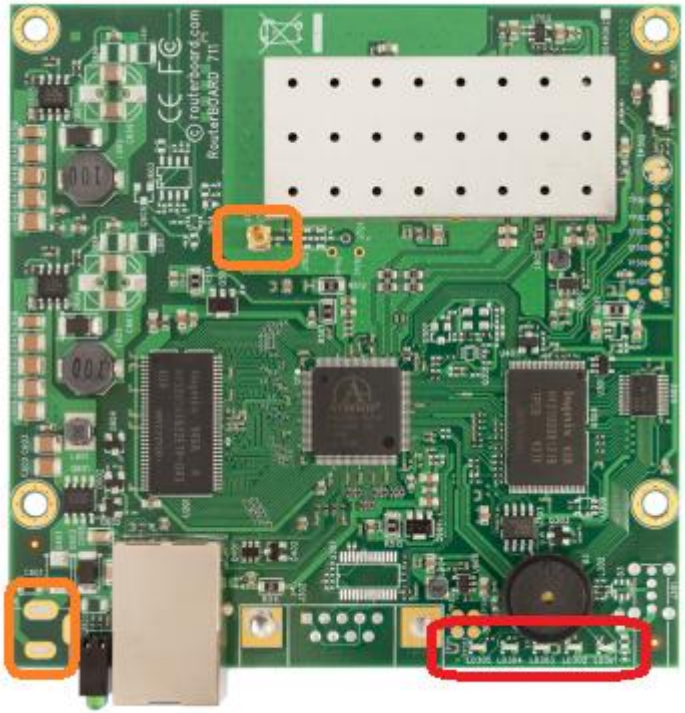
802.11a	RX Sensitivity	Composite TX Power
6Mbit	-95	21
54Mbit	-80	17
802.11n 5GHz		
MCS0 20MHz	-95	21
MCS0 40MHz	-92	19
MCS7 20MHz	-77	16
MCS7 40MHz	-74	13

- Dual band IEEE 802.11a/b/g/n standard
- Output Power of up to 25dBm @ a/g/n Band
- Support for up to 2x2 MIMO with spatial multiplexing
- Four times the throughput of 802.11a/g
- Atheros AR9220, chipset
- High Performance (up to 300Mbps physical data rates and 200Mbps of actual user throughput) with Low Power Consumption
- 2 X MMCX Antenna Connector (J4 - Chain 0)
- Modulations:
  OFDM: BPSK, QPSK, 16 QAM, 64QAM
  DSSS: DBPSK, DQPSK, CCK
- Operating temperatures: -50ºC to +60ºC
- Idle power consumption 0.4W
- Max power consumption 7W
- MiniPCI IIIA+ design (3mm longer than MiniPCI IIIA)
- 1.5mm heatsink, 3mm RF shield thickness
- ±10KV ESD protection on RF ports

802.11b	RX Sensitivity	TX Power
1Mbit	-93	24
11Mbit	-93	24
802.11g		
6Mbit	-94	25
54Mbit	-81	22
802.11n 2.4GHz		
MCS0 20MHz	-94	25
MCS0 40MHz	-92	24
MCS7 20MHz	-78	21
MCS7 40MHz	-75	20

802.11a	RX Sensitivity	TX Power
6Mbit	-97	25
54Mbit	-80	21
802.11n 5GHz		
MCS0 20MHz	-97	24
MCS0 40MHz	-92	22
MCS7 20MHz	-77	18
MCS7 40MHz	-74	17

RB711-5Hn-M



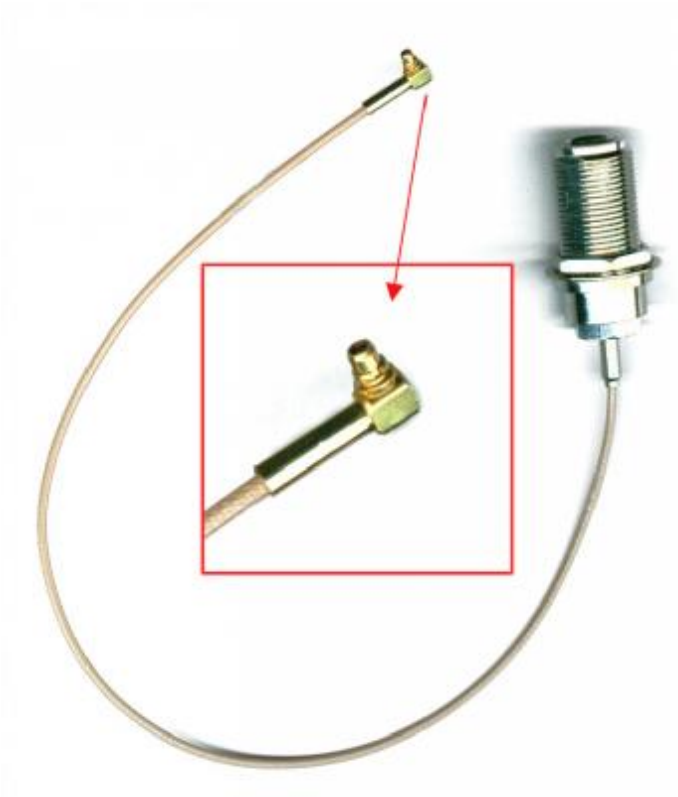
	RouterBOARD 711
CPU	MIPS24k based, Atheros AR7240 400MHz CPU
Memory	32MB SDRAM onboard memory (64MB on RB711A)
Boot loader	RouterBOOT
Data storage	64MB onboard NAND memory chip
Ethernet	**One** 10/100 Mbit/s Fast Ethernet port supporting Auto-MDI/X
Wireless	One built-in wireless card AR9280 802.11a/n wireless device
MiniPCI slot	none
Serial port	none
LEDs	Power and User LED, 5 status LEDs
Speaker	Mini PC-Speaker
Power options	Power over Ethernet: 10..28V DC (except power over datalines) Power jack: 10..28V DC (RB711A only)
Dimensions	105mm x 105mm
Weight	82 g (2.9 oz)
Temperature	Operational: -20°C to +65°C (-4°F to 149°F)
Humidity	Operational: up to 70% relative humidity (non-condensing)
Power consumption	280mA (345mA max) at 12V
RouterOS license	Level3 (Level4 on RB711A)

RX sensitivity	**802.11a**: –92 dBm @ 6Mbps to -76 dBm @ 54 Mbps **802.11n**: –92 dBm @ MCS0 to –73 dBm @ MCS7
TX power	**802.11a:** 23dBm @ 6Mbps to 19dBm @ 54 Mbps **802.11n:** 22dBm @ MCS0 to 15dBm @ MCS7

1 LED - on, if wireless client is connected to AP (usually >= -89dBm)
2 LEDs - on, if signal strength >= -82dBm
3 LEDs - on, if signal strength >= -75dBm
4 LEDs - on, if signal strength >= -68dBm
5 LEDs - on, if signal strength >= -61dBm

MMCX connector

- MMCX antenna connector provides a secure and sturdy connection to your antenna, and a special screw connection allows you to securely fasten the card in it’s place.



MIMO Antenna

- TQJ-2458MIK x 3 2.4G~2.483GHz, 5.15G~5.85GHz-2.5dBi@2.4G, 4dBi@5G
- TQJ-2458MIC x 6 2.4G~2.5GHz, 5.15G~5.85GHz-2.5dBi@2.4G, 4dBi@5G

TQJ-2458MIK×3

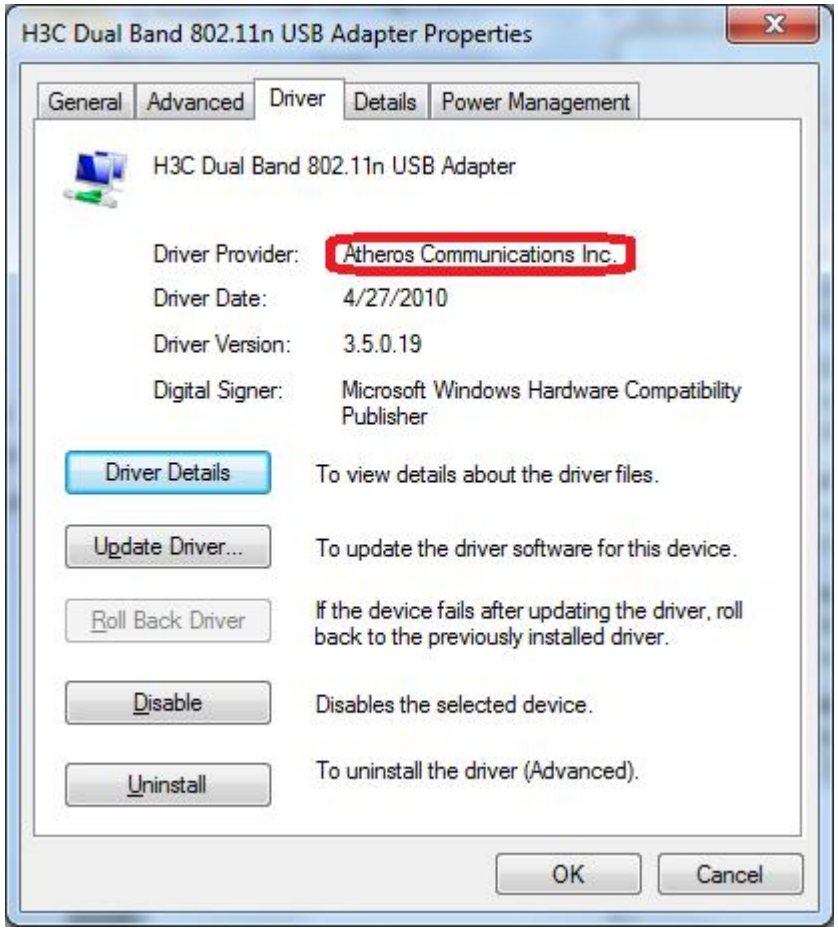
TQJ-2458MIC×6

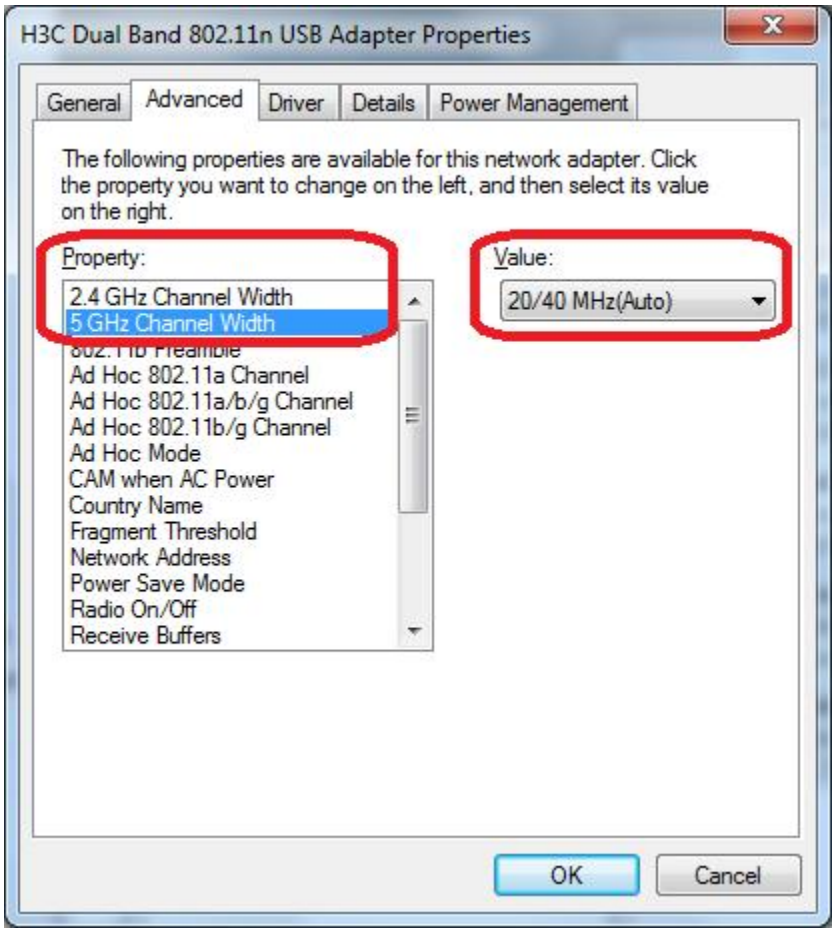
RB411AR

H3C WN612 Dual Band 802.11n USB Adapter

支持主要标准	802.11 局域网协议	802.11, 802.11a, 802.11b, 802.11g, 802.11i WMM, WPA/WPA2, 802.11h, 802.11j
		802.11n draft2.0
	速率支持	802.11a data rates 6, 9, 12, 18, 24, 36, 48, 54Mbps
		802.11b data rates 1, 2, 5.5, 11Mbps
		802.11g data rates 6 ,9, 12, 18, 24, 36, 48,54Mbps
		802.11n (draft) 11n data rates MCS 0 to 15
		支持自动速率调整
		支持 802.1x 认证
		支持 PSK 认证
		支持 EAP-TLS、EAP-TTLS、PEAP
		支持 WEP-40/WEP-104 加密
		支持 TKIP 加密
		支持 CCMP 加密
	802.11n	MIMO
		支持帧聚合
		支持 20/40MHz 带宽管理，包括动态 20/40MHz ，静态 20 MHz，静态 40 MHz
		支持 short GI，包括 400ns, 800ns 和自动选择
		支持 SM Power Save
	其他	支持 Adhoc 工作模式

H3C WN612 Dual Band 802.11n USB Adapter

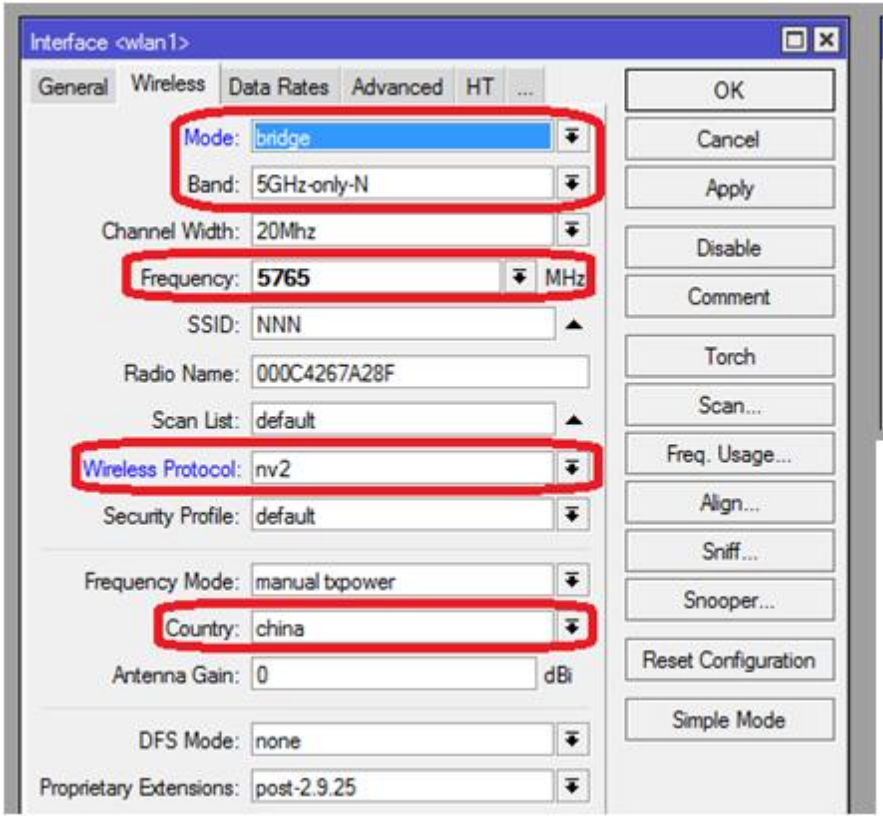




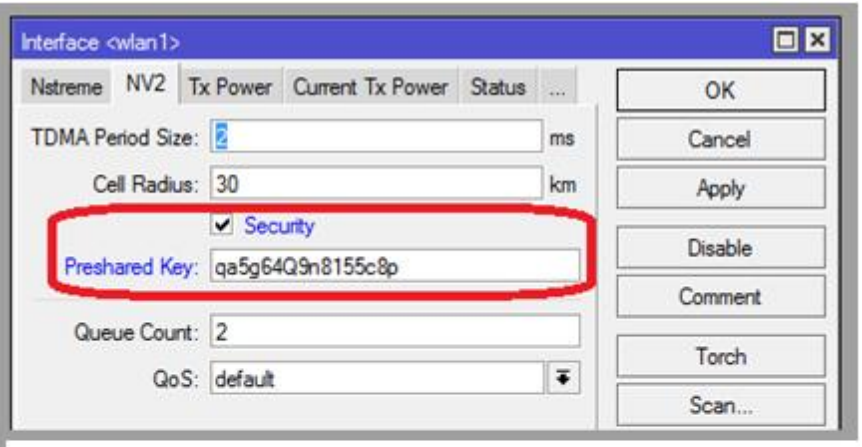
Nv2 protocol

- Nv2 protocol is proprietary wireless protocol developed by MikroTik for use with Atheros 802.11 wireless chips. Nv2 is based on TDMA (Time Division Multiple Access) media access technology instead of CSMA (Carrier Sense Multiple Access) media access technology used in regular 802.11 devices.
- TDMA media access technology solves hidden node problem and improves media usage, thus improving throughput and latency, especially in PtMP networks.
- Nv2 is supported for Atheros 802.11n chips and legacy 802.11a/b/g chips starting from AR5212, but not supported on older AR5211 and AR5210 chips. This means that both - 11n and legacy devices can participate in the same network and it is not required to upgrade hardware to implement Nv2 in network.
- *x86 does not currently support Nv2 (requires RouterBOARD hardware)*
  x86 may be supported in the future

Application examples 1 (Outdoor wireless bridge)



The bridge mode is basically the same as AP, but it only allows one connected client.

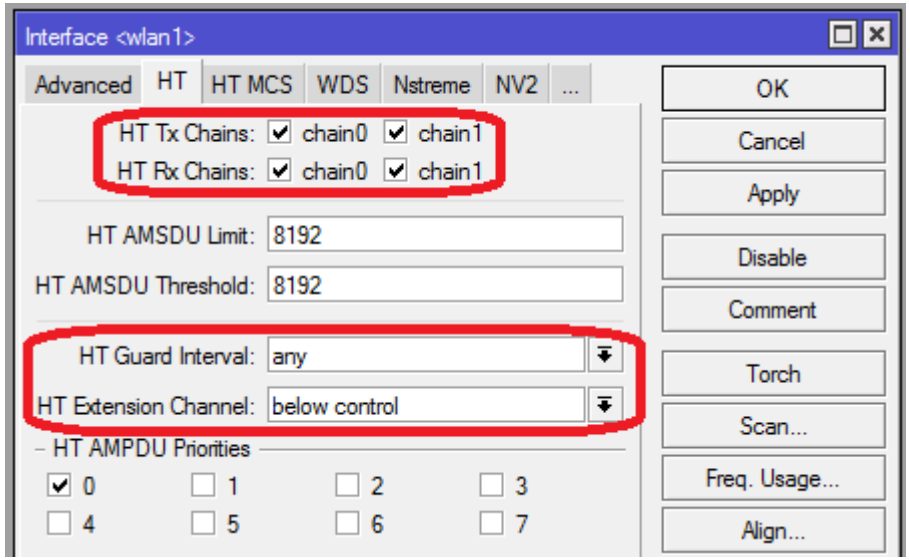


Nv2-security"> - specifies Nv2 security mode

Nv2-preshared-key"> - specifies preshared key to be used

wireless-protocol"> nv2
(default value: *unspecified*) specifies protocol used on wireless interface;

Application examples 1 (Outdoor wireless bridge)

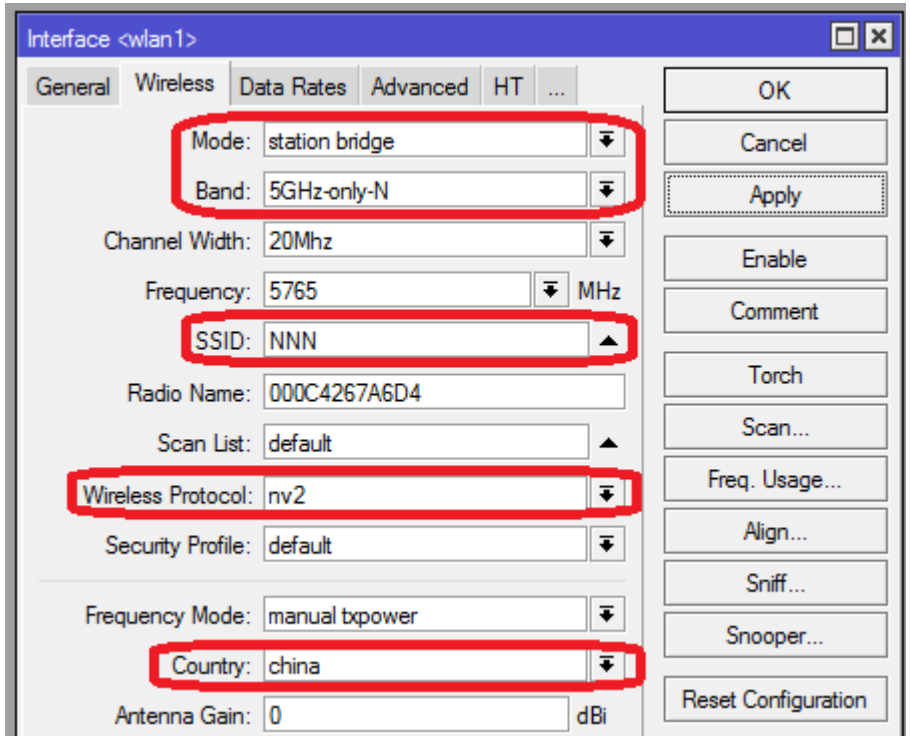


ht-rxchains - which antennas to use for receive.
ht-txchains - which antennas to use for transmit.

ht-guard-interval - whether to allow use of short guard interval. "any" will use either short or long, depending on data rate, "long" will use long.

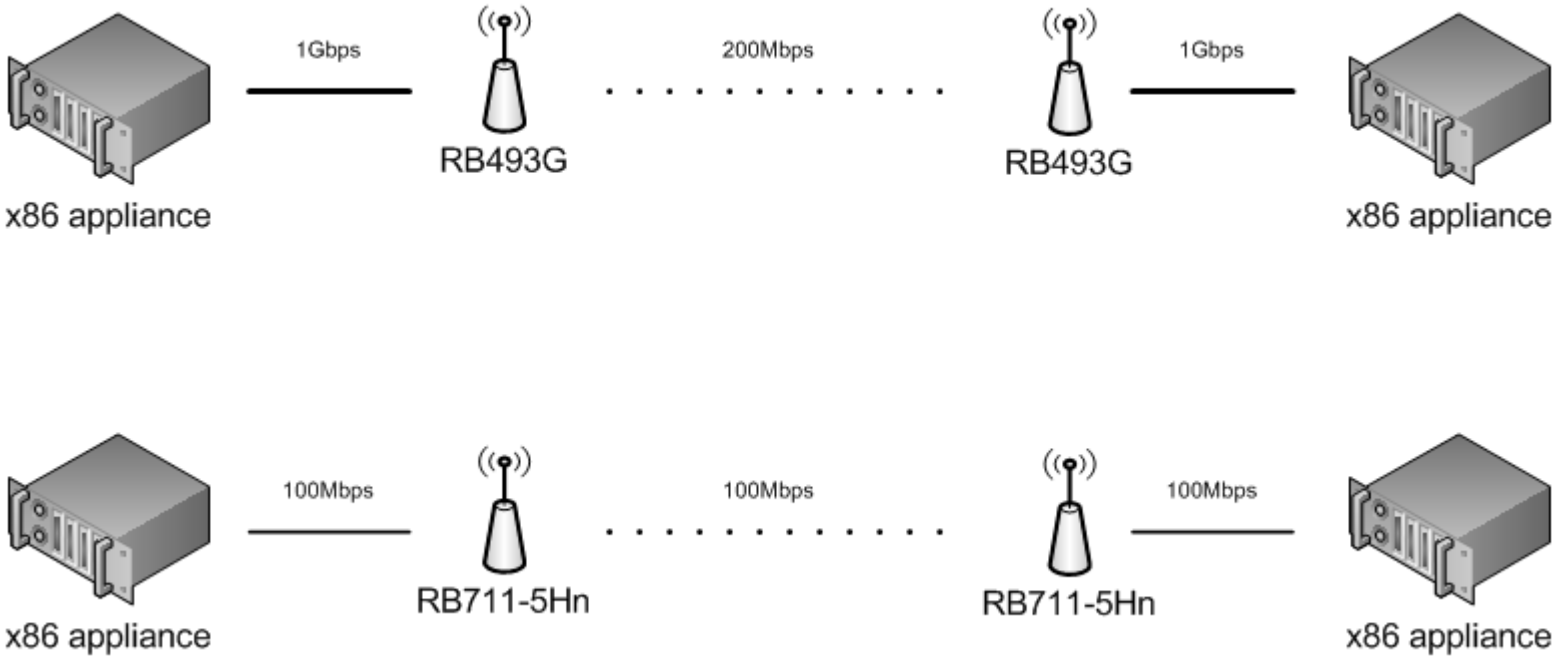
ht-extension-channel - whether to use additional 20MHz extension channel and if it should be located below or above control (main) channel. Extension channel allows 11n device to use 40MHz of spectrum in total thus increasing max throughput.

station-bridge

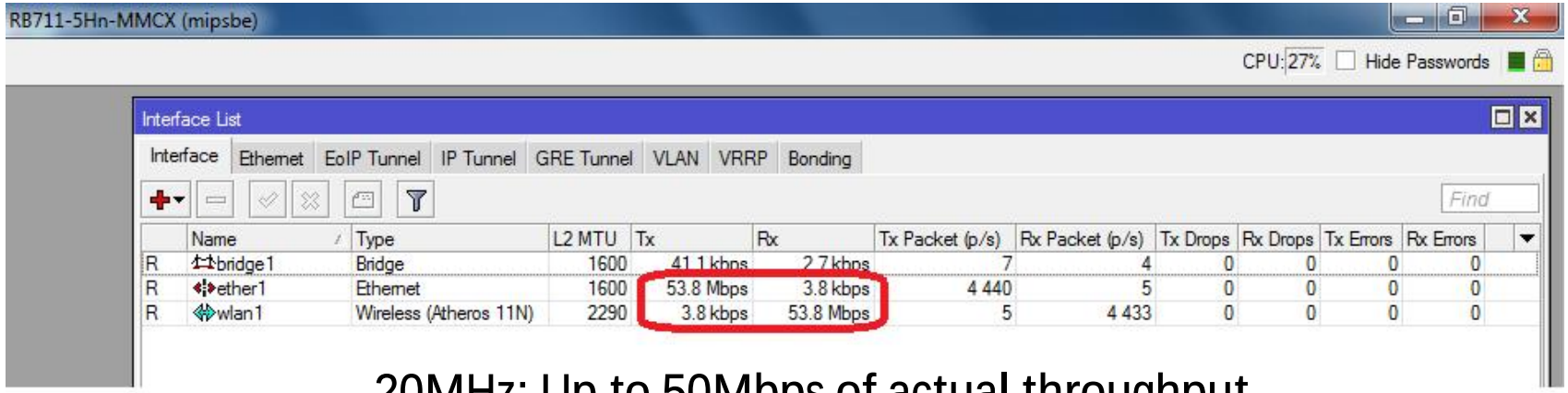


This mode works only with MikroTik APs and provides support for transparent protocol-independent L2 bridging on station device. This mode is MikroTik proprietary and can't be used to connect other brand devices.

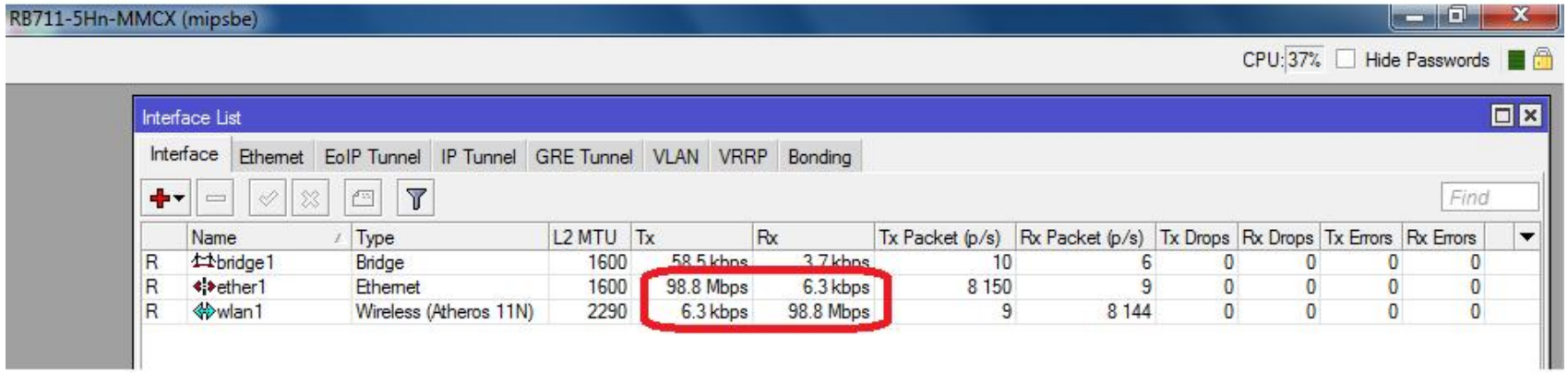
11n speed test



Speed test: RB711-5Hn to RB711-5Hn

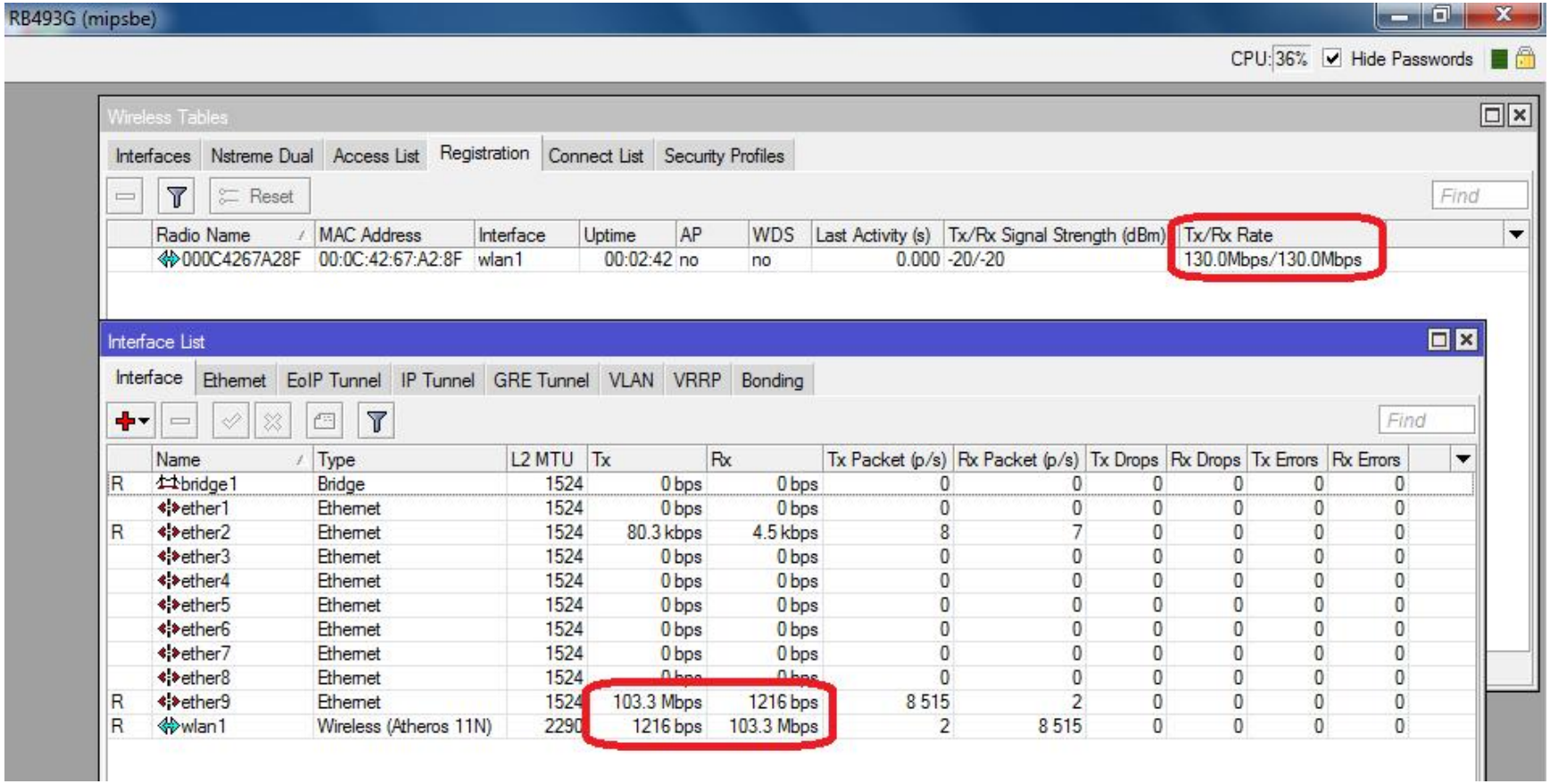


20MHz: Up to 50Mbps of actual throughput.



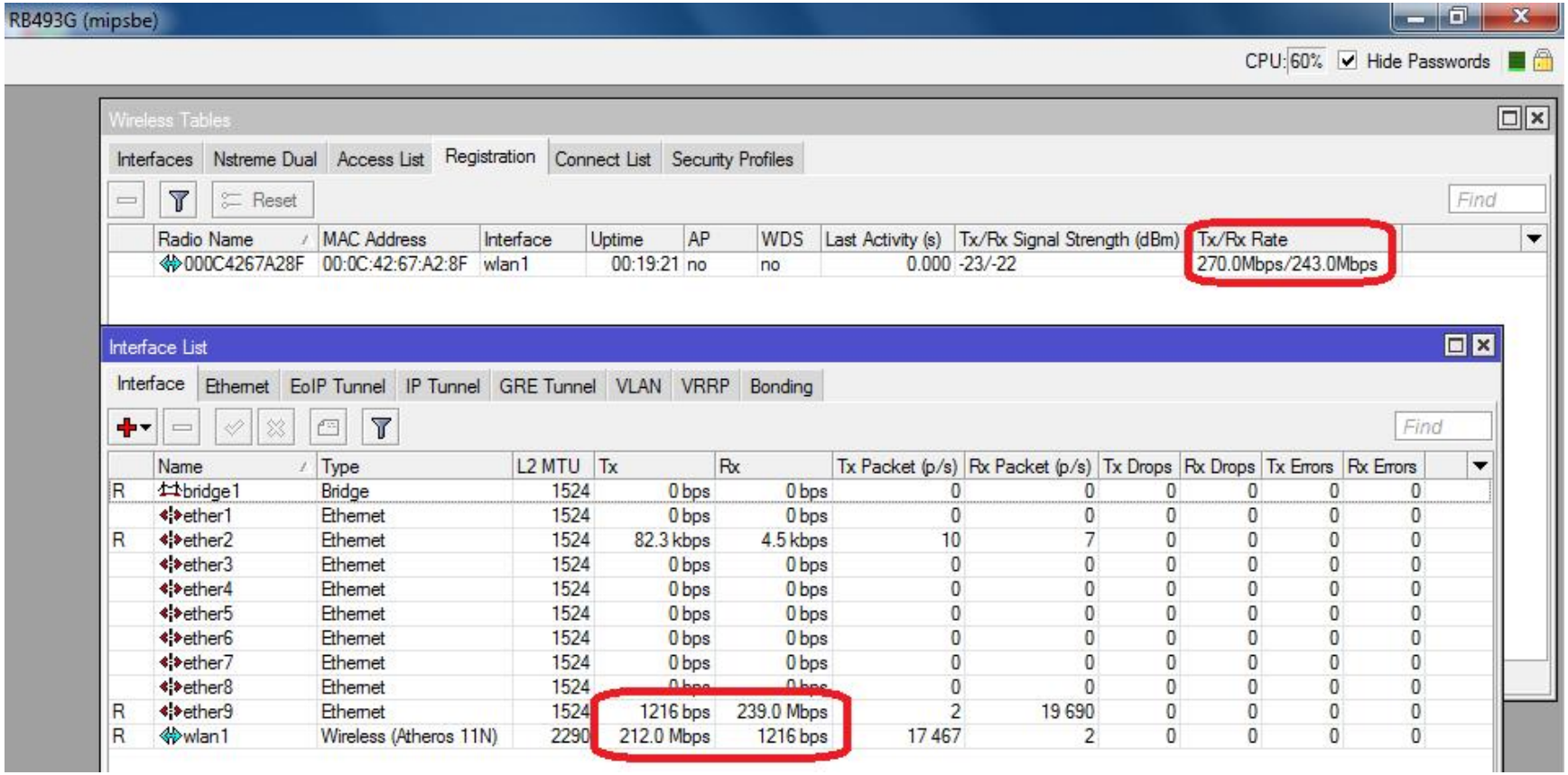
40MHz: Up to 100Mbps of actual throughput.

Speed test: RB493G to RB493G



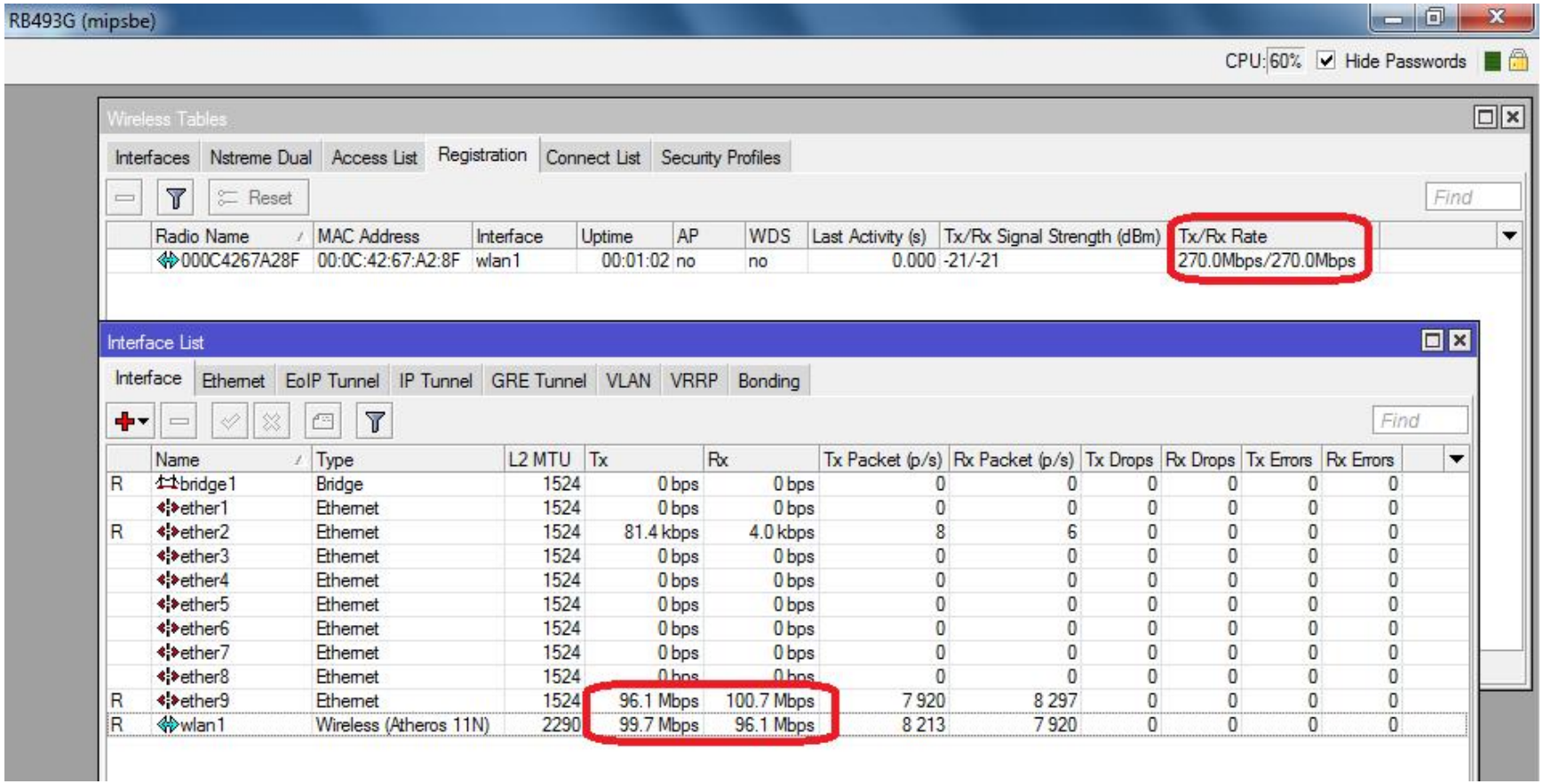
20MHz: Up to 100Mbps of actual throughput.

Speed test: RB493G to RB493G



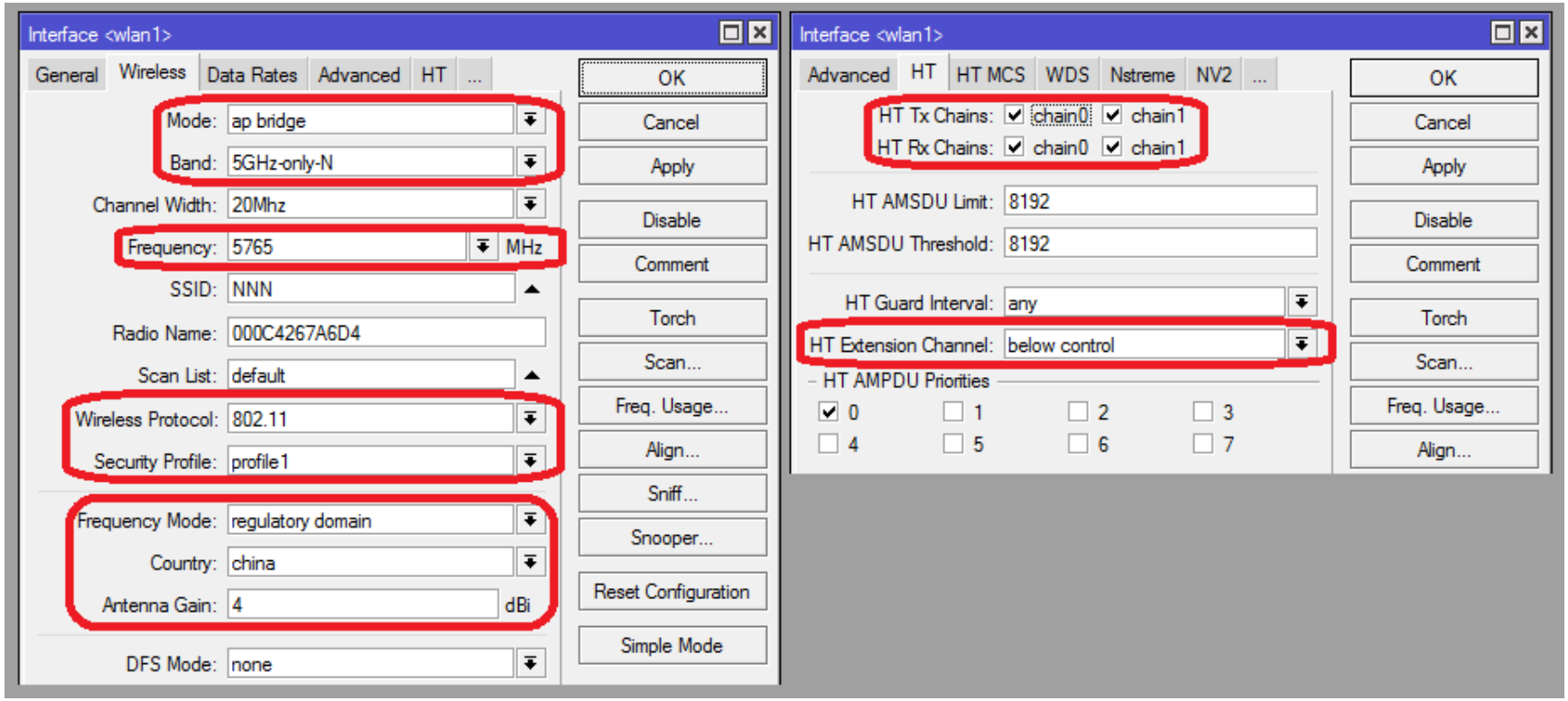
40MHz: Up to 200Mbps of actual throughput.

Speed test: RB493G to RB493G



40MHz: Up to 100Mbps Full Duplex of actual throughput.

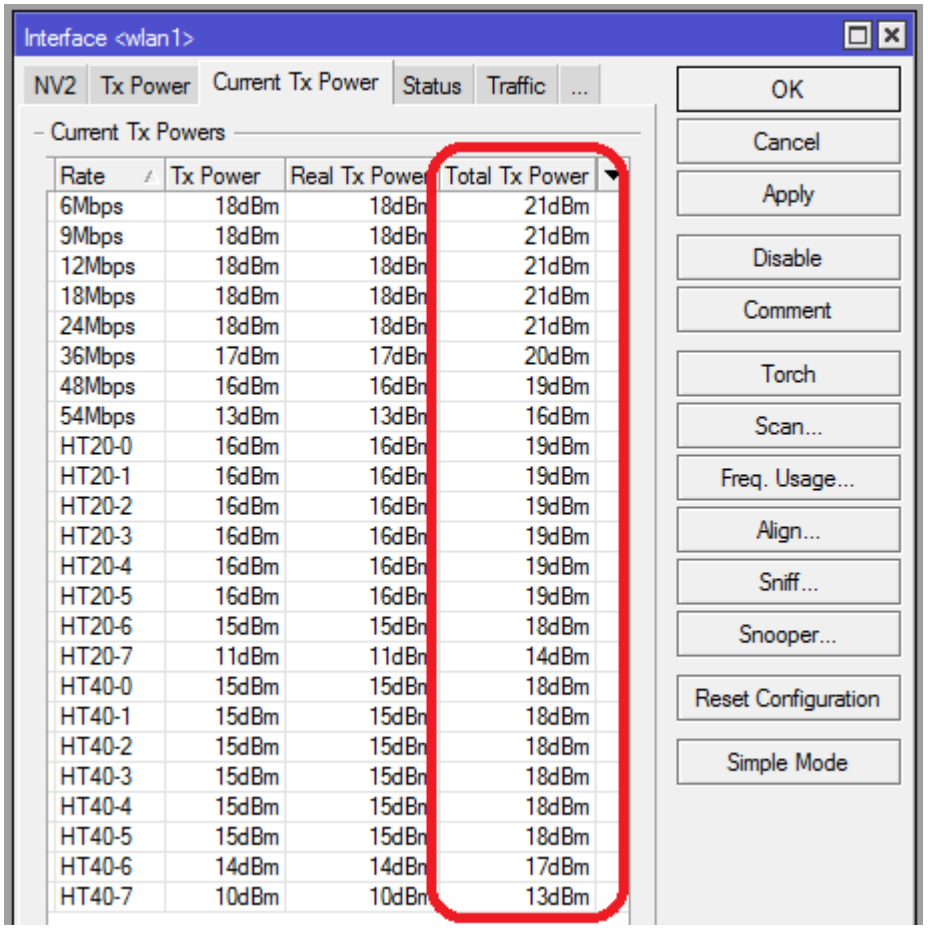
Application examples 2 (Indoor wireless access point)



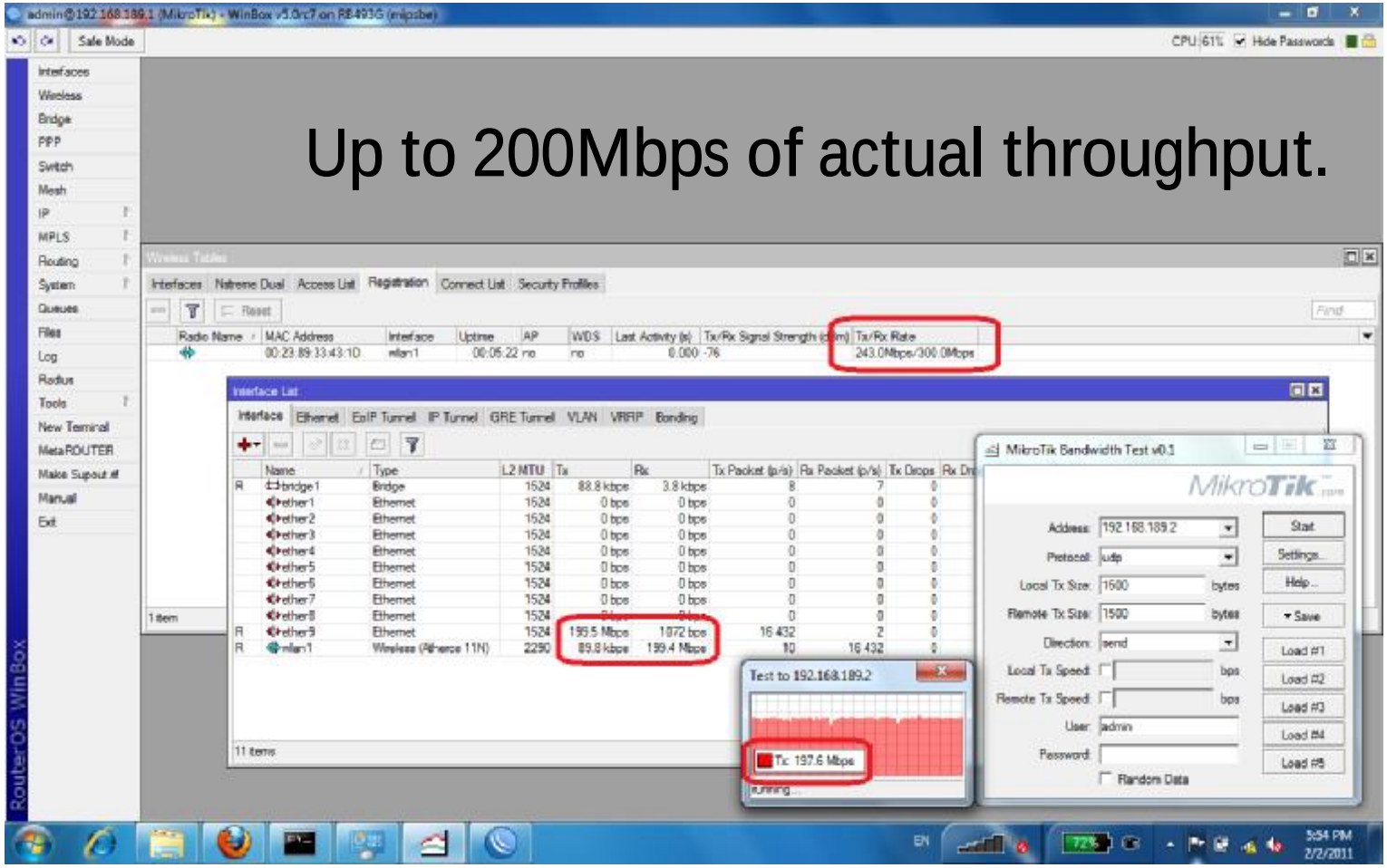
regulatory-domain - Limit available channels and maximum transmit power for each channel according to the value of country.

If China is set, these frequencies are used 5745, 5765, 5785, 5805, 5825

Total Tx Power



Speed test: H3C Dual Band 802.11n USB Adapter



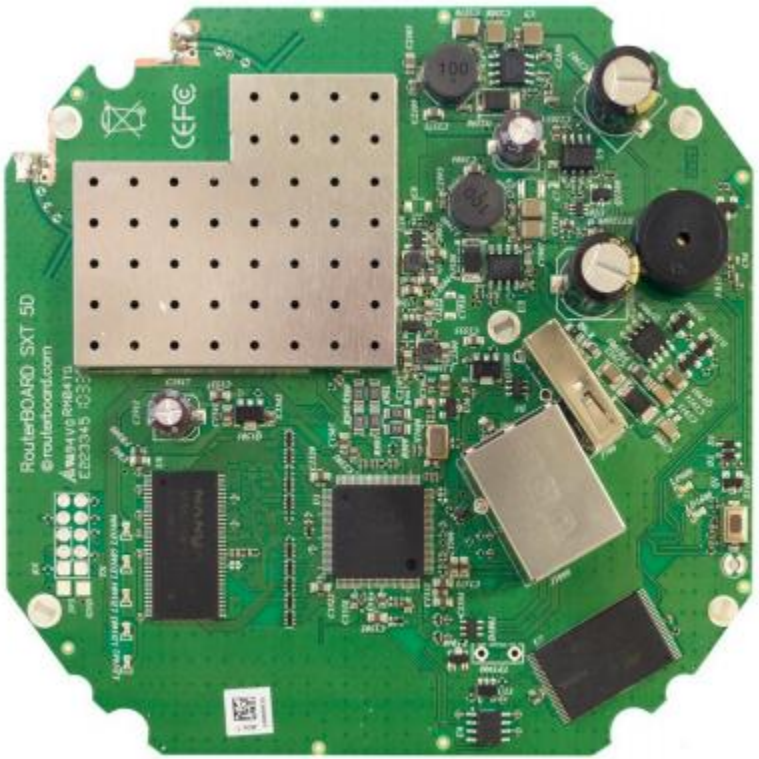
New product (RB/SXT)

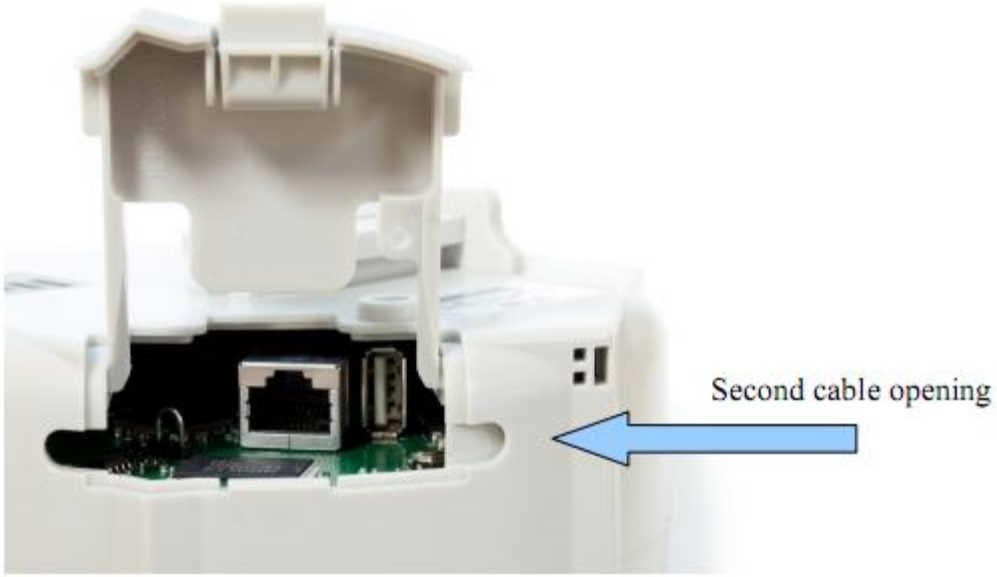
	RouterBOARD SXT 5HnD
CPU	AR7241 400MHz
Memory	32MB DDR SDRAM
Boot loader	RouterBOOT
Data storage	64MB onboard NAND memory chip
Ethernet	One 10/100 with Auto-MDI/X
Wireless	Built-in 5GHz 802.11a/n 2x2 MIMO
Antenna	Dual polarization 2x2 MIMO antenna
ESD protection	15kV ESD protection on each RF port 15kV ESD protection on the Ethernet port
MiniPCI slot	none
Serial port	none
LEDs	Power and User LED, 5 wireless LEDs
Extras	Beeper; Reset switch; USB 2.0 port; Voltage monitor; Temperature monitor
Power options	Power over Ethernet: 8..30V DC (except power over datalines) Packaged with a 24V PSU and a PoE injector
Dimensions	140x140x56mm
Weight	265g
Temperature	Operational: -30C to +80C

- 16dBi dual chain antenna built-in
- Signal strength LED indicators on back

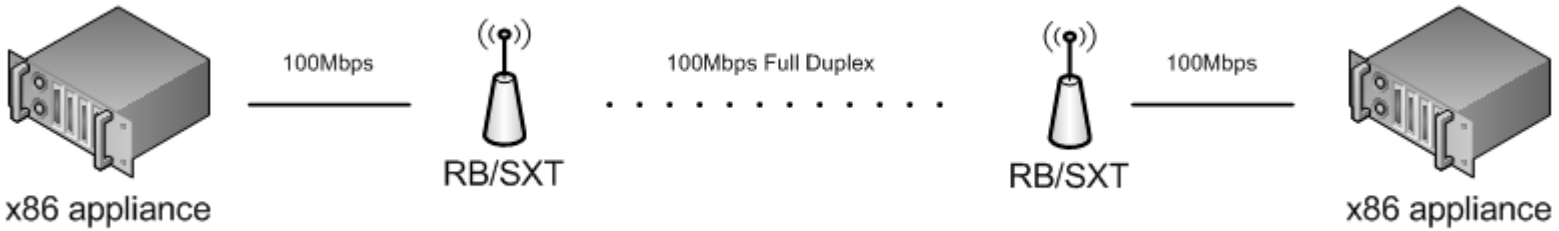
TX power	26dBm max

RB/SXT

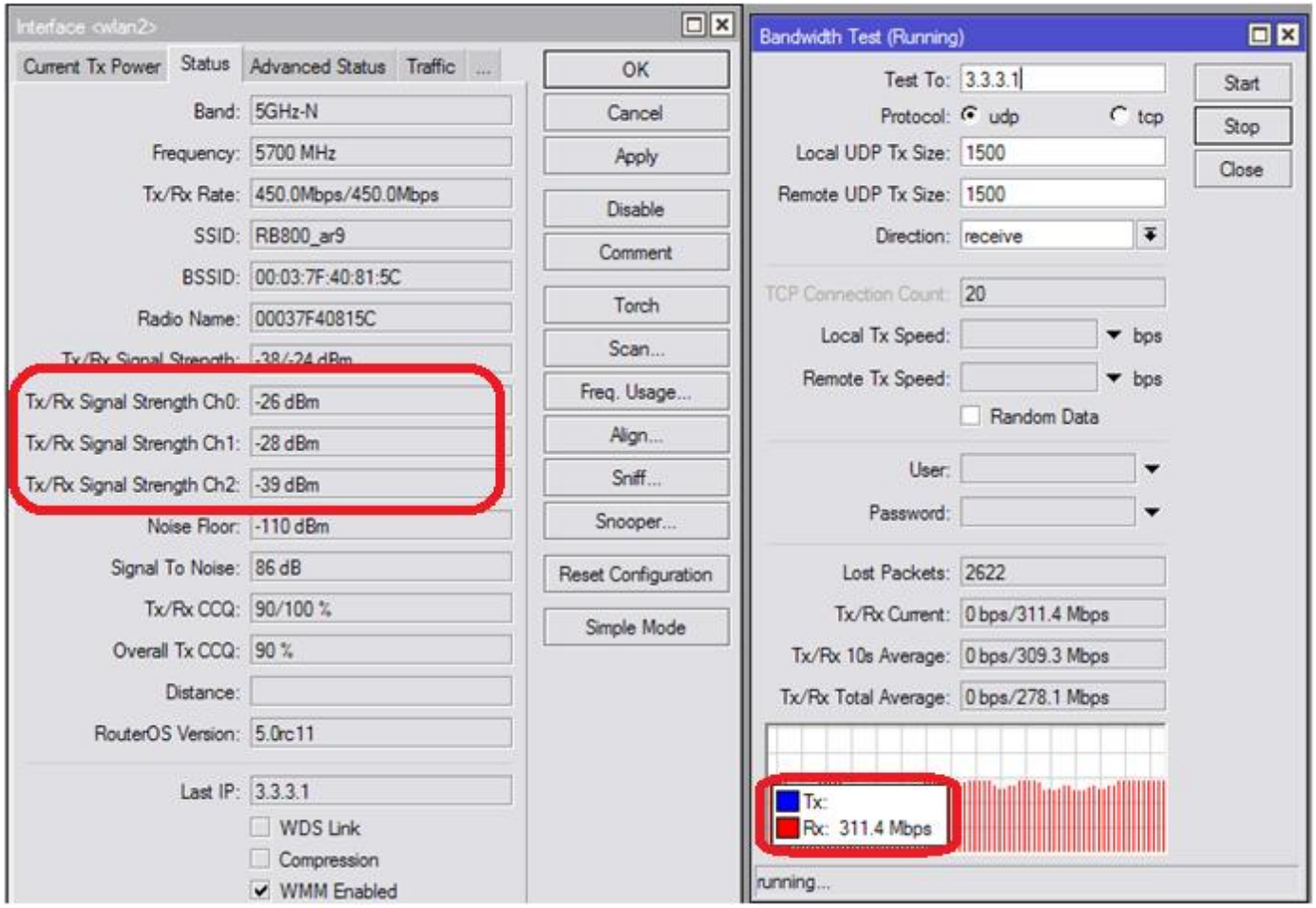




RB/SXT speed test



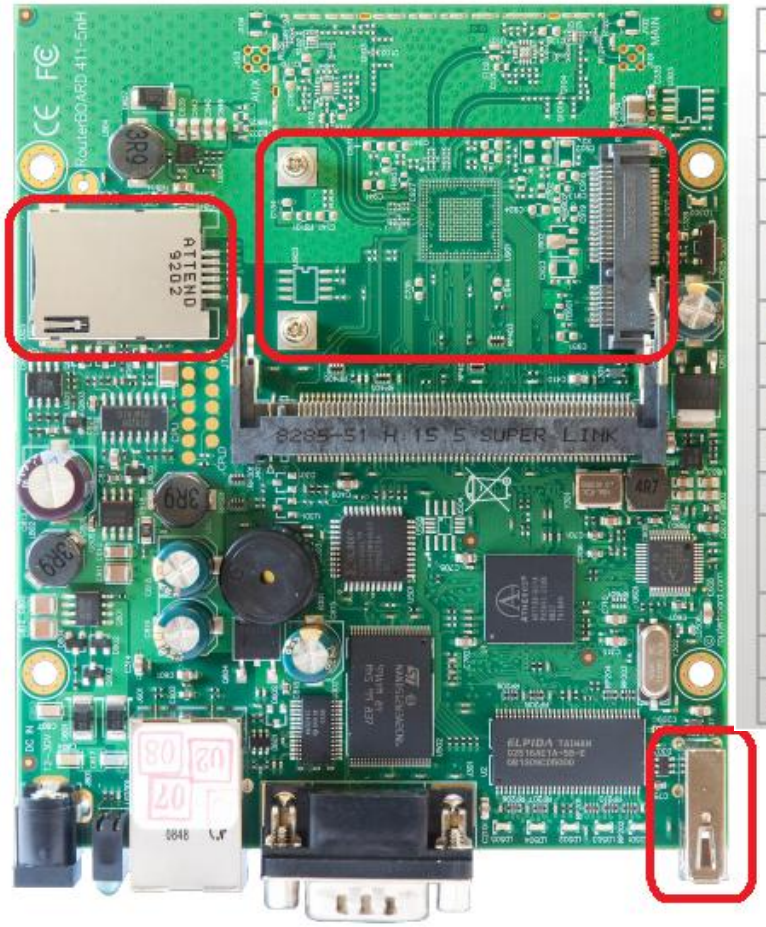
AR9380 chipset support



PART 2

- Introduction 3G products
  - RouterBOARD, 3G Modem, 3G Antenna, USB Accessories
- 3G application examples
  - Application examples 1 (WCDMA and TD-SCDMA)
  - Application examples 2 (CDMA2000)
  - Application examples 3 (VPDN)
- Speed test (WCDMA, CDMA2000, TD-SCDMA)

RB411U



CPU	Atheros AR7130 300MHz network processor
Memory	32MB DDR SDRAM onboard memory
Boot loader	RouterBOOT
Data storage	64MB onboard NAND memory chip
Ethernet	One 10/100 Mbit/s Fast Ethernet port with Auto-MDI/X
miniPCI	One MiniPCI Type IIIA/IIIB slot One MiniPCIe slot for 3G modem (onboard SIM connector)
Wireless	not built in, possible by adding a miniPCI card
Expansion	USB 2.0 with 5V 1A supply
Extras	Reset switch, Beeper, Input voltage monitor
Serial port	One DB9 RS232C asynchronous serial port
LEDs	Power, NAND activity, 5 user LEDs
Power options	Power over Ethernet: 10..28V DC (except power over datalines). Power jack: 10..28V DC
Dimensions	12.5 cm x 10.5 cm, Weight: 104g
Power consumption	3-12W
Operating System	MikroTik RouterOS v3, Level4 license

Huawei E220 (WCDMA)

Huawei EC1260, EC1261 (CDMA2000)

http://wiki.mikrotik.com/wiki/Supported_Hardware#3G_cards

Huawei ET127 (TD-SCDMA)

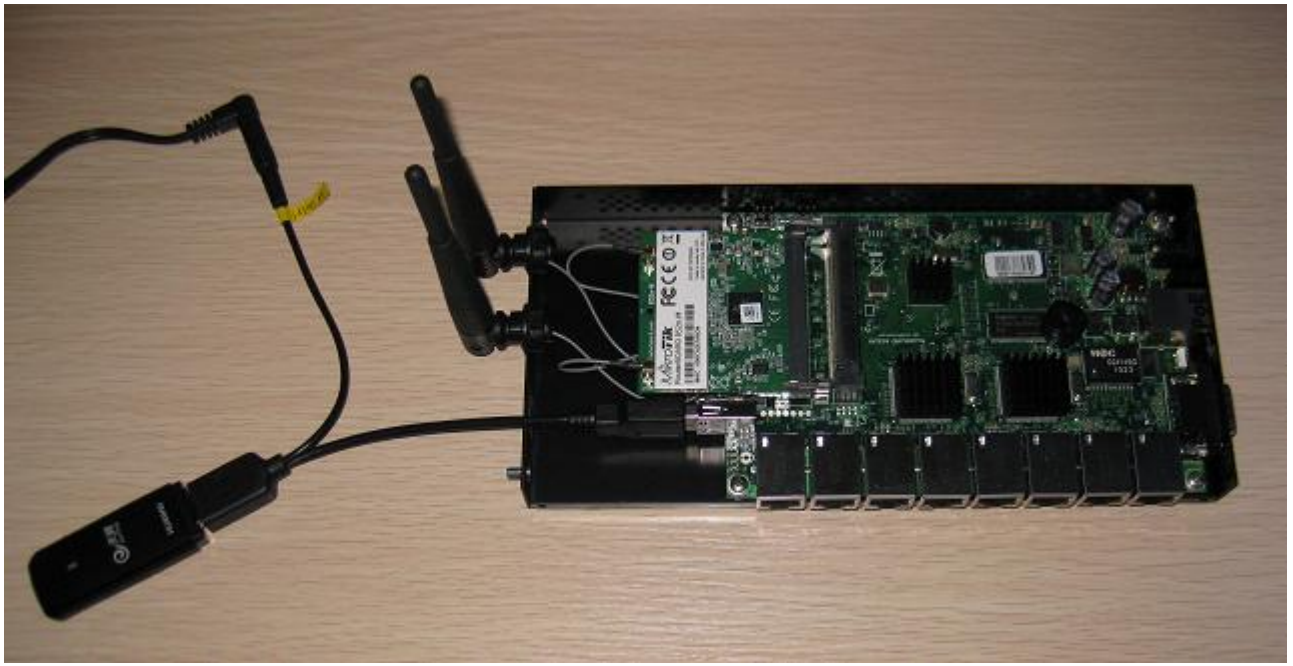
http://wiki.mikrotik.com/wiki/Supported_Hardware#3G_cards

Sierra Wireless MC8781 (WCDMA)

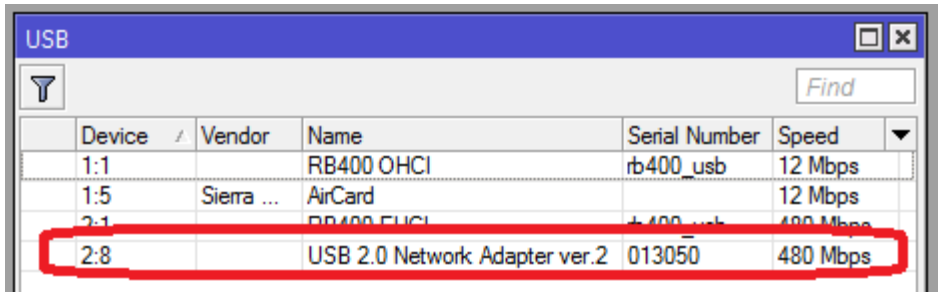
3G Antenna

Model	
Frequency range	824~960/1710~2500MHz
VSWR	≤1.5
Gain	3.5dbi
Polarization	Vertical
Maximum input power	50W
Impedance	50Ω
Cable type	RG58U
Length	3 M
Input Connector	N male
Dimensions of Antenna	Φ115×55mm
Weight	110g

5V power injector for RB493G and RB411UAHR

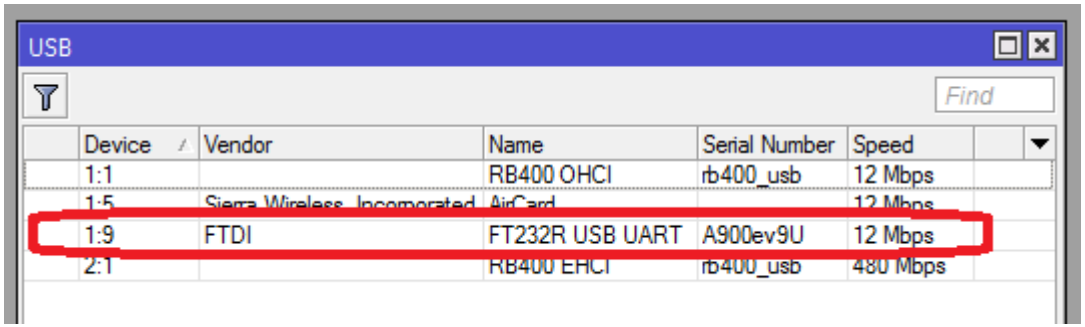


Linksys USB200M Ethernet Adapter



What's new in 5.0beta2 (2010-Apr-30 11:24):
*) added support for ASIX AX88xxx based USB Ethernet Adapters on RB4xx;

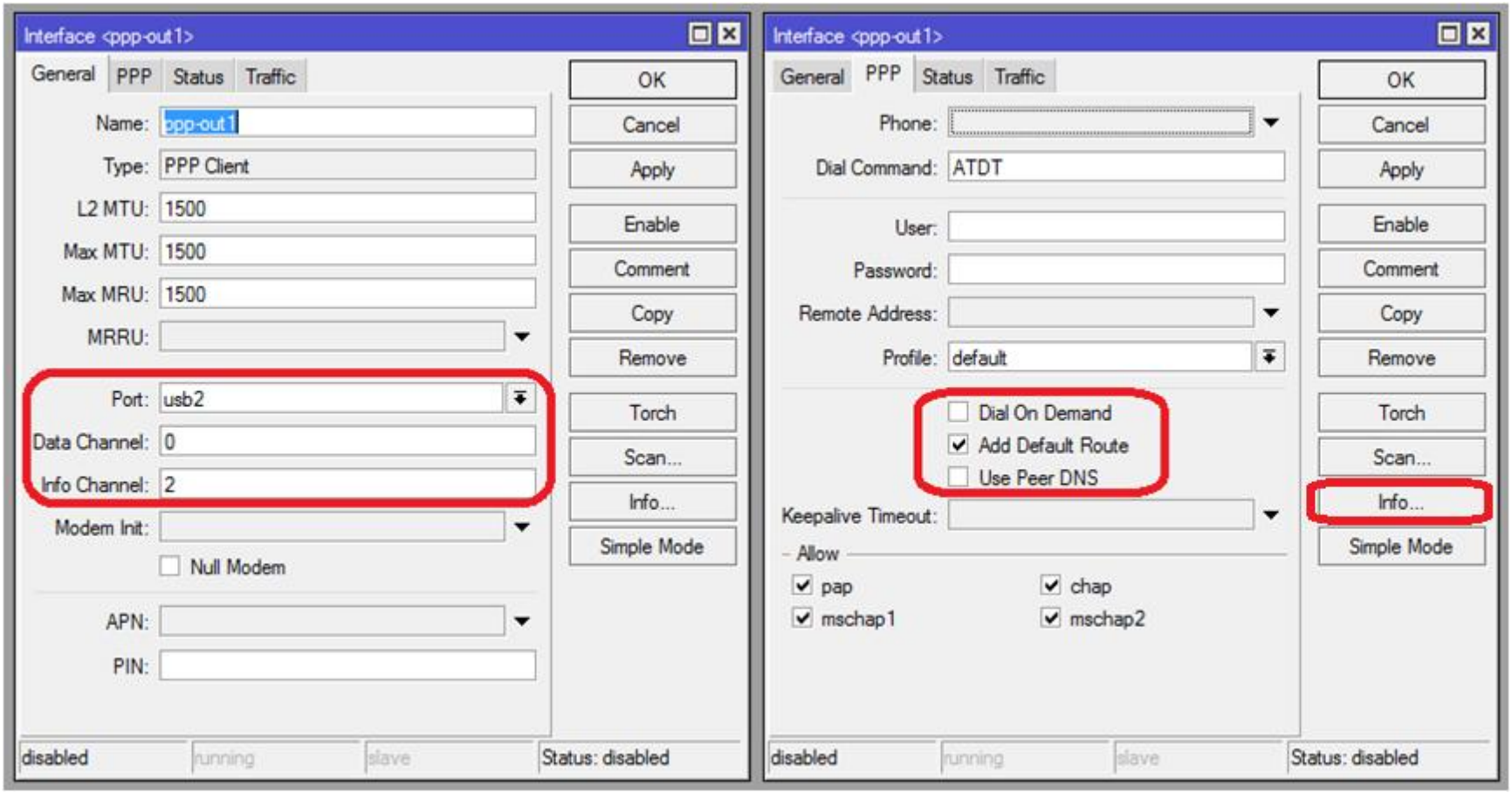
Z-TEK USB Serial Port Converter



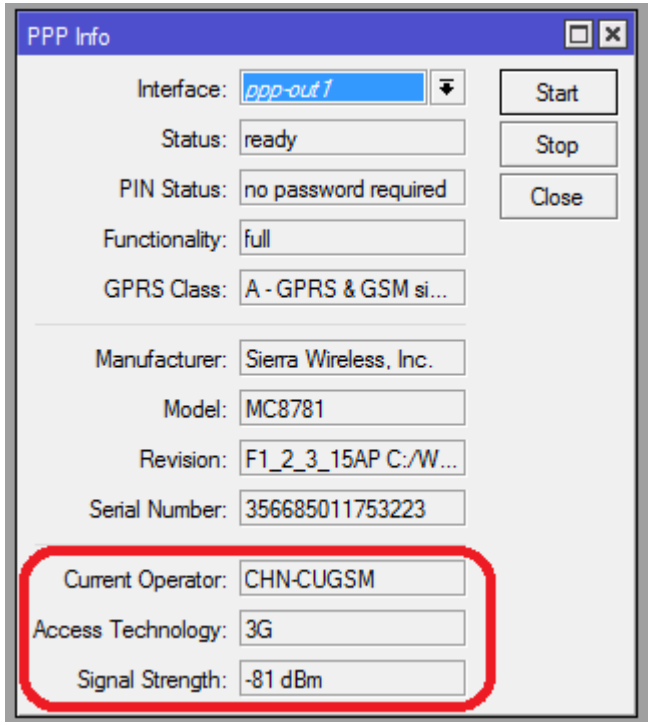
http://wiki.mikrotik.com/wiki/Serial_Port_Usage

RB411U and all accessories

Application examples 1 (WCDMA and TD-SCDMA)

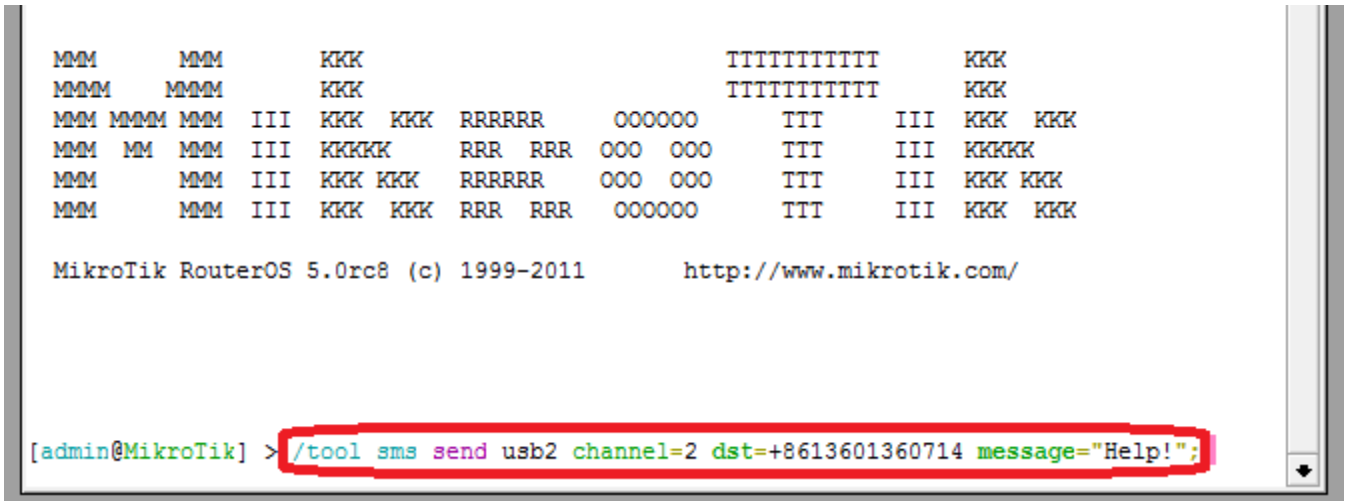


Application examples 1 (WCDMA and TD-SCDMA)

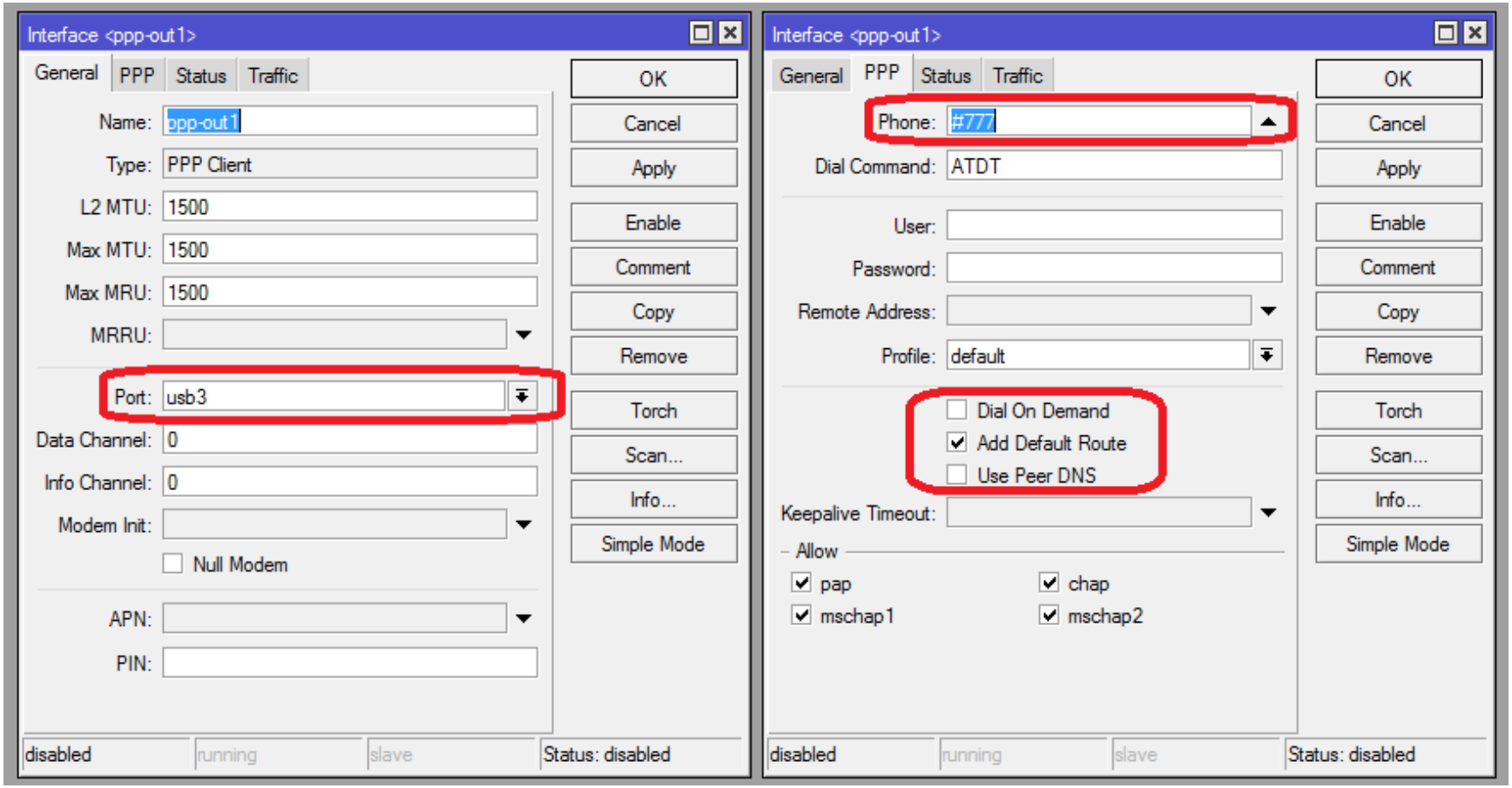


Sending SMS from the RouterBOARD

- Command line example to send an SMS:
  - /tool sms send usb2 channel=2 dst=+8613601360714 message="Help!";
- SMS can be sent while the port is used by other service (PPP or terminal)
- This feature is only supported for China Unicom and China Mobile.



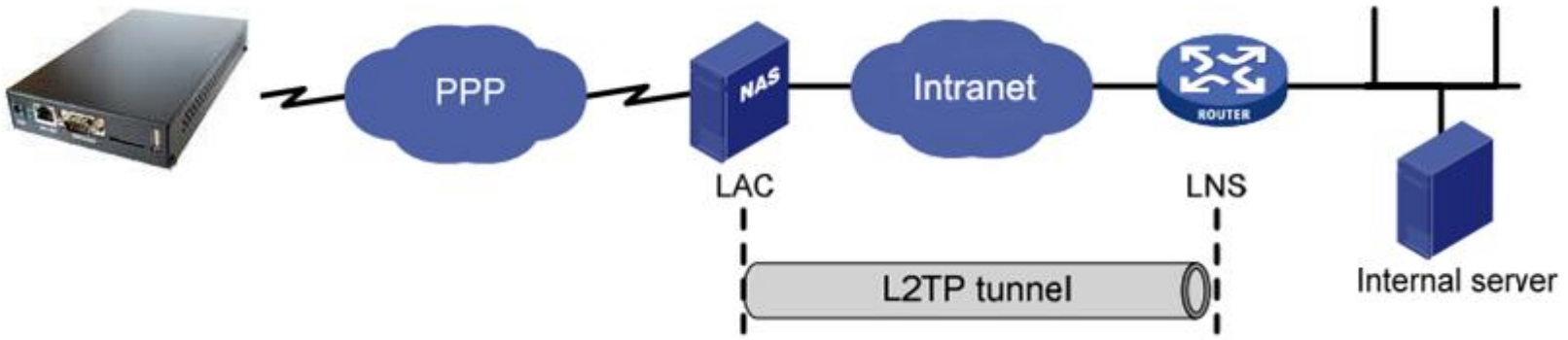
Application examples 2 (CDMA2000)



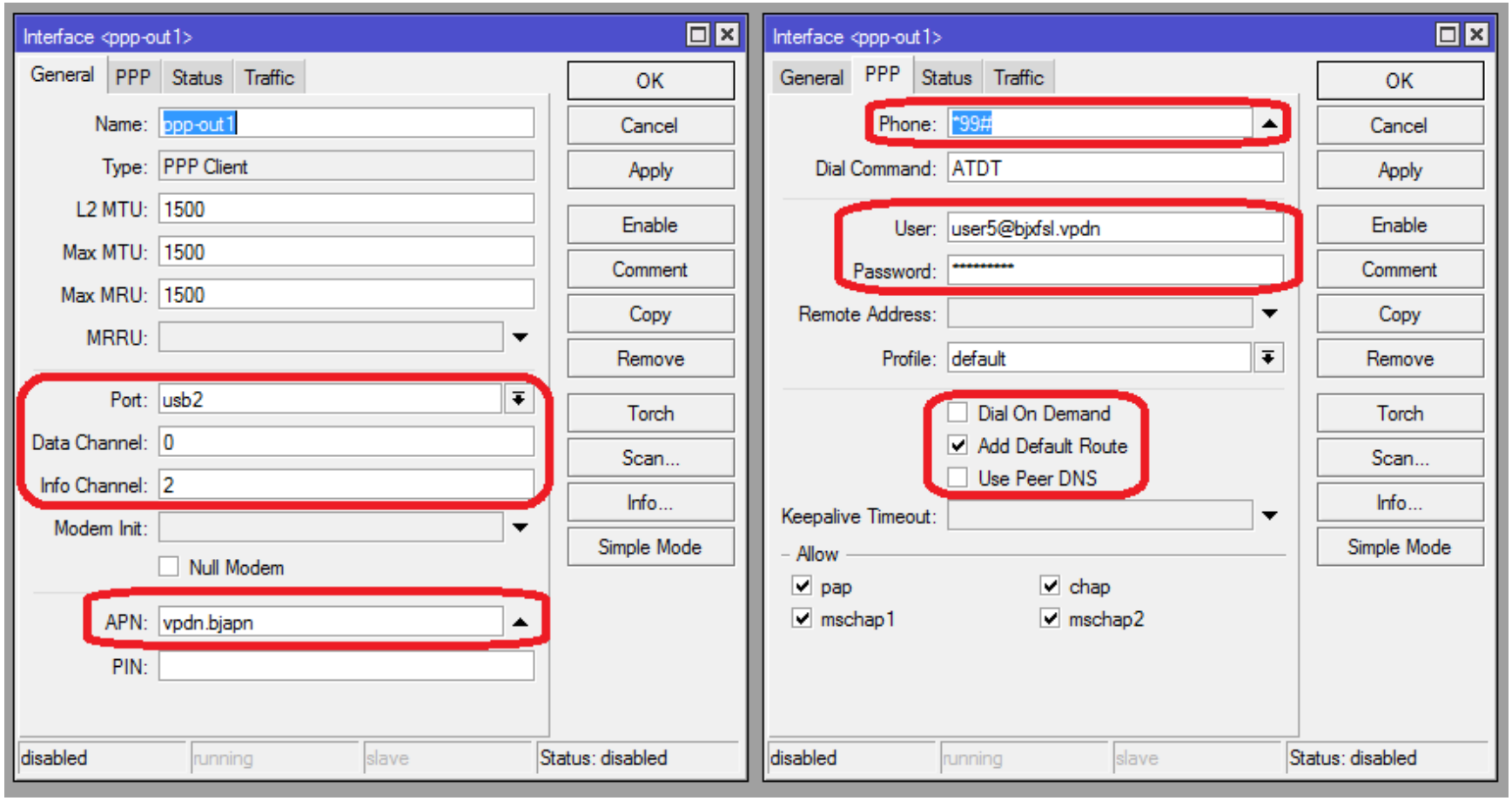
Virtual Private Dialup Network (VPDN)

- A VPDN is a network that extends remote access to a private network using a shared infrastructure. VPDNs use Layer 2 tunnel technologies (L2F, L2TP, and PPTP) to extend the Layer 2 and higher parts of the network connection from a remote user across an ISP network to a private network. VPDNs are a cost effective method of establishing a long distance, point-to-point connection between remote dial users and a private network.
- Instead of making connections directly to the network by using the expensive Public Switched Telephone Network (PSTN), access VPDN users only need to use the PSTN to connect to the ISP local point of presence (POP). The ISP then uses the Internet to forward users from the POP to the customer network. Forwarding calls over the Internet as opposed to making a long-distance PSTN call provides dramatic cost saving for the customer.

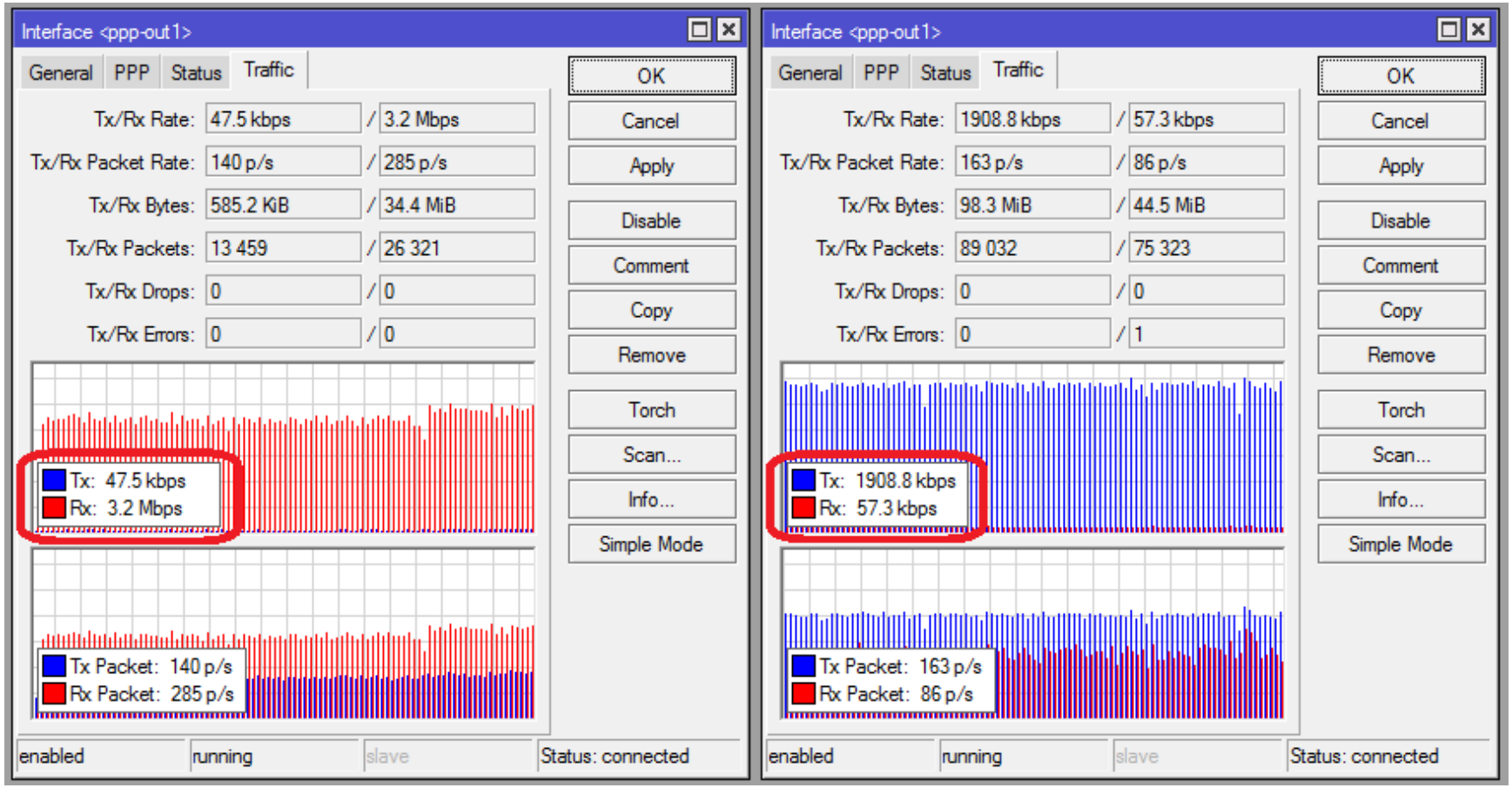
Application examples 3 (VPDN)



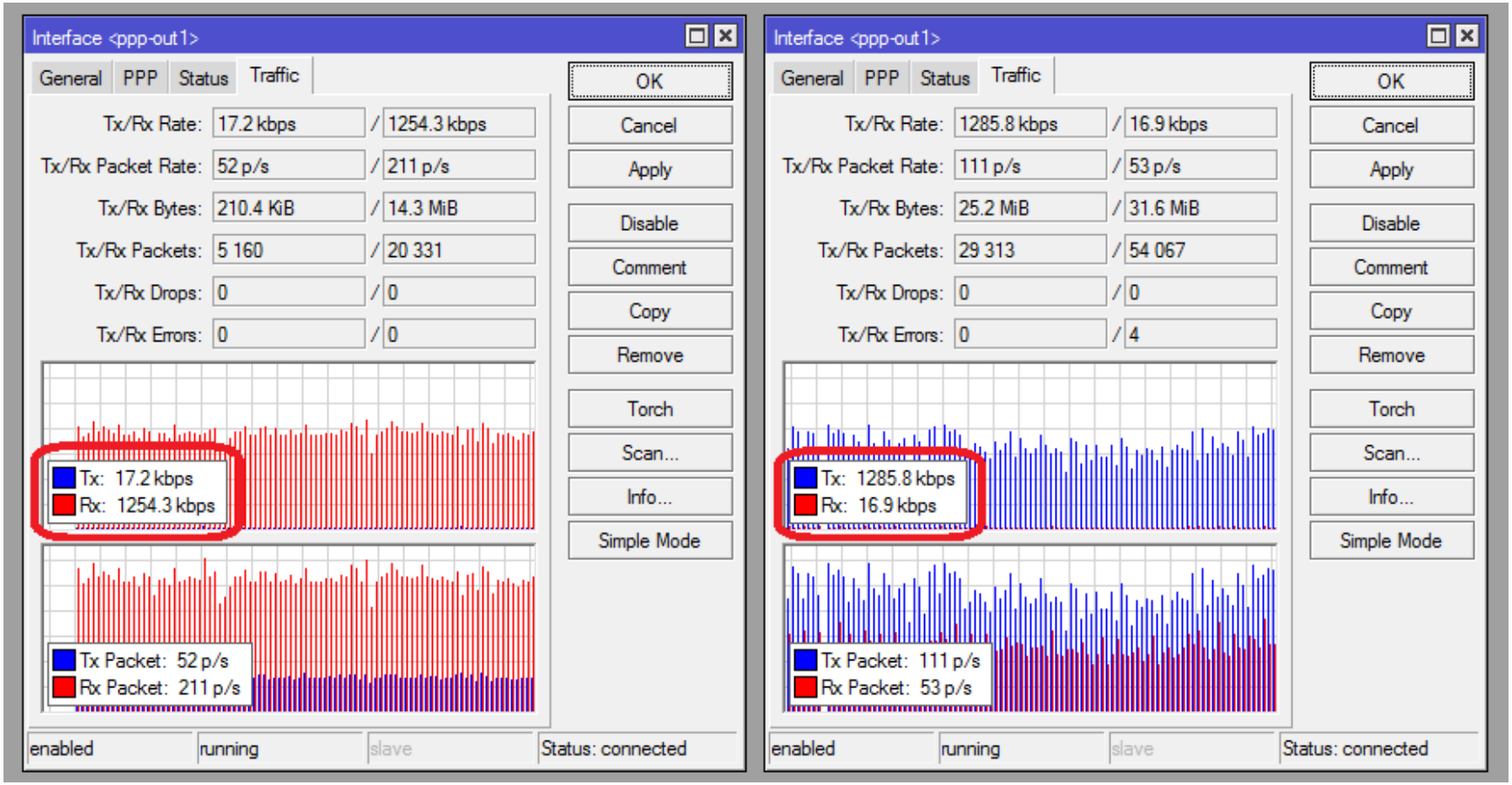
Application examples 3 (VPDN)



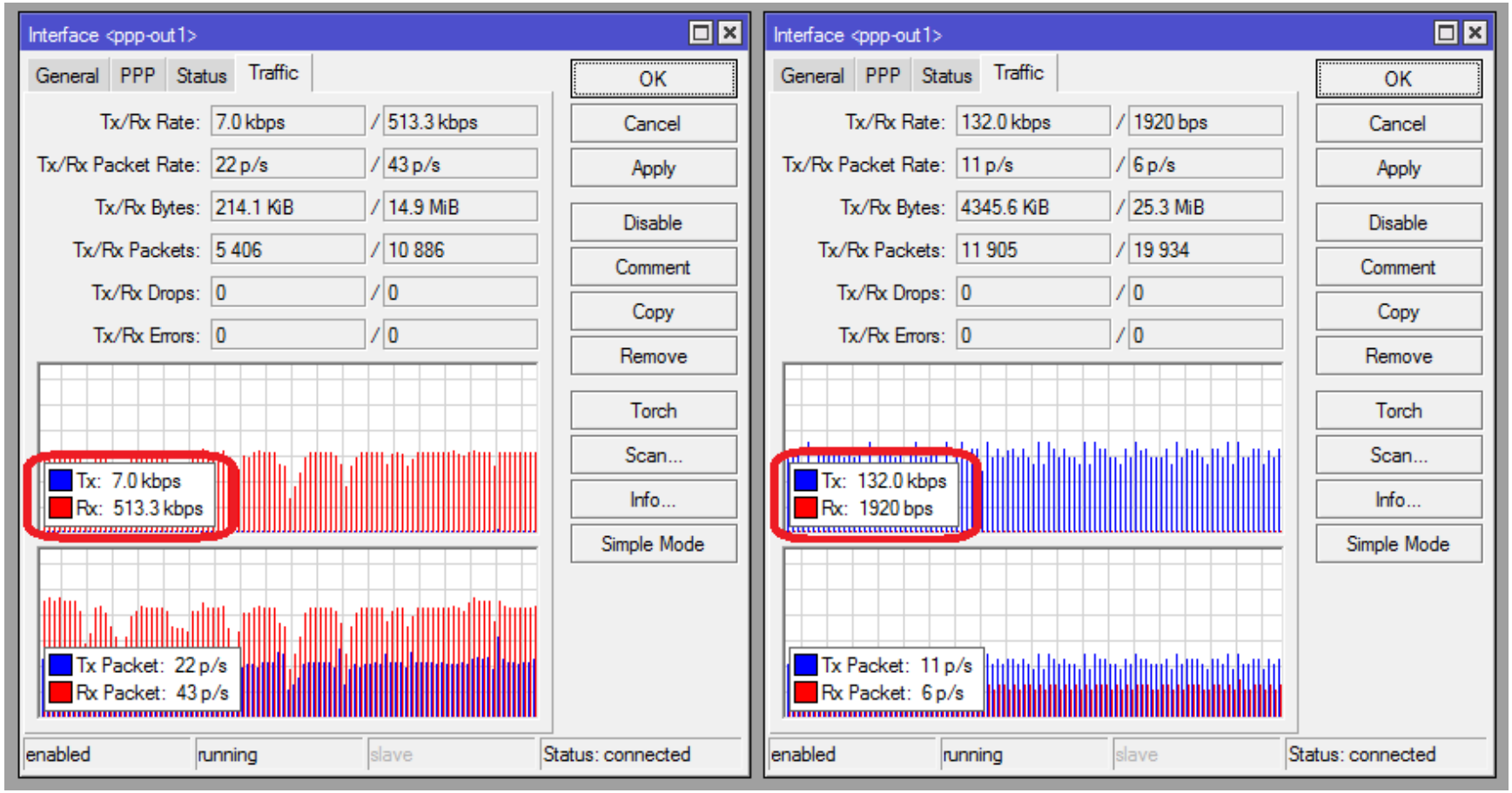
3G speed test: WCDMA



3G speed test: CDMA2000



3G speed test: TD-SCDMA



3G speed test: comparison

China Unicom (WCDMA)	Download – 3Mbps Upload – 2Mbps
China Telecom (CDMA2000)	Download – 1Mbps Upload – 1Mbps
China Mobile (TD-SCDMA)	Download – 512kbps Upload – 128kbps

Contact Information

- Chinese Name: 刘 哲
- Mobile: 13601360714
- E-Mail: jesseliu@convergingstream.com
- MSN: jesseliu@convergingstream.com
- QQ: 191110225
- Skype: jesse3750

End

Thank you for participating